TETRA TECH

Christopher Maurer

July 1, 2019

Toxics Cleanup Program

Washington Department of Ecology

300 Desmond Drive

Lacey, Washington 98504

Re: Site Investigation Report

Darling-Tacoma Facility – 2041 Marc Avenue, Tacoma, Washington

Facility No.: 25455514, Cleanup Site No.: 8475, VCP Project No.: SW1317

Mr. Maurer,

Please find enclosed three hard copies of the Site Investigation Report for the above-referenced facility. The Site Investigation Report is being submitted on behalf of Darling Ingredients, Inc. The report presents and evaluates results for the work conducted in 2017 and 2019. The 2017 work was conducted based on your comments on Darling's 2012 VCP submittal, with additional groundwater monitoring conducted by Tetra Tech in 2019. Tetra Tech is currently working to get the associated data entered into Ecology's EIM database.

Please contact me at 406-327-5235 with questions or comments related to the attached.

Sincerely.

Tetra Tech, Inc.

Natalie J. Morrow, LG, LHG

Project Manager/Sr. Environmental Geologist

cc: Bill McMurtry – Darling Ingredients, Inc.

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Site Investigation Report
Darling-Tacoma Facility

Darling Delaware Co, Inc. (aka Puget Sound By-Products) Facility

2041 Marc Avenue, Tacoma, WA

Facility No.: 25455514 ***Cleanup Site No.: 8475*** ***VCP Project No.: SW1317***

#114-571180
July 1, 2019

PRESENTED TO

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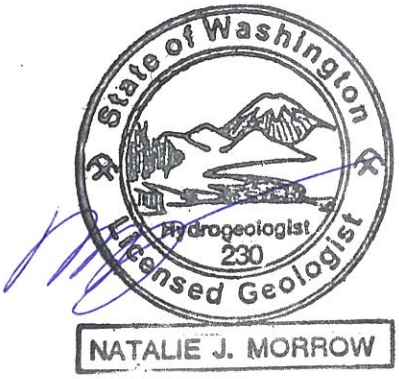

Reviewed by:

Maureen McGraw, PhD, PE
Senior Engineer/Hydrologist

7-1-19
Date

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ACRONYMS/ABBREVIATIONS

Acronyms & Abbreviations	Definition
°C	Degrees Celsius
°F	Degrees Fahrenheit
µg/L	Micrograms per liter
µS	Micro-Siemens
amsl	Above mean sea lvel
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene and xylenes
COPC	Contaminants of potential concern
CPLC	Cascade Pole and Lumber Company
DII	Darling Ingredients, Inc.
DPT	Direct push technology
DQOs	Data quality objectives
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
EPH	Extractable petroleum hydrocarbons
FID	Flame-ionization detector
ft/day	Feet per day
ft/ft	Feet per foot
GC/FID	Gas chromatogram/flame ionization detector
GC/MS-SIM	Gas chromatogram/mass spectrometry
GPS	Global positioning satellite
HQ	Hazard quotient
IDW	Investigation-derived waste
JSA	Job safety analysis
L/day	Liters per day
LUST	Leaking underground storage tank
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mL/day	Milliliters per day
MNA	Monitored natural attenuation
MTCA	Model Toxics Control Act
NOAA	National Oceanic and Atmospheric Administration
OSHA	Occupational Safety and Health Administration

Acronyms & Abbreviations	Definition
PAHs	Polynuclear aromatic hydrocarbons
cPAHs	Carcinogenic polynuclear aromatic hydrocarbons
PID	Photoionization detector
POC	Points of compliance
PQL	Practical quantitation limit
PVC	Polyvinylchloride
QA/QC	Quality assurance/quality control
QC	Quality control
RZA	Rittenhouse-Zeman & Associates
SGT	Silica gel treatment
SI	Site investigation
SOPs	Standard operating procedures
TOC	Total organic carbon
UST	Underground storage tank
VCP	Voluntary Cleanup Program
WES	Whitman Environmental Services

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) submitted a Voluntary Cleanup Program (VCP) application to Ecology in 2012 for the Darling Ingredients, Inc. (DII) facility located at 2041 March Avenue (the Facility) in Tacoma, Pierce County, Washington (**Figure 1**, **Appendix A**). The Facility is listed by Ecology as a leaking underground storage tank (LUST) facility due to petroleum releases associated with two former 10,000-gallon underground storage tanks (USTs), one diesel and one Bunker C fuel oil, that formerly operated at the Facility.

On April 26, 2016, Mr. Christopher Maurer of Washington Department of Ecology (Ecology; Ecology 2016a) provided comments on the VCP application via e-mail. Additional soil and groundwater investigation at the Facility was required based on Ecology's review of the VCP application (see Section 1.4). In 2019, another round of groundwater sampling was conducted to provide additional information on current groundwater conditions.

This RIWP is organized as follows:

- Section 1 – Provides an introduction including general site information, site use, physical environment, and site development and investigation history
- Section 2 – Includes information related to the field investigation, including the project objectives, conceptual site model, and results of the 2017 and 2019 investigation work.
- Section 3 – Includes additional evaluations including Mann-Kendall statistical analysis results, discussion of the silica gel treatment (SGT) results, and human health and ecological risk assessment.
- Section 4 – Provides summary and conclusions.
- Section 5 – Provides recommendations.
- Section 6 – Lists references.

Appendices included in this report are as follows:

- Appendix A – Includes figures.
- Appendix B – Contains tables.
- Appendix C – Provides boring and groundwater logs.
- Appendix D – Includes the laboratory and data validation reports.
- Appendix E – Provides the Mann-Kendall statistical analysis and risk assessment calculations.
- Appendix F – Includes a copy of the 2017 Site Investigation Work Plan.

1.1 GENERAL SITE INFORMATION

1.1.1 Project Identification

The Facility is located at 2041 Marc Avenue in a primarily heavy industrial area of Tacoma (**Figure 1**). DII's ingredients processing operation resides on an approximately 4-acre property owned by Port of Tacoma. (**Figures 1** and **2**, **Appendix A**). **Table 1-1**, below, presents Ecology's facility identification information and general facility location information.

Table 1-1. Facility Identification Table

Facility Identification & Location	Facility Information
Facility Name	Darling Delaware Co., Inc. (aka Puget Sound By-Products)

Facility Identification & Location	Facility Information
Facility Address	2041 Marc Avenue, Tacoma, Washington
Facility Number	25455514
Cleanup Site Number	8475
VCP Project Number	SW1317
Tax Parcel Number	0320031063
Township	20 North
Range	3 East
Section	3
Quarter Sections	Southwest ¼ of the Northwest ¼ and Northwest ¼ of the Southeast ¼
Latitude	47°15'20.9585" N
Longitude	-122°24'22.43035" W

Latitude and longitude based NAVD88, Washington State Plane coordinate system.

1.1.2 Project Contacts

The contacts for the project are listed below in **Table 1-2**.

Table 1-2. Project Contacts

Project Association	Entity	Contact	Contact Information
Site Manager	Ecology	Christopher Maurer	(360) 407-7223 cmau461@ecy.wa.gov
Property Owner	Port of Tacoma	Sarah Weeks	253-383-9450 sweeks@portoftacoma.com
Facility Operator	Darling Ingredients, Inc.	Bill McMurtry	972-281-4409 BMcMurtry@darlingii.com
Environmental Consultant	Tetra Tech, Inc.	Natalie Morrow, LG, LHG	406-543-3045 Natalie.morrow@tetratech.com

1.2 SITE USE

The Facility is a food processing byproducts conversion plant in an area zoned as PM1, for heavy industrial, warehousing, storage, vehicle service and repair. The operations at the Site began in approximately 1973. Prior to that time the property was operated as an unregulated an unsupervised landfill by the City of Tacoma (see Section 1.3.1).

Several structures comprise DII's operation including an office, office/storage room, work shop, office/shower/lunch room with adjoining carport parking for motorcycles, truck shop, rendering plant, scrubbing room, waste water room, finished product load-out building, chemical storage area, and multiple silos. The remaining portions of the property are used for vehicle and equipment parking and storage. The grounds of the facility are paved with asphalt, except for the southern equipment storage area where three wastewater treatment lagoons and a clarifier previously operated. **Figure 2** (Appendix A) presents a site map.

Adjoining properties to the Facility include:

- North: Tri Pack Transloading Warehousing (property owned by Port of Tacoma).
- South: Undeveloped land.
- East: Tacoma Rail (property owned by Port of Tacoma) followed by Six Robblees' (tire and trailer business) to the northeast, MacMillan Piper container shipping facility to the east, America Promotional Events (fireworks wholesaler) to the southeast.
- West: Marc Avenue followed by undeveloped land to the west and southwest, and AAA Trailer Repair to the northwest.

Based on observations from public rights-of-way and review of aerial photographs, the ground surface at the above adjoining facilities appear mostly unpaved, with some areas of the TriPack Transloading Warehouse property appearing in Google Earth aerial photographs as possibly partially paved in loading areas.

1.3 PHYSICAL ENVIRONMENT

The following summarizes the physical environment at and surrounding the Site.

1.3.1 Climate

Marine (or maritime) climate characterizes the Tacoma area, which generally features a mild climate with cool winters and warm summers (WRCC 2019a). Moist air moving inland from the ocean is released west of the Cascade Range due to orogenic lifting of the air over the mountains. The prevailing wind in the Puget Sound Lowlands is south or southwest during the wet season and northwest in summer.

Tetra Tech reviewed data from the Tacoma Number 1 (#1) station (WRCC 2018). National Oceanic and Atmospheric Administration (NOAA) shows the station as being located approximately 1,700 feet southwest of the Facility near the southwestern bank of the Puyallup River. NOAA (https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa8278) list the latitude of the station as 47.2472° and longitude as -122.4122°. The station is at an elevation of approximately 25 feet amsl.

The Tacoma #1, Washington (458278) (WRCC 2018) monthly climate summary for data between 1982 and 2016 indicated an average annual maximum temperature of 61.4 degrees Fahrenheit (°F) and the average minimum temperature of 45.3 °F. The summary indicated average annual rainfall for Tacoma is approximately 39.8 inches per year. The greatest monthly average precipitation occurs during the months of November (6.8 inches), December (5.7 inches), and January (6.1 inches) while the lowest average precipitation occurs during the months of June (1.6 inches), July (0.74 inches), August (0.83 inches), and September (1.3 inches).

1.3.2 Tideflats and Waterways

Commencement Bay, part of the Puget Sound waterway, resides over 1.5 miles north-northwest of the Facility. The Puyallup River is located approximately 0.3 miles (1,500 feet) west of the Facility. This river originates at Mount Rainer and generally flows to the northwest until it empties into Commencement Bay, where sediment carried by the river creates a large delta area, or tideflat.

Additional nearby waterways include the Sitcum Waterway located approximately 1 mile north of the Facility, the Blair Waterway is approximately 1.1 miles to the east, and the Hylebos Waterway is approximately 2 miles east. Gog-le-hi-te Wetlands Park resides approximately 900 feet west of the Facility. These wetlands are adjacent to and connected with the east bank of the Puyallup River. This wetland park was developed during cleanup of a portion of the Tacoma Tideflats Landfill.

1.3.3 Geologic & Hydrogeologic Conditions

1.3.3.1 Regional & Local Conditions

Commencement Bay is part of the Puget Sound waterway. The Puget Sound waterway is a large waterway carved out by glaciers during multiple ice age events. Flowing into Commencement Bay on the west is the Puyallup River. The Puyallup River originates at Mount Rainer and generally flows to the northwest, through the Puyallup Valley. The Puyallup River forms a delta as it empties into Commencement Bay (Ecology 2015). The area surrounding Commencement Bay is comprised of glacial deposits.

The hydrostratigraphy of the Tacoma Tideflats area at nearby site, Cascade Pole and Lumber Company (hereinafter, CPLC), was reviewed to evaluate general subsurface conditions within the Tacoma Tideflats. The CPLC site is located 0.25 miles northwest of the Facility on Marc Street. The CPLC site is also within the footprint of the former Tacoma Tideflats Landfill. Subsurface observations at the CPLC site include: 1) a 6- to 10-foot thick shallow, unconfined water zone (shallow aquifer); 2) a 6- to 7- foot thick silty clay to clayey silt aquitard separating the shallow aquifer from a lower water zone (deep aquifer); 3) a 6- to 10-foot thick, semi-confined deep aquifer; and 4) a second 3-foot thick aquitard comprised of sandy to clayey silt underlying the deep aquifer (AECOM & MFA 2014). The shallow aquifer consists of fine to medium sand with some sandy silt intervals, and silty clay beds present at some intervals. The deep aquifer consists of very fine to medium sand with trace silt. The aquifer separating the shallow aquifer from the deep aquifer was noted as containing wood and other organic matter (AECOM & MFA 2014).

Groundwater flow in the shallow aquifer at the CPLC site was primarily to the southwest, toward the Puyallup River. However, groundwater flow in the shallow aquifer at the nearby Milwaukee Railyard immediately north of the CPLC site flows to the north to northwest (consistent with that observed at the Facility). Groundwater flow in the deep aquifer at the CPLC site is typically to the southwest to west, toward the Puyallup River (AECOM & MFA 2014). However, a February 2012 monitoring event indicated flow in the deep aquifer to the north. The CPLC site has an average shallow aquifer horizontal gradient of 0.001 feet per foot (ft/ft) and a 0.005 ft/ft horizontal gradient for the deep aquifer. A downward vertical gradient between 0.14 and 0.18 ft/ft was also measured at the CPLC site (AECOM & MFA 2014).

Estimated hydraulic conductivities (based on slug tests) for the shallow aquifer range from 0.059 feet per day (ft/day) to 3.71 ft/day, with a mean of 0.541 ft/day. Estimated hydraulic conductivities for the deep aquifer range from 9.87 ft/day to 25.7 ft/day, with a mean hydraulic conductivity of 19.0 ft/day (AECOM & MFA 2014). Seepage estimates for the shallow aquifer range from 0.071 to 0.001 ft/day and 0.030 to 0.078 ft/day for the deep aquifer.

AECOM & MFA (2014) conducted a 24-hour tidal study that involved installation of a tidal gauge on a piling immediately north of the 11th Street Bridge on the Puyallup Waterway coupled with hourly on-site water level measurements. AECOM & MFA concluded that tidal influence in the shallow aquifer is not significant and that groundwater flow direction and gradients were not impacted by tidal changes in the Puyallup River. However, based on the hydraulic conductivities observed at this site, potential tidal influences may not be observed in a 24-hour study due to the lag time for the potential affects to be observed, and given the shallow gradient at the CPLC site and other sites in the area, it may be difficult to distinguish tidal influence from infiltration due to precipitation and runoff in the shallow aquifer.

1.3.3.2 Facility Subsurface Conditions

The topography at and in the facility vicinity is relatively flat and appears to have a gradual slope to the northwest, toward Commencement Bay. Subsurface soil borings were excavated at the Facility by RZA in 1989 and by MFG (Tetra Tech) in 2002 and 2017. The 1989 and 2002 borings were completed as groundwater monitoring wells. However, the three 1989 wells no longer exist and may have been paved over with asphaltic concrete (asphalt) and two (MFG-1 and MFG-2) of the four wells completed in 2002 still exist.

The Facility's surface is paved with asphalt that appears to be between 6 and 8 inches thick. Underlying the asphalt is sand to sandy gravel fill that is approximately 6 to 7 feet thick over most of the Site, with the exception of near MFG-1 where it appears as approximately 2 feet thick and at MFG-4 where it is around 4.5 feet thick. (RZA 1989 and MFG 2003). Organic fill comprised of degrading landfill materials extends to depths of approximately 12.5 to 16.5 feet bgs. The fill material graded from dry to slightly moist to saturated. The organic fill includes debris such as degrading fine organic "paste", small pieces of wood, roots, sticks, wire, glass, and metal. The debris is in a matrix ranging from black to brown silt to sandy gravel. Shell fragments were also observed within the matrix, indicating the non-landfill matrix is likely dredged tidal flat sediments. Underlying the landfill materials is silt ranging from light gray, dark brown to black silt with organics (e.g. roots). This silt is likely dredged tidal flat sediments. **Figures 3** and **4** (**Appendix A**) provide cross-sections for the Facility.

The saturated zone at the Facility is within the organic fill containing landfill materials. First encountered water recorded by RZA during drilling was 7 to 8 feet bgs (RZA 1989), MFG first encountered water at 7 to 7.5 feet bgs during drilling (MFG 2003). Static water levels recorded in well MFG-1 through MFG-4 ranged from 4.5 to 8.9 feet below top of casing (btoc) over the monitoring years of 2002 to 2004 (MFG 2004). The average depth to water at the Facility is approximately 6.5 feet bgs and the average water table elevation is 9.7 feet AMSL.

Based on topography and flow of the nearby Puyallup River, groundwater flow in the shallow water-bearing zone is expected to be to the north to northwest, toward Commencement Bay. RZA's report (1989) inferred a western groundwater flow direction. However, the orientation of RZA's map was incorrect as the north directional arrow on their map is actually pointing to the east. Correcting for this, the inferred flow direction would be to the north-northwest, toward Commencement Bay. MFG identified a groundwater flow primarily northward, with some fluctuation ranging from northwest to northeast. However, two of the 10 monitoring events conducted between 2002 and 2004 indicated a south to southwest flow direction (February 2002) and one event with an eastern flow direction (June 2004).

Water table elevations for nine of the monitoring events conducted quarterly between February 2002 and March 2004 varied by an average of 0.03 feet over the study area. The June 2004 event showed an outlier with a slightly greater elevation difference between the wells of 0.18 feet. Potentiometric surface maps developed by MFG (2004) indicated a very flat groundwater gradient of 0.0009 feet per foot (feet/foot) at the Facility based on water table elevations. **Section 2.3.5** discusses potential reasons for potential changes in groundwater flow direction.

Hydraulic conductivities have not been measured in on-site wells but are likely similar to those measured at the nearby CPLC site (see **Section 1.3.3.1**).

1.4 SITE HISTORY

1.4.1 Site Development

DII's earliest record of a conversion plant at the property was for an approval given to Johnson Manufacturing Company, Inc. to construct a plant in 1973. Puget Sound By-Products Company was the successor to Johnson Manufacturing Company, Inc., with Darling Ingredients Inc. (formerly Darling International Inc.) being the successor to Puget Sound By-Products.

The heavy industrial area in which the Facility resides is on the Tacoma Tideflats and within the boundaries of the extensive Old Tacoma Tideflats Landfill. The Tacoma Tideflats area consists of dredged sediment fill placed to allow for development of industrial land and waterways for boats and ships. Overlying the tideflats is the Tacoma Tideflats Landfill (aka Lincoln Avenue Landfill). Waste materials were placed on top of the tideflat sediment to further enable the land to be utilized for industrial and commercial development.

The City of Tacoma operated the unregulated and "largely unsupervised" Tacoma Tideflats Landfill from the 1940s through approximately 1964 (TPCHD 2001). The landfill is generally characterized as a former unregulated dumping area for municipal waste for Tacoma residents. In addition, industries may have also deposited solid

and/or hazardous waste materials in the landfill (TPCHD 2001). The landfill debris was regularly burned to reduce waste volumes. **Figure 1** presents the approximate lateral extent of the landfill; the Facility is located near the center of the former landfill. Based on the estimated boundaries on **Figure 1**, the former landfill covers over 300 acres in the area of the Facility.

1.4.2 Prior Environmental Investigations

Whitman Environmental Services (WES 1998) conducted a UST closure review in 1998. The WES report summarized tank closure and site investigation activities between 1989 and 1997. MFG, Inc. (Tetra Tech) began conducting investigation work at the Facility in 2002. The following sections summarize prior investigations conducted at the Facility. Summaries of constituents of potential concern (COPCs) that exceed soil screening level or groundwater standards in the following section are based on the screening levels and standards established at the time of the investigation.

1.4.3 1989 Underground Storage Tank Removal

Two 10,000-gallon USTs were previously located at the Site. These tanks were located adjacent to the east side of the work shop. The former tank basin is currently beneath the office/shower/lunch room building (**Figure 2**). One UST held diesel fuel for use by company trucks and the other UST held Bunker C fuel oil for use in the DII boiler. The two USTs and associated piping were removed on May 22, 1989 and properly disposed by Don Golden Company (Golden; WES 1998). The former Bunker C UST was taken to Northwest EnviroServices in Seattle and the diesel tank was disposed of at the Golden facility in Tacoma where it was cleaned, cut up, and scrapped.

Airo Services, Inc. used a vacuum truck to remove and dispose of 1,000 gallons of waste water from the excavation. Golden excavated approximately 112 cubic yards (approximately 170 tons) of soil during removal of the USTs (WES 1998). The soil was stockpiled and sampled. The stockpile soil samples were analyzed for total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylenes (BTEX). The method used to analyze for TPH was U.S. Environmental Protection Agency (EPA) method 418.1. However, this method does not differentiate between the fuel types; therefore, the results are presented as a total value for TPH. TPH results from the soil stockpile ranged from 4,672 to 8,370 milligrams per kilograms (mg/kg); ethylbenzene was detected at 0.41 mg/kg, and xylenes at 1.93 mg/kg. Benzene and toluene were not detected in the soil stockpile samples. The soil contained in the stockpiles was removed from the Facility and properly disposed on May 23, 1989 (WES 1998).

Ecology collected soil samples from the walls of the UST excavation and a grab sample from groundwater within the excavation (WES 1998). The excavation wall soil samples were analyzed for TPH only and the groundwater sample was analyzed for TPH and BTEX. Soil TPH concentrations in excavation sidewall samples ranged from 1,874 (south wall) to 2,854 mg/kg (north wall). TPH in the groundwater sample had a concentration of 4,565 milligrams per liter (mg/L), and ethylbenzene and xylenes were detected at concentrations of 0.5 mg/L and 0.44 mg/L, respectively. Benzene and toluene were not detected in the groundwater sample. The soil and groundwater analytical results exceeded their respective MTCA Method A cleanup levels referenced at the time of the removal. **Table 1-3**, below, provides the historic soil and water results from the UST removal work.

Table 1-3. Historic 1989 UST Excavation Results

Analytical Parameter	MTCA A Soil Cleanup Level (mg/kg)	Sidewalls Samples (mg/kg)		Soil Stockpile Samples (mg/kg)		MTCA A Ground-water Cleanup Level (µg/L)	3B Grab Water From Pit (µg/L)
		1B N. End UST Pit	2B S. End UST Pit	4B N. Stockpile of Soil	5B S. Stockpile of Soil		
BTEX (EPA 8015M)							
Benzene	0.03			<0.05		5	<50
Toluene	7			<0.05		1,000	<50
Ethylbenzene	6			0.41		700	500
Toluene	9			1.93		1,000	440
Total Petroleum Hydrocarbons (EPA 418.1)	--	2,854	1,874				
Total Petroleum Hydrocarbons (EPA 8015M)	--			4,565	8,370		4,565,000*

**Sample collected from UST excavation, sample is likely not representative of groundwater conditions as the sample would likely have been very turbid and contain soil and degrading landfill debris (e.g. degrading garbage, grass, and other organics).*

1.4.4 1989 Site Assessment

Rittenhouse-Zeman & Associates, Inc. (RZA) performed a subsurface soil and groundwater investigation at the Facility in September 1989. The RZA installed three borings during the 1989 site assessment and completed the borings as groundwater monitoring wells. The wells were completed in the shallow water-bearing zone beneath the Facility.

- Boring/well MW-4 was completed adjacent to the north side of the work shop at a location northwest of the UST basin.
- Boring/well MW-5 was completed in the driving/parking area northeast of the former UST basing.
- Boring/well MW-6 was completed adjacent to the south side of the work shop at a location southwest of the UST basin.

Total depths of the borings ranged from 14 to 16.5 feet bgs. Groundwater was encountered approximately 7 to 8 feet bgs during drilling. Fill material was encountered to depths of 12 to 16.5 feet during drilling. RZA recorded the fill material as medium dense, gray to brown silty sand with some gravel, followed by loose to medium dense black silty sand with wood chip waste, glass, metal and organic matter. Soil material encountered below the fill material consisted of stiff to medium stiff gray silt. This soil material is likely dredged tideflat material. RZA collected soil samples during drilling. The soil samples were analyzed for TPH by EPA method 418.1. TPH results ranged from 141 to 645 mg/kg (RZA 1989). **Table 1-4**, below, presents the historic subsurface soil boring results

Table 1-4. Historic 1989 Subsurface Soil Boring Results

Analytical Parameter	MTCA A Soil Cleanup Level	B-4 (S-3) 7.5’	B-5 (S-2) 5’	B-6 (S-2) 5’
Total Petroleum Hydrocarbons (EPA 418.1)	--	141*	<10	*645

* Sound Analytical Services, Inc. indicated results were representative of aged gasoline or mineral spirits.

RZA installed three wells in the former USTs area and performed groundwater sampling in 1989 following well completion. Well MW-4 was in the area of current well MFG-1, well MW-5 was located in the general area of MFG-3 (abandoned in 2017), and well MW-6 was located in the area of current well MFG-4 (not found in 2017; see **Section 2**). Initial groundwater results in 1989 indicated no detectable concentrations of TPH above the laboratory practical quantitation limit (PQL) of 10,000 µg/L. However, continued groundwater sampling from 1990 through 1993 indicated concentrations of TPH in MW-4 ranging from 1,000 to 44,000 µg/L and 2,200 to 32,000 µg/L in MW-6 (WES 1998). Of note, RZA's map is skewed such that it depicts north as actually to the east. Correcting for this, the inferred groundwater flow direction was to the north-northwest, consistent with observations made during Tetra Tech's investigations (see Section 1.4.5 and 2). All monitoring wells installed by RZA were abandoned in 1997. **Table 1-5**, below, presents the historic groundwater results.

Table 1-5. Historic 1989 Groundwater Results

Analytical Parameter	Sample Date	MW-4	MW-5	MW-6
Water Table Elevation (ft amsl)	1989	~9	~9	~9
Total Petroleum Hydrocarbons (EPA 8015M; µg/L)	9/12/1989	<10,000	<10,000	<10,000
	11/8/1989	7,200	10,000	10,000
	1/10/1990	20,000	7,000	10,000
	4/10/1990	9,400	12,700	19,000
	7/10/1990	7,000	5,000	43,000
	10/5/1990	5,600	Non-detect	9,200
	1/15/1991	2,200	1,100	23,000
	4/5/1991	<1,000	<1,000	36,000
	7/9/1991	3,400	3,500	43,000
	11/12/1991	1,700	2,300	9,400
	1/9/1992	2,000	3,000	20,000
	8/26/92	Not reported	10,000	4,600
	12/14/1992	Not reported	44,000	32,000
	1/27/1993	Not reported	8,500	2,200

The 1989 RZA map indicated three other on-site wells MW-1, MW-2 and MW-3. These wells were installed to monitor groundwater quality up-gradient and down-gradient of three former wastewater treatment lagoons and one former clarifier within the south portion of the property. The wells were completed to a depth of approximately 30 feet bgs, within the lower water-bearing zone. RZA inferred a western groundwater flow direction within the lower water-bearing zone.

1.4.5 2002 to 2004 Site Investigation & Groundwater Monitoring

MFG performed a subsurface investigation during February 2002 (MFG 2003). MFG and Maxim Technologies (both subsidiaries of Tetra Tech) conducted quarterly groundwater monitoring from 2002 (MFG 2003) through 2004 (Maxim 2004). The 2002 subsurface investigation was conducted in accordance with the Site Investigation Work Plan (MFG 2002). Investigation activities included:

- A document review for the Site and surrounding properties;
- Completion of four groundwater monitoring wells (MFG-1 through MFG-4);
- Sampling and analysis of subsurface soil and groundwater to evaluate petroleum hydrocarbon impacts;
- Measurement of water levels to evaluate groundwater flow direction;

- Obtain horizontal and vertical coordinates of each monitoring well by a licensed surveyor; and
- Completion of investigation and monitoring reports.

Appendix B includes data tables for investigation between 2002 and 2019.

- **Table 1** provides well completion information;
- **Table 2** presents soil analytical results;
- **Table 3** includes depth to water and water table elevation data; and
- **Table 4** presents groundwater analytical results.

1.4.5.1 2002 Subsurface Investigation

Surface material at the Facility is asphalt underlain by an average of approximately 6 feet of sand to sandy gravel fill. Fill material encountered in subsurface soil borings ranged from ground surface to 12.5 to 16.5 feet bgs. Fill material consisted of silt, sand and gravel mixed with landfill debris. Moisture graded from dry to slightly moist to saturated. Landfill debris included degrading fine organic paste, scrap wood, roots, and sticks; wire, glass, and metal. Underlying the landfill materials was silt ranging from light gray, dark brown to black silt with fine organics (e.g. rootlets). Each of the four subsurface soil borings were completed as groundwater monitoring wells. The wells were completed as follows (**Figure 2** and **Table 1**).

- Boring/well MFG-1 was completed adjacent to the north side of the work shop at a location northwest of the former UST basin. The well was near RZA well location MW-4.
- Boring/well MFG-2 was completed adjacent to the north fence line directly north of the former UST basin.
- Boring/well MFG-3 was completed east of the former UST basin.
- Boring/well MFG-4 was completed south of the work shop at a location southwest of the former UST basin.

Subsurface soil samples collected during the investigation were analyzed for TPH by NWTPH-Dx, extractable petroleum hydrocarbons (EPH) by modified WDOE TPH Policy Method, polynuclear aromatic hydrocarbons (PAHs) and naphthalenes by GC/MS-SIM, and BTEX by SW-846 method 8021B. Soil analytical results (**Table 2**) indicated the following:

- Soil sample MFG-B3 (7.5-8') was the only subsurface soil sample collected during the 2002 investigation that exceed the 2,000 mg/kg heavy oil range MTCA Method A Soil Cleanup Levels for unrestricted land use and industrial properties with a concentration of 3,000 mg/kg.
- Soil samples MFG-B3 (7.5-8') and MFG-B4 (8-8.5') exhibited concentrations of total carcinogenic polynuclear aromatic hydrocarbons (cPAHs) above the MTCA Method A Soil Cleanup level for unrestricted land use of 0.1 mg/kg and industrial land use of 2 mg/kg. Concentrations of total cPAHs in MFG-B3 (7.5-8') was 22.5 mg/kg and 2.3 mg/kg in MFG-B4 (8-8.5').

1.4.5.2 Quarterly Groundwater Monitoring

MFG completed quarterly groundwater monitoring from 2002 through 2004. Wells were sampled using low-flow purging and sampling. Water levels were collected after opening all four wells and letting them equilibrate prior to measuring depth to water with an electronic water level tape (**Table 3**). Field parameters monitored during purging included specific conductance, pH and temperature. Specific conductance ranged from 689 to 2,120 micro-Siemens (µS), pH ranged from 6.1 to 7.5 standard units, and temperature ranged from 12.8 to 20.3 degrees Celsius. Depth to water ranged from 4.51 to 8.87 feet btoc, water table elevations ranged from 7.9 to 11.2 feet amsl. The average depth to water was approximately 6.4 feet btoc and the average water table elevation of 9.4 feet amsl (**Table 4**).

Groundwater flow directions were estimated based on development of potentiometric surface maps using water table elevation data (**Table 3**). Groundwater flow directions ranged from northwest, north to east (MFG 2003 and Maxim 2004). Determination of groundwater flow direction and gradient is difficult at the Facility due to the minor water table elevation differences across the study area and the relatively flat groundwater gradient. Elevation differences between wells range from 0.01 to 0.05 feet with one outlier in June 2004 of 0.18 feet. The average elevation difference between wells, excluding the outlier, is 0.03 feet. The average groundwater gradient was 0.0009 feet per foot (ft/ft). (See Section 2.3.5 for discussion).

Diesel and mineral oil range TPH results from all wells and all monitoring events exceeded MTCA Method A Groundwater Cleanup Level of 500 micrograms per liter (µg/L) for each parameter. All heavy oil range results exceeded the MTCA Method A Groundwater Cleanup Level of 500 µg/L in all wells and all events except three events for MFG-1, two events for MFG-2 and MFG-3, and one event for MFG-4. However, diesel range, heavy oil range and mineral range TPH samples were also prepared using SGT during the 2003 and 2004 monitoring events.

SGT is an extraction process that removes polar organic material/hydrocarbons other than petroleum hydrocarbons, which are non-polar, from the sample prior to analysis. SGT is used in situations where high concentrations of non-petroleum hydrocarbon organic matter is present, such as the landfill and tideflat materials present in the subsurface at the Facility. What is remaining in the sample, and reported by the laboratory, following SGT are the concentrations of petroleum hydrocarbons or non-polar hydrocarbons in the sample.

TPH analyzed with SGT resulted in no detectable diesel, heavy oil or mineral range TPH in any of the groundwater samples above the laboratory PQL. EPH carbon range results also indicated non-detect to low concentrations (<150 µg/L). **Table 4** presents the groundwater data.

1.4.6 2012 VCP Application

Tetra Tech prepared a VCP application for the Facility in 2012. Mr. Christopher Maurer of Ecology reviewed the document in 2016 (Ecology 2016a) and provided a list of deficiencies that needed to be addressed prior to consideration of facility closure. **Table 1-3**, below, lists Ecology's requested work as presented in Mr. Maurer's e-mail dated April 27, 2016.

Table 1-6. Summary of VCP Application Deficiencies

VCP Topic	Deficiency
1. Subsurface Soil Borings	Install four new soil borings as close as possible to the former underground storage tanks location; one boring on the north, east, and south sides. A fourth boring will be drilled in the vicinity of monitoring well MFG-3. The borings are to be installed to a depth of 12 feet. Soil samples from the borings are to be analyzed for diesel and heavy oil, with and without silica gel cleanup.
2. Monitoring Well Installation	Install two new monitoring wells in place of monitoring wells MFG-1 and MFG-2 unless monitoring wells MFG-1 and MFG-2 are found to be in a fully functional condition. Groundwater samples from the two wells, either existing or replacement, are to be analyzed for diesel and heavy oil, with and without silica gel cleanup.
3. Monitoring Well Assessment	If possible, locate groundwater monitoring wells MFG-3 and MFG-4 and determine if they are fully functional. If they are not fully functional, abandon them according to State standards. If groundwater monitoring wells MFG-1 and MFG-2 are not fully functional, likewise abandon them according to State standards.

VCP Topic	Deficiency
4. Tidal Groundwater Influence	If reasonable, determine if the groundwater level is tidally influenced. *November 2016 discussions between N. Morrow of Tetra Tech and C. Maurer of Ecology: There are many variables at and in the vicinity of the site that could influence groundwater levels and flow direction. Water table elevations between wells varies by 0.03 feet, on average, during most of the past monitoring events.* *Based on our November 2016 conversation, we discussed that the Facility is paved but almost the entire surrounding area is unpaved. Other factors that may affect groundwater levels and local flow direction include: 1) runoff from the site (however, it appears that facility runoff is generally contained and captured on-site); 2) infiltration of water to the shallow water zone from the surrounding unpaved lands; 3) runoff from large roofs on the adjoining property; 4) the nearby wetland ponds, Puyallup River and Commencement Bay; 5) hydrostatic rebounding from the adjoining railroad tracks; and 6) preferential flow paths related to subsurface utility lines.* *It was concluded that determining tidal influence would likely be difficult and require a lengthy study. As such, N. Morrow and C. Maurer agreed that DII would not need to conduct the study for this site investigation. However, precipitation events for the days leading up to the groundwater monitoring event would be reviewed and field personnel would document, as possible, runoff patterns and infiltration areas.*
5. Cross-Section Preparation	Prepare and submit to Ecology two cross-sections of the site. Include in the cross-sections soil lithology, aquifer locations, monitoring wells, and soil borings. Include in the cross-sections the data from the new soil borings and, if installed, the new groundwater monitoring wells.
6. Site Investigation Report	Prepare and submit to Ecology a report describing the results of the above additional site characterization. At the time the report is submitted to Ecology, enter the report data into Ecology's EIMS database. This is a recent change in Ecology policy. Ecology now requires that data be entered into the EIMS database at the time of the submittal of a report rather than at the time a final opinion letter is prepared.

Data collected during the investigation was compared to current MTCA cleanup levels.

2.0 FIELD INVESTIGATION – 2017 AND 2019

2.1 PROJECT OBJECTIVES

2.1.1 Purpose of Project

The objectives of the 2017 site investigation were to complete a soil and groundwater investigation to evaluate environmental impacts from the former USTs and support Facility closure. The goal of this investigation is to evaluate current facility conditions near the former UST basin. Based on the information obtained, Ecology may make additional recommendations for further site assessment, risk assessment, and/or cleanup planning.

Tetra Tech conducted additional groundwater sampling in 2019 to evaluate current groundwater conditions and obtain additional data to support statistical evaluations of petroleum hydrocarbon concentrations in groundwater.

2.1.2 Contaminants of Potential Concern

Mr. Maurer of Ecology requested analysis of petroleum hydrocarbons to evaluate potential impacts related to the former UST leak. COPCs for the 2017 and 2019 investigations included petroleum hydrocarbons associated with diesel and Bunker C fuels. **Table 2-1**, below, presents the COPCs based on the results of past investigations:

Table 2-1. Contaminants of Potential Concern

Contaminant	Origin
Petroleum Hydrocarbons	Diesel and Bunker C fuels associated with the former 10,000-gallon USTs removed in 1989.

2.1.3 Scope of Work

The scope of work for the 2017 investigation was developed based on prior investigations at the Facility and Ecology's list of VCP deficiencies. The following scope of work was developed to evaluate current site conditions:

- Task 1 – Assess Condition of Existing Wells: Attempt to locate MFG-1 through MFG-4 and assess whether wells are fully functional. Abandon any wells that are not found to be fully functional.
- Task 2 – Subsurface Soil Investigation: Drill and sample soil from four subsurface soil borings. Analyze soil samples for diesel and heavy oil, with and without silica gel cleanup.
- Task 3 – Groundwater Investigation: Install replacement wells for MFG-1 and MFG-2 if the original wells were found to not be fully functional. Develop the wells and sample groundwater from the four wells. Evaluate site and adjoining properties for areas of infiltration and runoff and evaluate precipitation data prior to the groundwater sampling event.
- Task 4 – Investigation Report: Prepare a soil and groundwater investigation report for Ecology review. The report will include two cross-sections prepared using new subsurface soil and well data.

The site investigation work plan (Tetra Tech 2017) details the data quality objectives (DQOs) for this project.

An additional groundwater monitoring event was conducted in January 2019 to further evaluate current site conditions. The 2019 groundwater sampling event included sampling of wells MFG-1 and MFG-2 consistent with the 2017 site investigation work plan.

2.1.4 Study Boundary

Based on Ecology's comments on the VCP application, standard points of compliance (POCs) were used. The lateral study boundary is the Facility boundary and adjoining properties, where necessary and accessible. The vertical boundary is from ground surface to the lowest most depth that could potentially be affected by the Facility. This is likely the aquitard at the base of the shallow aquifer, observed as the olive gray silt in the base of the site boreholes. Ecology considers human exposure via direct contact or other exposure pathways is from ground surface to 15 feet bgs.

2.1.5 Cleanup Levels

Soil and groundwater results were used to evaluate data collected during the investigation. **Table 2-2**, below, presents the soil and groundwater analytical parameters for this project along with the analytical method, MTCA Method A groundwater and industrial soil cleanup levels, and required laboratory reporting limit / practical quantitation limits (PQL) for this project. The parameter list is based on Mr. Maurer's April 26, 2016 e-mail (Ecology 2016a). EPH parameters were added for possible use in MTCA Method B/C calculations and risk assessment, if needed. EPH parameters were not analyzed in 2019 as all EPH constituents have been non-detect since 2002.

Table 2-2. Soil & Groundwater Analytical Methods & Cleanup Levels

Parameter	Analytical Method	Lab PQL Soil (mg/kg)	Lab PQL GW (µg/L)	MTCA Method A Soil Cleanup Level for Industrial Properties (mg/kg)	MTCA Method A Groundwater Cleanup Levels (µg/L)
Diesel-Range Petroleum Hydrocarbons (With & Without SGT)	NWTPH-Dx				
Diesel Range Hydrocarbons		25	250	2,000	500
Heavy/Motor Oil Range Hydrocarbons		100	500	2,000	500
Mineral Oil Range Hydrocarbons		--	--	4,000	500
Extractable Petroleum Hydrocarbons	WA MTCA-EPH				
C8 – C10 Aliphatics		5	50	--	--
C10 – C12 Aliphatics		5	50	--	--
C12 – C16 Aliphatics		5	50	--	--
C16 – C21 Aliphatics		5	50	--	--
C21 – C34 Aliphatics		5	50	--	--
C10 – C12 Aromatics		5	50	--	--
C12 – C16 Aromatics		5	50	--	--
C16 – C21 Aromatics		5	50	--	--
C21 – C34 Aromatics		5	50	--	--
Moisture		--		--	--

-- no cleanup level

2.2 CONCEPTUAL SITE MODEL

Groundwater flow direction at the Facility is primarily to the northwest, toward Commencement Bay and approximately parallel to the Puyallup River (see Section 2.2.4). Potential sources of contamination at the Facility include leaks associated with the two former 10,000-gallon diesel and Bunker C USTs removed in 1989. Based on historic reports, the majority of impacted subsurface materials (soil and landfill wastes) were removed during the 1989 cleanup effort.

However, some residual petroleum hydrocarbons remained in the sidewalls and in groundwater (**Section 1.4.3**). The volume of soil removed was approximately 112 cubic yards. The extent of the excavation is unknown. However, an estimate of the excavation extent can be made based on the volume (10,000 gallons each) and assuming the tanks were likely around 26 feet long by 8 feet in diameter. Each UST would be roughly 1,307 cubic feet in size, which would occupy a volume of around 48 cubic yards each if it were soil. An excavation totaling roughly 20 feet wide by 30 feet long by 8.5 feet deep would result in an estimated 188 bank cubic yards. The estimated volume of soil removed would be 92 bank cubic yards after subtracting the 96 cubic yard volume occupied by the USTs. This would result in an estimated 115+/- excavated cubic yards, close to the volume of 112 cubic yards (170 tons) reportedly removed in 1989. **Figure 3** and **Figure 4** (**Appendix A**) present cross-sections showing the subsurface of the Facility. **Figure 5** (**Appendix A**) provides a Conceptual Site Model.

Additional potential sources of hazardous wastes, petroleum hydrocarbons, and degrading organic wastes for the property are related to waste materials associated with the former Old Tacoma Tideflats Landfill. While some of the operations adjoining the Facility may use, store, or transport hazardous wastes or petroleum hydrocarbons, the majority of these operations appear to be in a down-gradient or cross-gradient direction of the Facility.

Section 3.3 presents a human health and ecological risk assessment for the Facility. The city of Tacoma supplies potable drinking and wash water to the Facility and surrounding industrial operations in the facility area. Exposure pathways for site visitors and on-site workers for dermal contact and/or ingestion of potentially impacted soil or groundwater at the Facility are not considered complete as potentially impacted soil resides an average of 6 feet bgs beneath asphalt and unimpacted soil, and groundwater at and in the Facility area is not used for drinking water or wash water.

2.3 2017 AND 2019 INVESTIGATION RESULTS

The site investigation work plan (Tetra Tech 2017) discusses the investigation methods and standard operating procedures used to conduct the investigation. The following sections provide the investigation results.

2.3.1 Access & Utility Clearances

Tetra Tech contacted the one-call utility locate center for utility clearance prior to conducting the 2017 subsurface activities. Tetra Tech also scheduled a private on-site utility locate by Applied Professional Services, Inc. to clear potential on-site, local utilities that may have been installed by Port of Tacoma or DII. Underground lines were found adjacent to wells MFG-1 and MFG-2 and subsurface soil boring SB-1 (see below). An old, abandoned local utility line was discovered while trying to locate MFG-4. The line ran from north to south between the shop and animal off-load ramp. However, the work was able to commence without moving borehole locations outside of the planned investigation areas.

2.3.2 Assess Condition of Existing Wells

Site re-paving work since the last well sampling event in 2004 resulted in the four existing wells (MFG-1 through MFG-4) potentially being covered with asphalt. **Table 1** (**Appendix B**) provides well construction details. Tetra Tech used a global positioning system (GPS) unit and metal detector to try to locate the four wells. Once the well or a metal signature was found, Cascade Drilling's breakout crew worked to uncover the well/metal object discovered using a jackhammer. The following discusses the well conditions and associated work.

MFG-1 Well Condition

MFG-1 was found and appeared to be in relatively good condition. The metal surface vault for MFG-1 was in fair condition and the inner well cap was in-place and in good condition. The polyvinylchloride (PVC) casing also appeared to be in good condition and there was no indication of asphalt sealants on the outer or inner portion of the well casing. Approximately 1 to 2 inches of new asphalt was placed in the area of MFG-1. Therefore, Cascade installed a new well vault at MFG-1, which raised the top of the well vault to the current asphalt level, and a new locking well cap was installed. Due to the limited amount of new asphalt at MFG-1, the PVC casing did not require an extension.

MFG-2 Well Condition

The metal surface vault for MFG-2 appeared damaged. Cascade indicated a surface grinder may have been used prior to paving, which caused the metal surface plate to become scratched and brittle. The metal surface plate broke when trying to uncover and open the well. Despite damage to the metal surface plate, the inner well cap was in-place and in good condition and there was no indication of asphalt sealants on the outer or inner portion of the well casing.

Approximately 4 to 6 inches of new asphalt was placed in the area of MFG-2. Therefore, Cascade installed a new section of PVC well riser and installed a new well vault, which raised the top of the well vault to the current level of asphalt.

MFG-3 Well Condition

MFG-3 was found and appeared to be impacted by asphalt paving activities. The metal surface plate had been damaged as well as the inner PVC well cap. Asphalt sealant appeared on the upper portion of the interior of the PVC well casing. Therefore, Tetra Tech and Cascade abandoned the well. Bentonite chips were placed in the well to just below the asphalt surface. The PVC casing was then cut to approximately the base of the asphalt. Fast-acting, black-dyed concrete patch was then placed in the hole and brought to the level of the current asphalt surface.

MFG-4 Well Condition

Well MFG-4's location did not appear to have been in an area where re-paving was conducted. However, it was in an area where a new drainage swale was constructed and connected to a sump that handles surface wash water and precipitation. The sump has a pump that pumps the water to the northwest corner of the rendering plant building for water re-use (**Figure 2**). MFG-4 was likely disturbed and partially removed during construction of the drainage swale. Metal signatures in the area of MFG-4 were found to be small pieces of metal and an old abandoned utility line between the shop and the animal off-load ramp. Well MFG-4 could not be found despite using the GPS, metal detector, and jackhammer to investigate several locations in the area where MFG-4 had been previously located. Fast-acting, black-dyed concrete patch was placed in the investigation holes to patch the asphalt surface.

2.3.3 Subsurface Soil Investigation

Tetra Tech conducted a subsurface soil investigation at the Facility in 2017 using a Geoprobe 660 direct-push technology (DPT) drill rig. The purpose was to evaluate current soil conditions adjacent to the former UST tank basin and the adjacent to well MFG-3.

2.3.3.1 Subsurface Soil Boring Locations

Field personnel excavated four subsurface soil borings adjacent to the former UST basin on the north, east and south, including a location adjacent to abandoned well MFG-3 during the 2017 investigation. **Figure 2** (**Appendix A**) shows the location of the soil borings and wells. The three closest borings to the former UST basin are approximately 10 feet north (SB-1), 30 feet east (SB-2), and 20 feet south (SB-4). Boring (SB-3), adjacent to MFG-3, is approximately 50 feet southeast of the former UST basin (**Figure 2**). The total depth of each borehole was 15 feet bgs. The boreholes were backfilled with bentonite chips after all soil samples were collected from each boring. Fast-acting, black-dyed concrete patch was used to repair the pavement at each investigation location.

2.3.3.2 Subsurface Soil Lithology

Continuous soil cores were extracted from each of the four borings for logging and soil sampling. A portion of each soil core was preserved for possible laboratory analysis. Volume permitting, the remaining portion was used for on-site soil screening of volatile organic vapors using a photoionization detector (PID). Field screening results were documented on the field boring logs. Field personnel documented the subsurface lithology and waste material encountered in each boring (**Appendix C**).

The lithology encountered in the borings was consistent with that observed in 2002 while drilling boreholes for wells MFG-1 through MFG-4. The upper portion of each borehole consisted of sandy gravel fill to between 5 and 6 feet bgs, which was underlain by artificial fill consisting primarily of fine-grained degrading wood wastes with metal, glass, brick, and other organics such as shells and roots. Some larger fragments of wood up to 2-inch in size was observed in one borehole.

Figures 3 and **4** (Appendix A) present cross-sections for the Facility in the North-South and West-East directions, respectively. The cross-sections include the 2002 and 2017 subsurface soil borehole data and estimated

groundwater elevations based on depth to water collected during the July 20, 2017 site investigation. First encountered water in boreholes during the July investigation ranged from 6.5 and 7.5 feet btoc.

2.3.3.3 Subsurface Soil Sampling and Analysis

One subsurface soil sample was collected from each soil boring at the approximate air-water interface at a depth of 6.5 to 7 feet bgs. One exception includes the sample collected from MFG-1, which was collected from the 4.5- to 5-foot depth interval due to poor recovery at or near the air-water interface, despite multiple borehole attempts to obtain soil from deeper intervals. The sample from the air-water interface appeared to be the worst-case interval based on visual indications of staining and odor. The PID readings were not elevated and ranged from 0 to 12 parts per million (ppm), which is considered to be within the background fluctuation range of the instrument.

Subsurface soil samples were analyzed as per **Table 2-3**, below. One equipment rinsate blank was also collected for the project. Field personnel hand-delivered the subsurface soil samples to TestAmerica laboratory in Tacoma, Washington for analysis. **Appendix D** provides the laboratory and data validation reports.

Table 2-3. Subsurface Soil Analytical Requirements

Parameter	Analytical Method	Laboratory Required Reporting Limit (mg/kg)
Diesel-Range Petroleum Hydrocarbons – With Silica Gel Cleanup	NWTPH-Dx	Diesel – 25 Heavy Oil – 100 Mineral Oil - NR
Diesel-Range Petroleum Hydrocarbons – Without Silica Gel Cleanup	NWTPH-Dx	Diesel – 25 Heavy Oil – 100 Mineral Oil - NR
Moisture	SM-2540G-1997 (or similar)	NA

2.3.3.4 Subsurface Soil Analytical Results

Table 2 (**Appendix B**) presents the subsurface soil analytical results. Soil samples were analyzed for diesel and motor oil petroleum hydrocarbons with and without SGT by Method NWTPH-Dx. Samples were also analyzed for EPH fractions to evaluate concentrations in the different carbon ranges and for potential calculation use with MTCA Method B/C, if needed (**Table 2**). **Table 3-2**, below, summarizes the analytical results and cleanup level exceedances. **Figure 6** (Appendix A) shows the 2017 soil results on a site map. **Appendix D** includes the laboratory analytical reports.

Table 2-4. Subsurface Soil Analytical Requirements

Analytical Parameter	MTCA Method A Soil Cleanup Level (mg/kg)	Analytical Results (mg/kg)			
		SB-1 (4.5-5')	SB-2 (6.5-7.5')	SB-3 (6.5-7.6')	SB-4 (6.5-7.5')
Total Petroleum Hydrocarbons – Without SGT					
Diesel Range (C10-C24)	2,000	190	1,400	1,400	**3,300**
Motor Oil Range (>C24-C36)	2,000	780	1,200	**3,800**	**9,700**
Total TPH without SGT		*970*	*2,600*	*5,200*	*13,000*
Total Petroleum Hydrocarbons – With SGT					

Analytical Parameter	MTCA Method A Soil Cleanup Level (mg/kg)	Analytical Results (mg/kg)			
		SB-1 (4.5-5')	SB-2 (6.5-7.5')	SB-3 (6.5-7.6')	SB-4 (6.5-7.5')
Diesel Range (C10-C24)	2,000	160	1,300	1,100	**2,400**
Motor Oil Range (>C24-C36)	2,000	670	890	**3,400**	**9,500**
Total TPH without SGT		*830*	*2,190*	*4,500*	*11,900*

Bold – exceeds cleanup level.

Subsurface soil analytical results were compared with MTCA Method A Soil Cleanup Levels. Concentrations of petroleum hydrocarbons in subsurface soil collected and analyzed from SB-1 and SB-2 did not exceed the cleanup levels of 2,000 mg/kg, while subsurface soil samples collected from SB-3 and SB-4 did exhibit concentrations above cleanup levels. Analysis of the samples with SGT indicated a slight decrease in concentration but soil results remained above the soil cleanup level.

Of interest, TestAmerica noted in the laboratory narrative that subsurface soil samples collected from SB-1, SB-3, and SB-4 had a hydrocarbon pattern in the diesel range that was later than a typical diesel fuel pattern, but that there were also peaks that showed a hydrocarbon pattern that was earlier than a typical diesel pattern. The laboratory did not know the exact reason for this. But the variability could be due to matrix interference, other degrading non-petroleum hydrocarbon organics present in landfill and tidal flat materials, or degraded hydrocarbons related to the former USTs.

2.3.3.5 Data Review, Verification, and Validation

Tetra Tech conducted a data review, verification, and validation on the groundwater data collected in 2017 and 2019. The review was conducted using EPA's National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (EPA 2017) for guidance. The data was collected and analyzed as per the site investigation work plan (Tetra Tech 2017). No data was rejected during the data review, verification, and validation effort. All data is considered useable and completed. **Appendix D** includes a copy of the data evaluation report.

2.3.4 Groundwater Investigation

Tetra Tech sampled groundwater in 2017 from wells MFG-1 and MFG-2 at the Facility following the DPT soil investigation, as per Ecology's request. Tetra Tech also assessed the area to evaluate potential influences to groundwater flow direction (see **Section 2.3.5**). Groundwater was also sampled on January 24, 2019 to evaluate current groundwater conditions. The site investigation work plan (Tetra Tech 2017a) provides sampling method details. Field personnel generally followed EPA's low-flow groundwater purging and sampling technique. Wells were purged and sampled using a peristaltic pump and dedicated, disposable tubing. For sampling consistency, the tubing intake location was within the top 2 feet of the saturated screen interval.

2.3.4.1 Field Measurements

Tetra Tech measured depth to water in MFG-1 and MFG-2 prior to groundwater monitoring activities by opening both wells and allowing the static water level to stabilize before recording the depth to water in the wells. The water level in MFG-3 was also recorded prior to abandonment of the well in 2017.

Field personnel monitored and record temperature, pH, specific conductance, dissolved oxygen, and oxidation-reduction potential. Field parameters were monitored during purging using a multi-parameter meter and flow-through cell. Turbidity was estimated through visual inspection because the turbidity meter would not calibrate.

Field personnel used a 5-gallon bucket, graduated in liters to track purge rate and volume. The wells were purged at a consistent rate of 0.25 per minute, such that well drawdown was less than 0.3 feet. Wells were sampled following field parameter stabilization. Field parameters were generally considered stable when three successive readings were within the following (EPA 2010):

- pH +/- 0.1 pH units
- Temperature +/- 3%
- Specific conductance +/- 3%
- Dissolved oxygen +/- 10% if >0.5 mg/L, or stable if three values less than 0.5 mg/kg
- Oxidation-reduction potential +/- 10 millivolts

Table 2.5, below, summarizes the 2017 and 2019 field data. **Table 3** (**Appendix B**) provides depths to water and water table elevation data for data between 2002 and 2019. **Figure 6** shows the results on a site map.

Table 2-5. Summary of 2017 and 2019 Field Parameters

Field Parameter	MFG-1		MFG-2	
	2017	2019	2017	2019
Depth to Water (feet below top of PVC)	7.02	5.47	6.83	5.25
Water Table Elevation	8.99	10.54	8.81	10.39
Temperature (°C)	15.8	12.7	17.5	13.3
pH (s.u.)	6.5	6.5	6.7	6.5
Specific conductance (µS/cm)	1,980	1,258	1,281	989
Oxidation-reduction potential (mV)	-146.9	-86.2	-87	-87
Dissolved oxygen	0.29	--	0.31	--

Depth to water measured in MFG-3 in 2017 was 7.37 feet below the top of the PVC (btoc) measuring point prior to well abandonment. The water table elevation at MFG-3 based on the 2002 well survey is 9.48 feet btoc. However, Tetra Tech adjusted this elevation using the 2017 survey of MFG-1 (see **Section 2.3.6**), which resulted in an adjusted water table elevation to 9.22 feet btoc. This adjusted elevation was estimated based on the 0.26 feet elevation difference observed at MFG-1 between the 2002 and 2017 survey elevations. **Figure 2** shows the water table elevations for 2017 and 2019.

Groundwater flow direction is estimated to be to the north-northwest based on the water table elevations at MFG-1, MFG-2, and the 2017 measurement at MFG-3. The 2019 data also indicated a likely north-northwest flow direction based on the 2019 water table elevations measured in MFG-1 and MFG-2. This flow direction is consistent with the flow of the nearby Puyallup River and nearby waterways, which flow to Commencement Bay. The north-northwestern flow direction is likely the baseline groundwater flow direction as the site area was experiencing the driest summer on record in 2017 (see Section 3.5)

2.3.4.2 Groundwater Analytical Results

TestAmerica laboratory in Tacoma, Washington analyzed the groundwater samples. Groundwater field duplicates were collected in 2017 and 2019, and one equipment rinsate blank was collected for the project in 2017.**Table 4** (**Appendix B**) includes groundwater analytical results. **Table 3.4**, below, summarizes the analyses requested for 2017 and 2019. EPH fractions were also analyzed in 2017. **Table 3-5**, below, summarizes groundwater analytical results for the samples collected on July 20, 2017 and January 24, 2019. **Appendix C** provides the groundwater monitoring logs. **Appendix D** provides the laboratory analytical reports.

Table 2-6. Groundwater Sampling - Analytical Requirements

Parameter	Analytical Method	Laboratory Required Reporting Limit (µg/L)
Diesel-Range Petroleum Hydrocarbons – With Silica Gel Cleanup	NWTPH-Dx	Diesel – 250 Heavy Oil – 250 Mineral Oil - NR
Diesel-Range Petroleum Hydrocarbons – Without Silica Gel Cleanup	NWTPH-Dx	Diesel – 250 Heavy Oil – 250 Mineral Oil – NR

.

Table 2-7. Summary of 2017 and 2019 Groundwater Analytical Results

Analytical Parameter	MTCA Method A Groundwater Cleanup Levels	Analytical Results (µg/L)			
		MFG-1		MFG-2	
		2017	2019	2017	2019
Total Petroleum Hydrocarbons – Without SGT					
Diesel Range (C10-C24)	500	**990**	**800**	**600**	**510**
Heavy Oil/Motor Oil Range (<C24-C36)	500	450	**550**	290	430
Total TPH without SGT		*1,440*	*1,305*	*890*	*940*
Total Petroleum Hydrocarbons – With SGT					
Diesel Range (C10-C24)	500	220	120	79	<65
Heavy Oil/Motor Oil Range (<C24-C36)	500	<77	<96	<78	<96
Total TPH without SGT		*220*	*120*	*79*	*<96*

Consistent with prior sampling events, groundwater results for both 2017 and 2019 indicate exceedances of diesel range hydrocarbons above MTCA Method A Groundwater Cleanup Level of 500 µg/L when analyzed without SGT. However, analytical results for the same samples analyzed using SGT indicated a significant reduction in concentrations, such that concentrations of these groundwater samples were either non-detect or were well below he groundwater cleanup level. This reduction is likely due to the extraction of polar organic matter. **Section 3** provides a discussion.

In addition, the laboratory narratives for the 2017 and 2019 analytical reports provided the following comments of interest:

- The elution pattern for MFG-1, MFG-2, and the duplicate sample (natural sample MFG-2) exhibited elution patterns later than the typical diesel fuel pattern used by the laboratory for quantitative purposes.
- The peak profiles present for samples MFG-2 (and its duplicate) in 2017 and MFG-1 in 2019 were a-typical of a hydrocarbon pattern and consisted of discrete peaks.

Similar to the soil samples collected in 2017, the laboratory did not know the exact reason for the unusual elution patterns and peak profiles. But the variability could be due to matrix interference, other degrading non-petroleum hydrocarbons organics present in landfill and tidal flat materials, or degraded hydrocarbons related to the former USTs.

2.3.4.3 Data Review, Verification, and Validation

Tetra Tech conducted a data review, verification, and validation on the groundwater data collected in 2017 and 2019. The review was conducted using EPA's National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (EPA 2017) for guidance. The data was collected and analyzed as per the site investigation work plan (Tetra Tech 2017). No data was rejected during the data review, verification, and validation effort. All data is considered useable and completed. **Appendix D** includes a copy of the data evaluation report.

2.3.5 Groundwater Influence Study

Ecology initially requested an assessment to evaluate whether tides influence groundwater at the Facility due to the three cases of variability in groundwater flow direction. The Site appears to have a northwestern baseline groundwater flow direction, with variations observed ranging from northwest and northeast. However, one of the 10 monitoring events (2002-2004) indicated an eastern flow direction and two events showed a southern flow direction. Tetra Tech discussed the tidal study request further with Ecology's Mr. Christopher Maurer in November 2016. Because of the number of variables that could affect groundwater levels and flow direction, Ecology agreed the tidal study did not need to be conducted.

However, Tetra Tech proceeded to conduct a limited qualitative evaluation of possible influences that could affect the real or perceived groundwater flow direction. Tetra Tech evaluated potential factors such as infiltration and subsurface features (e.g., water pipelines) at and adjoining the Facility as observed from the Facility or public rights-of-way, barometric pressure, and measurement error.

The evaluation conducted during the 2017 investigation did not include physical collection of precipitation or runoff data, or formal documentation of all possible water and sewer lines in the area of the Facility. Rather, it was meant to evaluate likely areas of potential runoff, infiltration, and location of potential subsurface utilities that could influence static water levels. The findings are presented below. Additional detailed investigations would need to be conducted to better understand the exact type and degree of influence on groundwater flow direction, including potential tidal influences.

- **Barometric Fluctuations** – Barometric pressure acts as a blanket stress applied to the land surface and to the open well water level. The manner in which a groundwater system responds to this pressure is variable and directly related to the degree of confinement, and hydraulic and storage characteristics of the groundwater system. Therefore, barometric fluctuations can have a discernible impact on water level measurements and can change fairly rapidly due to weather changes.
- **Depth to Water Measurement & Gradient** – Depth to groundwater averages 6.5 feet bgs (average elevation 9.7 feet amsl). Slight differences in groundwater elevations have been observed between the on-site monitoring wells. Depth to water measurements are taken multiple times from the same measuring point prior to recording the reading in the field notebook. The measurements are taken using an electronic water level instrument. While errors are unlikely given the procedure used, human errors are possible. In addition, rounding up to 0.05 (e.g., 8.05 feet) or down to 0.04 (8.04 feet) when the measuring point falls between two numbers on the graduated electronic tape could affect calculated potentiometric surfaces and, hence, groundwater flow directions given the average water table elevation difference of 0.03 feet and a gradient of 0.0009 feet/foot observed at the Facility.
- **2017 Precipitation** – The amount of precipitation for February and March 2017 in the Seattle-Tacoma area was more than double the average precipitation for February (8.85 inches) and almost double the average for March (7.32 inches). April precipitation (4.21 inches) was 1.5 inches above average and May precipitation (2.28 inches) was slightly above average.

  The summer of 2017 in the Seattle-Tacoma area was a record-setting dry summer, recording 55 consecutive days with no measurable precipitation between June 18 and August 11, 2017. The site investigation was conducted on July 20, 2017, in the middle of the dry period. The groundwater flow direction observed at the time of the investigation was to the north-northwest, toward Commencement

Bay. This northern flow direction is expected to be the Facility's baseline groundwater flow direction without influence from recent precipitation events. This is consistent with the flow direction for the Puyallup River and apparent flow of the nearby waterways.

- **Facility Paving and Runoff** – The Facility is fully paved with asphalt. Based on discussion with site personnel and observations made in the field, it appeared that the asphalt is sloped such that all or almost all precipitation runoff from the pavement and buildings is captured on-site. Precipitation or wash water is captured in the animal off-load area, the area between the shop and the animal off-load ramp near former well MFG-4, and adjacent to the east side of the truck weigh scale. At each of these locations, water is captured, and pumps deliver the water to the northwest corner of the rendering plant building where the water is re-used. Therefore, minimal water is expected to infiltrate into the subsurface from on-site precipitation and runoff.
- **On-Site Underground Utilities** – Electric and gas lines connect with the Facility along Marc Avenue. An underground electric line runs east to the truck shop near the northeast corner of the Facility. Other likely underground lines include water and sewer lines.

  This includes the subsurface water conveyance lines that capture water in two sumps, one located near the truck scale and the other located near the former location of MFG-4. The lines convey runoff water from the facility to the rendering plant for re-use. The line was installed in recent years and likely was not present during the 2002 to 2004 monitoring years. There were no known leaks to the lines in 2017. However, there was a leak observed in the pipeline between the rendering plant and office buildings in April 2019.

  Prior and/or future leaks in water or sewer lines could affect flow direction in the shallow groundwater system. Groundwater flow conditions did not appear to be affected by leaks based on the northern baseline flow direction at the time of the July 2017 and January 2019 groundwater monitoring events.
- **Facility Floor Drains** – No floor drains were observed during the time of the site investigation. In addition, Facility manager at the time of the 2017 investigation (Brad Fleeman) said he did not know of any floor drains or sumps on the property, other than those sumps that transmit water to the rendering plant. He said the facility files do not contain any building or utility records indicating there are, or were in the past, any interior floor drains or sumps or any former drains or sumps located outside of the buildings, except those described above.
- **Infiltration from Adjoining Properties**: With the exception of where buildings are located, almost all of the entire surrounding land adjoining the Facility is unpaved. As such, infiltration from the adjoining properties could influence groundwater flow direction at the Facility, depending upon the quantity and duration of a precipitation event. Precipitation events could also create a rise in the nearby Puyallup River, which could also affect groundwater flow.

  Of particular interest is the large building adjoining the property on the north. This building has a large, metal roof and does not have a gutter system. Precipitation from the south side of the building is expected to runoff and infiltrate into the unpaved area between the building and the Facility's fence. If a significant quantity and/or duration of precipitation infiltrates in this area, it is reasonable to anticipate a temporary mounding of the shallow groundwater table could occur. As such, this mounding could result in a temporary change in groundwater flow direction. Besides the very shallow gradient at the Facility and slight groundwater elevation differences observed between wells, these factors may explain why some variation of flow direction was observed in the past.
- **Truck and Railroad Traffic** - Tetra Tech also considered truck traffic and the railroad yard with several tracks that adjoin the Facility on the east. It is unknown whether local, on-site truck traffic or railroad traffic has the ability to affect water levels in the shallow groundwater zone at the Facility.

  However, a Water Resources Paper published by the USGS (1962) showed that passing railroad train traffic did affect water levels in nearby wells at the USGS study site due to temporary loading along the ground surface and the hydrostatic pressure placed on the aquifer. The USGS found that as the train approached the nearby well, the load temporarily compressed the aquifer, which caused a rise in the water level. The water level subsequently declined back to its initial position once the train fully passed. Ohio Department of Natural Resources (2011) also observed changes in water levels due to temporary

loading effects from heavy traffic or nearby trains. The local effects at the Facility would be contingent on factors such as the elasticity of the aquifer, amount of loading, distance from the source (e.g., railroad tracks), and possibly other factors. A detailed study would be needed to evaluate this effect.

2.3.6 Well Survey

Tetra Tech contracted with APS Surveying & Mapping to re-survey the coordinates for MFG-1 and MFG-2. MFG-1 did not require any modification to the well casing. Because of the new asphalt layer, the casing on MFG-2 required and extension. Therefore, the elevation of the measuring point for MFG-2 changed. However, both wells required re-surveying to update their measuring point elevations on the top of the PVC based on Washington State Plan Coordinates, South Zone as expressed in U.S. survey feet and to the NAD88/2012 horizontal datum. Elevations were measured at the top of the north side of the PVC. Elevations were recorded to 0.01-foot accuracy. **Table 1** has been updated with the 2017 data.

3.0 ADDITIONAL EVALUATIONS & DISCUSSIONS

Tetra Tech conducted additional evaluations on the data collected from the Facility. This includes analysis of the data using U.S. Environmental Protection Agency's (EPA's) Mann-Kendall Statistical Analysis method, evaluation of SGT analyses, and a risk assessment.

3.1 MANN-KENDALL STATISTICAL ANALYSIS

Tetra Tech conducted a trend analysis on groundwater results for each of the of the petroleum hydrocarbon ranges (e.g. diesel, heavy oil, and mineral oil) for samples collected from wells MFG-1 through MFG-4. **Appendix E** provides copies of the statistical analysis calculations. The trend analysis was conducted using the Mann-Kendall statistical analysis. The analysis is a nonparametric method used for detection monitoring of a series of data over time. The analysis allows the question to be asked on whether the concentration at an individual well is increasing, decreasing, or staying the same (EPA 2009). The basic analysis tests the null hypothesis, which assumes that there is no discernable trend in the data over time. The alternative hypothesis is that there is a trend. A trend is considered significant based on the confidence interval set for the analysis. For example, a 90% confidence interval would mean that a discernable trend would be present if the analysis returns a p-value equal to or less than 0.10.

Tetra Tech used available groundwater data from the four wells at the Facility to conduct the Mann-Kendall statistical analysis. Groundwater was first sampled in the four wells 2002. Groundwater data for wells MFG-1 and MFG-2 were available through 2019. However, wells MFG-3 and MFG-4 have been destroyed, so data is not available after June 2004 to evaluate the trend based on current conditions. **Table 5-1**, below, shows the Mann-Kendall p-values calculated for the well data, along with data ranges, and the number of observations for each petroleum hydrocarbon type.

Table 3-1. p-value for Mann-Kendal Trend Analysis

Well	Earliest Sample Date	Latest Sample Date	p-Value Diesel Range (C10-24)	p-Value Heavy Oil Range / Motor Oil Range (>C24-C36)	p-Value Mineral Oil Range (<C10)	Number of Observations for each Concentration *(Diesel, Heavy Oil, Mineral Oil)*
MFG-1	2/13/2002	1/24/2019	0.0092	0.0566	0.0635	10, 10, 8
MFG-2	2/13/2002	1/24/2019	0.0042	0.0880	0.1735	10, 10, 8
MFG-3	2/13/2002	6/8/2004	0.0248	0.1346	0.0635	8, 8, 8

MFG-4	2/13/2002	6/8/2004	0.0094	0.1735	0.0354	8, 8, 8

The analysis returned a confidence interval of greater than 99% for the presence of a decreasing trend for diesel range components for MFG-1, MFG-2, and MFG-4, and confidence of greater than 97% for MFG-3. For the heavy oil range, the confidence intervals for a decreasing trend are 94% and 91% for MFG-1 and MFG-2, respectively. The decreasing trend confidence interval were 86% and 83% for heavy oil range in groundwater from wells MFG-3 and MFG-4, respectively, based on data through 2004. If current data was available, it is anticipated that the confidence interval for a decreasing trend would be higher for wells MFG-3 and MFG-4. Mineral oil data is only available through 2004 for all wells. The analysis for mineral oil showed a confidence interval ranging from 83 to 95% for the four wells.

Degradation of petroleum hydrocarbons is based on many different factors including pH, temperature, moisture, electron receptors, co-located compounds, and length and degree of branching of hydrocarbon chains. Based on the data available, all of the compounds evaluated are showing a decreasing trend overtime.

3.2 SILICA GEL TREATMENT

SGT is an extraction process that removes polar organic material/hydrocarbons (e.g., naturally-occurring organics) other than petroleum hydrocarbons, which are non-polar, from the sample prior to analysis. SGT is used in situations where high concentrations of non-petroleum hydrocarbon organic matter is present, such as the landfill and tideflat materials present in the subsurface at the Facility. What is remaining in the sample, and reported by the laboratory, following SGT are the concentrations of petroleum hydrocarbons or non-polar hydrocarbons in the sample.

Ecology (2016b) indicates that a background sample would need to be collected in order to use SGT for groundwater samples analyzed from the Facility. However, obtaining a background sample without potential petroleum hydrocarbon contamination may not be possible given that the Facility is centrally-located within the boundary of the Old Tacoma Tide Flats Landfill. Historically, the area was developed by dredging tideflat materials, which are high in organic matter, and placing them in the facility area. Following that activity, the area was used as a large unregulated landfill by the county. The tideflat and landfill materials contain an abundance of degrading organic matter.

Non-petroleum organic matter comprises the majority of the shallow groundwater matrix at the Facility based on borehole samples. Non-petroleum organic matter observed during the 2002 and 2017 subsurface investigations consists of very fine and fine wood matter, organic “paste” consisting of unidentifiable degrading organic matter, and pieces of degrading wood. This is in addition to the organics present due to dredged tidal flat material. It is reasonable to anticipate that these fine-grained organics and colloidal organic matter would be entrained in groundwater samples collected from the Facility and surrounding area.

The NWTPH-Dx and NWTPH/EPH methods were used to analyze the groundwater samples collected from the Facility. The methods use a methylene chloride extraction, followed by sample analysis. Although this method is often used to analyze petroleum hydrocarbons, the method is not specific to petroleum hydrocarbons. As such, other compounds that may be present in groundwater can be quantified during these analyses. At the Facility, naturally-occurring organics are an example of polar compounds that could be found in groundwater and that would be included in the quantification during the TPH analysis.

The dense gray to black silty sand and the organic fill associated with the former landfill that have been observed in the borings since 1989 would both contain natural organic matter. Based on the history of the area and the materials observed in borings, the gray to black silty to silty sand includes material that is most likely dredged tidal flat material. The organic fill observed in the borings includes degrading roots, wood waste, and household organic wastes associated with the Old Tacoma Tideflats Landfill. These large sources of naturally-occurring

organic compounds are present in the saturated zone at the Facility and have the potential to interfere with TPH analysis as dissolved or colloidal material entrained in the samples.

In reviewing the laboratory comments, the laboratory noted elution patterns occurred both earlier and later than typical diesel fuel used by the laboratory for quantitative purposes and that the peak profile present was atypical for hydrocarbons. Consistent with analyses performed in the past, the samples were analyzed with a silica gel treatment (SGT) to separate the polar hydrocarbons (e.g., naturally-occurring organics) from the non-polar hydrocarbons (petroleum hydrocarbons) within the samples.

The results from the SGT analysis indicates that the concentration of non-polar hydrocarbon compounds (petroleum hydrocarbons) are below the MTCA Method A Groundwater Cleanup Level. When the laboratory applied the technique in 2003 and 2004 the reporting limit of 250 µg/L was below the clean-up level for diesel range compounds, but at the reporting level of 500 µg/L for other hydrocarbon ranges. Due to advances in laboratory analytical techniques, the reporting limits have decreased significantly, and the 2017 and 2019 sample results indicate that although hydrocarbons are detected in MFG-1 and MFG-2, that the concentrations are well below the groundwater clean-up levels, and the concentrations continue to decline. For example, in MFG-1 the diesel range organics decreased from 220 µg/L to 120 µg/L between July 2017 and January 2019 and heavy oil range continued to be non-detect.

Ecology's Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2016b) states that some heavy fuels like #6 fuel oil and Bunker-C contain polar organics that may be organically bound to sulfur. Ecology's guidance document states that up to 10% to 20% of those polar organics may be lost under SGT. Even if the samples analyzed for this project lost 20% polar organics, and that 20% were added back to the samples, the TPH results would still be well below MTCA A Groundwater Cleanup Levels for both diesel and heavy oil range hydrocarbons. In fact, TPH with SGT for diesel and heavy oil range hydrocarbon results for 2017 and 2019 would actually need to have between 417% to 1,299% of polar hydrocarbons to be added back to the sample results in order for the TPH with SGT results to meet or exceed MTCA A groundwater cleanup levels. For example:

1. The 2019 groundwater sample collected from MFG-1 was non-detect for heavy oil range hydrocarbons at a method detection limit of <96 µg/L under SGT. Using 96 µg/L as a possible concentration for heavy oil and adding 20% back to that concentration to account for potential polar organic loss during SGT would result in an "adjusted" concentration of 115 µg/L. To exceed the MTCA A Groundwater Cleanup Level of 500 µg/L, an adjustment of 521% to account for polar hydrocarbon loss would be needed before the "adjusted" concentration of 500 µg/L (96 µg/L x 521% = 500 µg/L) would meet or exceed the groundwater cleanup level of 500 µg/L. Using one-half of the detection limit (48 µg/L) is used to evaluate risk. If this were the case, over 1,042% of polar hydrocarbons would need to be added back before the result would meet the 500 µg/L.
2. Applying the same principal as above to the 2019 MFG-1 diesel range concentration of 120 µg/L under SGT would result in a "adjusted" concentration of 144 µg/L if 20% were added back to the concentration to account for potential polar hydrocarbon loss. Further, an adjustment of 417% to the 120 µg/L concentration would be needed to account for potential polar hydrocarbon loss before the "adjusted" diesel range concentration of 504 µg/L (120 µg/L x 417% = 500 µg/L) would meet or exceed the MTCA A Groundwater Cleanup Level of 500 µg/L.

Calculating this for all 2017 and 2019 TPH with SGT results indicates a range of 417% to 1,299% for the amount of polar hydrocarbons required to be added back before concentrations would meet or exceed the MTCA Method A Groundwater Cleanup Level. Based on these calculations, it is reasonable to conclude that the majority of hydrocarbons observed in groundwater at the Facility are the result of dissolved and colloidal organic matter from sources such as degrading landfill and tideflat organic debris, and possibly even tallow or fats that may have migrated to subsurface soil prior to paving of the facility.

Despite the residual soil concentrations, the petroleum hydrocarbons have significantly decreased in groundwater over the last 30 years. The residual petroleum hydrocarbon mass in the soil has not only degraded to non-detectable concentrations but the residual petroleum hydrocarbons appear to be tightly sorbed onto the highly

organic subsurface materials and, as such, appear to be relatively immobile and in equilibrium with the groundwater.

3.3 RISK ASSESSMENT

3.3.1 2002 Site-Specific Risk Assessment

Tetra Tech conducted a site-specific risk assessment of data collected in 2002 as per MTCA regulations and guidelines (MFG 2002). The risk assessment evaluated both human and ecological receptors in relation to the chemicals of potential concern (COPCs) of benzene, toluene, ethylbenzene, and total xylenes (BTEX); naphthalene; total petroleum hydrocarbons; and carcinogenic PAHs. The following conclusions were presented in 2002:

- BTEX and naphthalene concentrations were below cleanup levels, therefore, no further evaluation was conducted.
- Carcinogenic PAH concentrations were also less than MTCA Method A Groundwater Cleanup Levels, except for the September 2002 monitoring event. Since carcinogenic PAHs have low solubility in water and high octanol-water partition coefficients, it is likely that the carcinogenic PAHs detected in groundwater during the September quarterly monitoring event were the result of very fine-grained landfill materials in the sample, rather than dissolved PAHs in groundwater. As a result, carcinogenic PAHs in groundwater were not evaluated further during the risk assessment.
- The 2002 risk assessment used the CLARC spreadsheet, and followed MTCA regulations and guidelines, and used EPH concentrations in subsurface soil. The risk assessment found that EPH concentrations were shown to comply with Method B Soil Cleanup Levels for unrestricted land use.
- Carcinogenic PAHs in subsurface soil were evaluated under MTCA Method C, using a Modified Method C Industrial Soil Cleanup approach. The results indicate carcinogenic PAHs in subsurface soil had an acceptable lifetime cancer risk of 1E-6.

The results of the 2002 site-specific risk assessment (MFG 2002) found that residual petroleum hydrocarbon constituents present in subsurface soil/landfill materials and groundwater at the Facility do not pose an adverse human health or ecological risk. The remedial actions taken at the time of the tank and soil removal in 1989 are believed to be protective of both human health and ecological receptors.

At the request of Ecology (2016a), additional soil and groundwater samples were collected in 2017 as described in Section 2. The 2017 samples were used to update the risk assessment findings in compliance with Ecology's 2016 guidance (Ecology 2016b). The following section presents the site conditions as related to exposures, data available, site-specific screening concentration, and results.

3.3.2 Update to Human Health Risk Assessment

Per Ecology guidance (2016b) potential risks to humans from exposure to affected soils and groundwater were evaluated for the Facility. Exposure media, pathways, sampling data, and results are described below.

3.3.2.1 Exposure Media, Routes, and Receptors

Potential sources of contamination at the Facility include spills and leaks associated with the two former 10,000-gallon diesel and Bunker C USTs removed in 1989, with soil impacts at approximately 8 feet bgs as indicated by soil sampling performed in 2002. Soil samples collected in 1998 at 5 feet bgs contained 645 mg/kg total TPH, below the Method A soil cleanup level of 2,000 mg/kg. Data from 2002 indicated no impacts to soil at a depth of 3.5 feet bgs (maximum detected total TPH concentration of 119 mg/kg). In 2017, the soil sample collected at 4.5 to 5 feet bgs also showed little TPH impact (less than 1,000 mg/kg with and without SGT). Additional potential

sources of contamination for the property are related to waste materials associated with the former Tacoma Tideflats Landfill or potential impacts from adjoining operations that may use petroleum hydrocarbons.

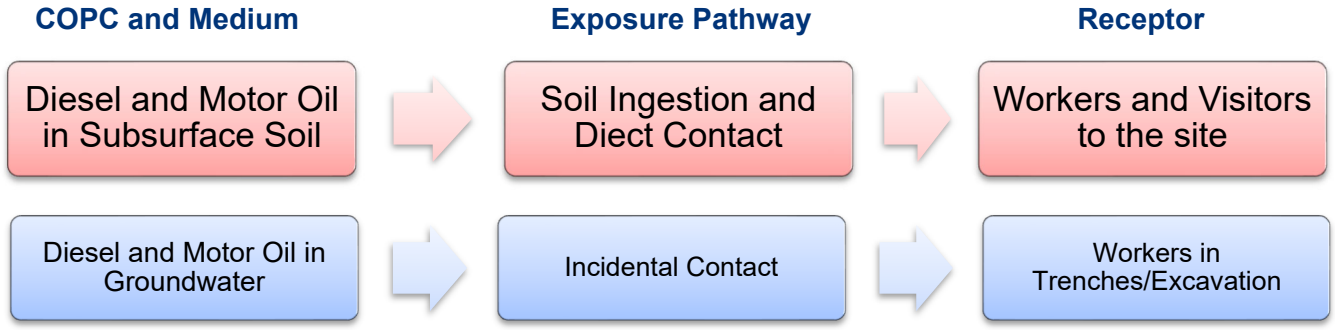
The Facility is currently zoned for heavy industrial, warehousing, storage, and vehicle service and repair. It is surrounded by warehousing facilities, shipping facilities, tire and trailer businesses, a railway area and an undeveloped parcel (owned by Port of Tacoma). The Facility is paved with asphalt. Groundwater is shallow, occurring at an average of approximately 6.5 feet bgs.

Current potential human receptors include on-site workers, visitors, and construction/utility workers. The primary exposure routes and pathways for concern at the Facility are limited to incidental ingestion and dermal contact with soil. Current facility conditions and activities limit the frequency and the depth to which current receptors could contact soil, as the Facility is paved. The city supplies water to the Facility for washing, drinking, and commercial/industrial uses. However, there is the potential for incidental ingestion and dermal contact by construction workers to shallow groundwater if excavation were to occur to this depth (approximately 6.5 feet bgs).

Per Ecology guidance (2016b), the point of compliance for soil based on direct contact by humans is defined as throughout the site from the ground surface to 15 feet bgs. Therefore, soil samples collected within this depth interval were evaluated in the risk assessment. Direct contact pathways are considered potentially complete. However, the inhalation pathway for diesel-range hydrocarbons does not appear complete as more volatile petroleum hydrocarbons, such as BTEX components, were not detected in soil during the 2002 investigation or in groundwater from the 2002 through 2004 groundwater monitoring events. Therefore, the inhalation pathway was not further evaluated during this risk assessment.

As stated above, groundwater at the Facility is not used. Water is supplied to the Facility by the City of Tacoma. The shallow groundwater eventually flows to the Commencement Bay. However, the direction and rate of flow are influenced by many factors as discussed in Section 2.3.5. Groundwater beneath the Facility is likely not potable given the proximity of the Facility to the river and adjoining wetlands, and construction on top of a former landfill. Incidental contact by workers during trenching or excavation was considered potentially complete for the risk assessment, but ingestion of groundwater under domestic supply conditions is not a complete pathway.

Therefore, as directed by Ecology's guidance document (Ecology 2016b), the following pathways were examined for potential risks to human receptors:



3.3.2.2 Subsurface Soil

Soil data were collected in 2017 from four soil borings at depths ranging from 4.5 feet to 7.6 feet bgs. These samples showed detections of extractable hydrocarbons and measured total diesel and motor oil range organics. The highest results were found in Sample SB-4 at 6.5 to 7.5 feet bgs. **Table 3-2**, below, present the 2017 soil analytical results.

Table 3-2. 2017 Soil Analytical Data

Analytical Parameter	*MTCA Method C Site-Specific Soil Cleanup Level (mg/kg)	Analytical Results (mg/kg)			
		SB-1 (4.5-5')	SB-2 (6.5-7.5')	SB-3 (6.5-7.5')	SB-4 (6.5-7.5')
Total Petroleum Hydrocarbons – Without SGT					
Diesel Range (C10-C24)	19,498	190	1,400	1,400	**3,300**
Motor Oil Range (>C24-C-36)	19,498	780	1,200	**3,800**	**9,700**
Total TPH without SGT		*970*	*2,600*	*5,200*	*13,000*
Total Petroleum Hydrocarbons – With SGT					
Diesel Range (C10-C24)	19,498	160	1,300	1,100	**2,400**
Motor Oil Range (>C24-C36)	19,498	670	890	**3,400**	**9,500**
Total TPH with SGT		*830*	*2,190*	*4,500*	*11,900*

Bold – Exceeds MTCA Method A soil cleanup level of 2,000 mg/kg
* Calculated value using MTCATPH 11.1 calculator.

The fractional composition of sample SB-4 (6.5-7.5') was used as representative of worst-case conditions and entered into the MTCA TPH calculator. **Table 3-3**, below, presents the data entered into MTCATPH 11.1.

Table 3-3. MTCA TPH Calculator Soil Inputs

Extractable Hydrocarbon Range	Concentration from SB-4 (6.5-7.5')
Aliphatic fraction C8-C10	49 mg/kg
Aliphatic fraction C10-C12	57 mg/kg
Aliphatic fraction C12-C16	80 mg/kg
Aliphatic fraction C16-C21	310 mg/kg
Aromatic Fraction C10-C12	85 mg/kg
Aromatic Fraction C16-C21	510 mg/kg
Aromatic Fraction C21-C36	2,000 mg/kg

In addition, carcinogenic PAH (cPAH) concentrations measured in 2002 at MFG-4 (closest to SB-4) were used in the Method C calculation to account for potential cPAH content of impacted soil. **Table 3-4**, below, presents the cPAH values were used in the MTCATPH 11.1.

Table 3-4. MTCA cPAH Calculator Soil Inputs

Extractable Hydrocarbon Range	Concentration from MFG-4 (8-8.5')
Benzo(a)anthracene	0.27 mg/kg
Benzo(a)pyrene	0.51 mg/kg
Benzo(b)fluoranthene	0.64 mg/kg
Benzo(k)fluoranthene	0.18 mg/kg

Extractable Hydrocarbon Range	Concentration from MFG-4 (8-8.5')
Chrysene	0.34 mg/kg
Dibenzo(a,h)anthracene	<0.2 mg/kg (entered as 0.1 mg/kg)
Indeno(1,2,3-c,d)pyrene	0.39 mg/kg

These TPH and PAH results were input to the MTCATPH 11.1 calculator to calculate a soil screening concentration for direct contact with soil. **Appendix E** provides the calculations. The calculated result for Method C for industrial exposure, was 19,498 mg/kg based on carcinogenic risk and 28,100 mg/kg based on non-carcinogenic hazard. These site-specific screening concentrations for TPH are far above the detected concentrations of 3,300 mg/kg for diesel range and 9,700 mg/kg for motor oil range results, totaling 13,000 mg/kg for all TPH. The maximum resulting risk associated with the detections in SB-4 (without silica gel treatment) would be 6.7E-6 and a hazard of 0.46 (calculated as detected concentration divided by the site-specific screening level). Using the analytical results associated with SGT of the samples, the risk is 6.1E-6 and 0.42. Both of these results are within acceptable limits.

Based on the site-specific screening level, there are no unacceptable risks from contact with soil to industrial receptors. It is also unlikely that any receptor would have extensive or prolonged contact with the soil at these depths given most utility and construction work occurs between 3 and 4 feet bgs, with more limited construction work (e.g. building foundations) extending to greater depths. Sample SB-4 was collected at a depth of 6.5 to 7.5 bgs, and the material at this depth is composed of the former landfill contents. In addition, the water table is encountered at approximately 6.5 feet bgs. Both the soil conditions and presence of groundwater would require specific health and safety plans for construction workers per Occupational Safety and Health Administration (OSHA) and Washington regulations. This would include personal protective equipment to include gloves, full-body work clothing, eye protection, and boots. The requirement for personal protective equipment would further decrease the potential for any incidental contact with the subsurface soil or landfill materials or groundwater.

3.3.2.3 Groundwater

Groundwater was also sampled in 2017 and analyzed for TPH constituents with and without SGT. As described in Section 3.2, the analytical results associated with the SGT samples showed no to low detections of TPH Diesel and Heavy Oil/Motor Oil fractions and the concentrations detected in TPH without SGT are likely representative of concentrations of polar hydrocarbons from landfill and tideflat degrading organics. The analytical results support that there are no TPH impacts to groundwater above the Method A screening value of 500 ug/L.

In addition, the groundwater is not used as a domestic supply, and is not subject to incidental contact by Facility users under typical conditions. Groundwater does not constitute a potable water supply due to its: 1) proximity to the Puyallup River and associated wetland areas; 2) contact with historical landfill contents; and 3) current land use zoning. Nonetheless, Method A clean-up levels were used to evaluate groundwater contact by human and ecological receptors.

Table 3-5. Calculated Risk - Hazard Quotients

Analytical Parameter	MTCA Method C Site-Specific Groundwater Cleanup Level (µg/L)	Analytical Results			
		MFG-1		MFG-2	
		Result (µg/L)	HQ	Result (µg/L)	HQ
Total Petroleum Hydrocarbons – Without SGT					
Diesel Range (C10-C24)	500[b] / 74,000[c]	**800**	**1.6**	**510**	**1.0**
Motor Oil Range (>C24-C-36)	500[b] / 74,000[c]	550	1.1	430	0.86
Total TPH without SGT		*1,305*	*2.6*	*940*	*1.9*
Total Petroleum Hydrocarbons – With SGT					
Diesel Range (C10-C24)	500[b] / 74,000[c]	120	0.24	<65	<0.065[a]
Motor Oil Range (>C24-C36)	500[b] / 74,000[c]	<96	<0.092[a]	<96	<0.092[a]
Total TPH with SGT		*120*	*0.24*	*<96*	*<0.16[a]*

Bold – Exceeds MTCA Method A groundwater cleanup level
HQ – Hazard quotient
a – Based on ½ the reported detection limit (DL). Calculated as (1/2DL/500)*1E-6
b - Based on 2 liters per day (L/day) ingestion rate for drinking water intake.
c – Based on 53 milliliters per day (mL/d) or 0.053 L/day for incidental ingestion.

Appendix E provides copies of the risk assessment calculations. Using the reported results from 2017, risks from groundwater ingestion are close to and below the acceptable noncarcinogenic risk (HQ) value of 1.0. The groundwater analytical results for TPH with SGT are well below 500 µg/L and are associated with risks well below 1 (using 1/2 the reported detection limit or the reported detected value). Of note, the screening concentration of 500 µg/L is based on the assumption of a drinking water intake of 2 liters per day (L/day; 2,000 mL/day). However, groundwater at and in the surrounding area is not used for drinking water due to the Facility being in a heavy industrial area and particularly due to the former landfill and tideflat materials that comprise the shallow groundwater system. Therefore, it reasonable to expect that over the long term the only contact with groundwater would be incidental contact by construction workers if excavation is below 6 feet. Incidental contact is generally associated with an incidental intake of 53 milliliters per day (ml/day) (EPA 2011, based on incidental water ingestion while swimming). Adjusting the screening concentration of 500 µg/L for the difference between drinking water intake and incidental ingestion (a factor of 37.7) results in a screening concentration of over 74,000 µg/L, which is significantly above all detected groundwater concentrations of TPH analyzed with or without SGT.

Based on analytical results, lack of a complete exposure pathway, and site-specific considerations, groundwater does not pose a threat to human health and, as discussed in Section 3.1, TPH appears in equilibrium with groundwater and bound to subsurface soil materials, therefore, it does not appear to be leaching to groundwater or migrating off site.

3.3.3 Updated Ecological Risk Evaluation

Per MCTA Regulations (WAC 173-340-7490) a terrestrial ecological risk evaluation is necessary for the Facility. An ecological risk evaluation was performed in 2002 and is updated here. The goal of the ecological risk evaluation is to determine whether a release to soil may pose a threat to terrestrial receptors. A simplified terrestrial ecological risk evaluation was performed per WAC 173-340-7492 and Ecology guidance (2016b) given the industrial nature of the Facility and surrounding land uses, as well as the nature and extent of the petroleum release.

The process for conducting a simplified terrestrial ecological evaluation includes an exposure analysis, pathway analysis, and estimation of potential threat. As previously described, the release to soil occurred at approximately 8 feet bgs and TPH impacts have only been detected at depths greater than 6 feet bgs. The Facility as well as the impacted area are covered by pavement and buildings and no exposed soil occurs in the area of investigation. Land use in the surrounding area is exclusively heavy industrial and is zoned as such. There is one parcel of undeveloped land belonging to the Port of Tacoma to the west of the Facility. Materials associated with the former Tacoma Tideflats Landfill can be found at depths greater than 6 feet bgs. Per WAC 173-340-7492, only potential exposure pathways to small mammals and birds need to be considered for industrial property, and the evaluation may be ended if there are no potential pathway from soil contamination to wildlife.

Ecology (2016b) states that for sites with institutional controls to prevent excavation of deeper soil, a conditional point of compliance may be set at the depth of the biologically active soil zone. This zone is assumed to extend to 6 feet. At this Facility, there is no potential pathway from soil contamination to wildlife due to the presence of pavement and buildings over the impacted area and most of the Facility property, and the depth to impacted soils (greater than 6 feet). There are few ecological receptors given the industrial zoning of the area and, therefore, per WAC 173-340-7492, only small mammals and birds need to be considered. In addition, one soil sample was collected in the 0 to 6 feet bgs depth in 2017, and the total TPH result of 830 mg/kg was below the Table 749-2 (WAC 173-340-900) screening value of 15,000 mg/kg and below the wildlife screening values of 6,000 mg/kg as presented in Table 749-3 of WAC 173-340-900.

Based on sampling data and site-specific conditions, there are no potential threats to ecological receptors at this Facility from the historic TPH release.

4.0 SUMMARY AND CONCLUSIONS

4.1 SUMMARY

The Facility is in an area zoned heavy industrial in the Commencement Bay area of Tacoma. The Puyallup River is approximately 1,400 feet west of the Facility and generally flows north to northwest. The river empties into Commencement Bay approximately 1.5 miles northwest of the Facility. The facility property is owned by Port of Tacoma but operates as an animal rendering plant. The rendering plant first began operation in 1973 as Johnson Manufacturing Company, Inc. and subsequently Puget Sound By-Products Company, with Darling Ingredients Inc. (formerly Darling International Inc.) as the current operator.

The Facility is the location of former diesel and Bunker-C USTs. The USTs were located on the east side of the workshop building and used for truck fuel (diesel) and heating fuel oil (Bunker-C). The USTs and the majority of impacted subsurface materials were removed in 1989. However, some residual impacted soil materials remained in place in the excavation sidewalls. Subsurface soil and groundwater assessments have been conducted at the Facility over the last 30 years. The most recent subsurface soil and groundwater investigations were conducted in 2017, with subsequent groundwater sampling in 2019. Subsurface soil results indicated residual concentrations of TPH for diesel and heavy oil range hydrocarbons above MTCA Method A Soil Cleanup levels at depths greater than 6.5 feet bgs. Groundwater sampling results indicate some residual hydrocarbons in wells MFG-1 and MFG-2; however, analysis of the samples using SGT indicate TPH concentrations well below the MTCA Method A Groundwater Cleanup Level.

The subsurface of the Facility is complicated by the fact that the Facility is centrally located within the boundaries of the Old Tacoma Tideflats Landfill. The landfill was operated as an unregulated landfill by the City of Tacoma from the 1940's through approximately 1964. The landfill was constructed over the former Tacoma tideflats and dredged tideflat material. The Facility was subsequently constructed over these materials.

Unimpacted surface fill of sands and gravels extend to approximately 6 feet bgs. The average depth to water is approximately 6.5 feet bgs. The surface fill is underlain by organic fill consisting of degrading organic landfill debris, including some tideflat materials, that extend to depths of up to 15 feet bgs. The landfill material contains an abundance of organic materials, including wood, sticks, and other fine, unidentifiable degraded organic matter (e.g., “organic paste”). Other items identified in the debris include glass. metal (e.g., wire). Burning of landfill materials was common practice to reduce the volume of materials present in the landfill so that additional wastes could be disposed. In addition, tideflat material appears to be mixed with some of the landfill material. Dredged tideflat materials likely comprises the underlying silt layer at the base of the shallow groundwater zone present at the Facility. The tideflat materials include silts with fine organics such as rootlets and shell fragments.

Groundwater flow direction at the Facility is primarily to the north-northwest, toward Commencement Bay. Some variations have been observed in groundwater flow direction due to the very shallow gradient (0.0009 ft/ft) observed and potential influences such as precipitation and runoff events. The shallow groundwater occurs at an average of about 6.5 feet bgs, within the landfill materials. It is reasonable to expect that precipitation and infiltration events could temporarily affect groundwater flow in the area of the Facility. TPH-impacted groundwater does not appear to be migrating off site and there are no drinking water supply wells at the Facility or in the facility area. In addition, it is not reasonable to expect that groundwater beneath the Facility or surrounding area would be considered potable due to the area being: 1) constructed over a former tidal flat, and dredged tideflat and unregulated landfill materials; 2) the location of the nearby Puyallup River, associated wetlands, and waters of Commencement Bay which may interact with the shallow groundwater system; and 3), and the Facility being in an industrially-zoned area.

To better understand the risks posed by residual concentrations of TPH in soil and groundwater, Tetra Tech conducted a human health and ecological risk assessment for data collected at the Facility in 2002 and again in 2019. Tetra Tech also evaluated: 1) concentrations in groundwater following EPA’s Mann-Kendall statistical analysis, and 2) use of SGT for data collected. Results of these studies indicated the following: 1) concentrations of TPH without SGT in subsurface soils are well below the calculated site-specific MTCA C Industrial Soil Cleanup level; 2) groundwater concentrations of TPH (without SGT) are at an acceptable level of risk; and 3) concentrations of TPH in groundwater show a declining trend; 4) TPH with SGT results indicate that the hydrocarbons in results for TPH without SGT are likely polar hydrocarbons rather than petroleum hydrocarbons; and 5) residual petroleum hydrocarbons are tightly bound (sorbed) to subsurface material, are immobile, and in equilibrium with groundwater.

4.2 CONCLUSIONS

Based on soil sampling conducted in 2017 there are likely residual soil concentrations above MTCA Method A Soil Cleanup Levels adjacent to and possibly beneath the office/shower/lunchroom building. However, excavation of the residual impacted soil adjacent to the former USTs is not feasible due to the presence of the buildings and other facility infrastructure. Excavation adjacent to the buildings/infrastructure has the potential to adversely impact the integrity of these features. In addition, Tetra Tech conducted a number of evaluations of the data collected between 2002 and 2019 and has made the following conclusions that indicate the residual hydrocarbons are of low risk to human health and ecological receptors.

- Statistical analysis completed on petroleum hydrocarbons for groundwater data available between 2002 and 2019 indicates that the concentrations of petroleum hydrocarbons have declined over the last 30 years and these declines are statistically significant. This implies that the residual hydrocarbon mass in the soil is tightly sorbed onto the highly organic subsurface materials and, as such, appear to be relatively immobile and in equilibrium with the groundwater.
- Groundwater TPH with SGT results indicate that the concentrations of petroleum hydrocarbons have been below MTCA Method A Groundwater Cleanup Levels since at least 2003. Improvements in analytical techniques has allowed quantification of the concentration of TPH after the SGT to

concentrations that are well below the MTCA Method A Groundwater Cleanup Level, and support the conclusion that concentrations continue to decline.

- 2017 and 2019 groundwater TPH with SGT results for diesel range and heavy oil range hydrocarbons would require an adjustment between 417% and 1,299% before the potential loss of polar organics from using SGT would result in hydrocarbon concentrations meeting or exceeding the MTCA Method A Groundwater Cleanup Levels of 500 µg/L.
- The 2002 and 2019 risk assessments both indicated acceptable levels of risk for human health and ecological receptors to subsurface soil and groundwater.
    - Concentrations of TPH in subsurface soil at the Facility are well below the site-specific TPH cleanup level of 19,498 mg/kg calculated as part of the 2019 risk assessment. Based on the site-specific screening level, there are no unacceptable risks from contact with soil to industrial receptors.
    - Risks from groundwater ingestion are close to and below the acceptable noncarcinogenic risk value of 1.0 for TPH without SGT and well below for results of TPH with SGT. TPH with SGT are also well below the groundwater cleanup level of 500 ug/L and are associated with noncarcinogenic risks well below 1.0. In addition, Concentrations of TPH in groundwater with and without SGT at the Facility are well below the site-specific TPH cleanup level of 74,000 µg/L for incidental ingestion exposure, which may be expected for construction workers.

5.0 RECOMMENDATIONS

Tetra Tech, on behalf of DII, request that the Facility be listed as a resolved closure where the groundwater cleanup standards have been achieved. It is acknowledged that residual low concentrations of petroleum hydrocarbons are still present at the Facility. However, excavation of the residual hydrocarbons sorbed to subsurface materials is not feasible due to potential compromise of the structural integrity of the structures in the former USTs are. And, importantly, the Mann-Kendall statistical analysis, review of TPH with SGT results, and the 2002 and 2019 human health and ecological risk assessments indicate that closure of the Facility is warranted and the residual petroleum hydrocarbons in subsurface soil and groundwater do not provide any long-term risks to human health, safety, or the environment. Natural degradation of petroleum hydrocarbons in groundwater and in subsurface materials will continue over time.

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APPENDIX A – FIGURES

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Topographic Quad Background: Tacoma North 1993 (North Half) / Tacoma South 1978 (South Half)

January 2017

Figure 1
Location Map
Darling-Tacoma
2041 Marc Avenue, Tacoma, WA

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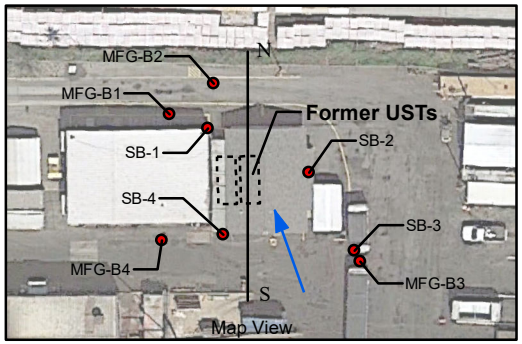
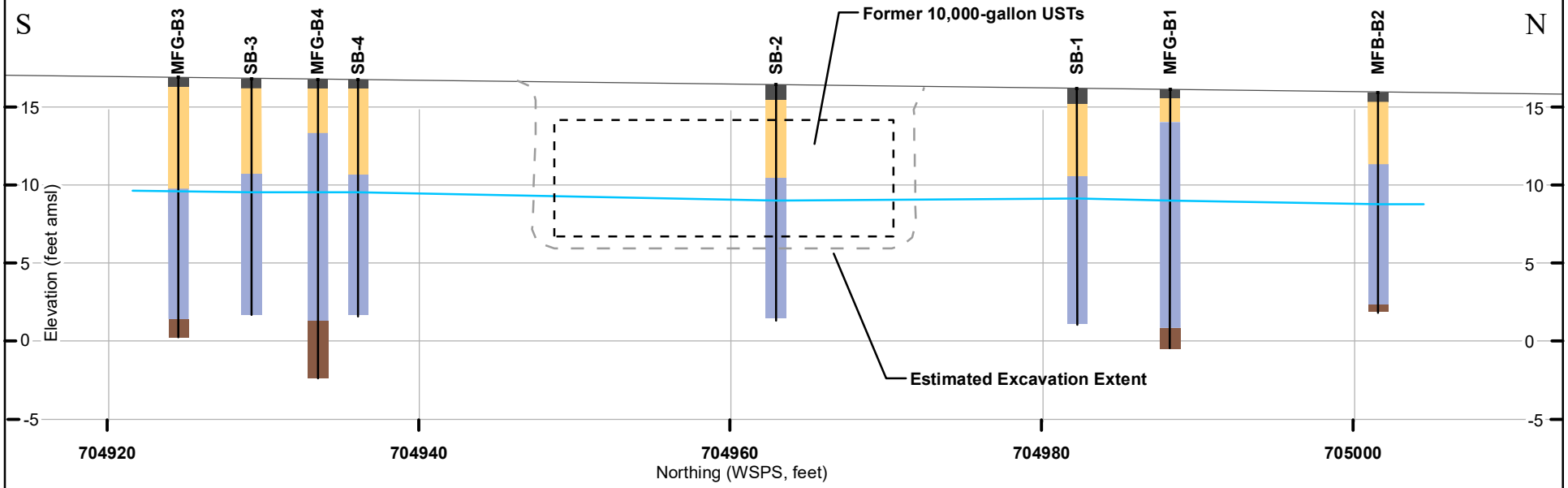
114-570494
4/5/2019

Groundwater Flow (estimated)
Groundwater Monitoring Well
Soil Boring Location
8.99 (10.54) 2017 (2019) Water Table Elevation (feet amsl)
Fence
Former USTs

Figure 2
Site Map
Darling-Tacome
2041 Marc Avenue
Tacoma, Washington

C:\CData\DarlingTacoma\Arcmap\DTXSns.mxd





Asphalt and Road Base Gravel

GM/GP – Fill – Sandy gravel to sand and silt mixtures. Gray, dark brown, to tan

AR – Landfill Materials – Wood wastes, organic roots and "paste", metal, wire, glass, brick, and shell fragments. No to minor sand and gravel matrix. Dark brown to black.

ML – Silt. Olive gray, dark brown to black

Groundwater Elevation (Estimated, July 20, 2017)

Groundwater Flow (estimated)

UST Location and sizes are estimated

Note: Wells and borings projected to centrally located cross-section line

114-571180

4/5/2019

Figure 3
North to South Cross-Section
Darling-Tacoma
2041 Marc Avenue, Tacoma, WA

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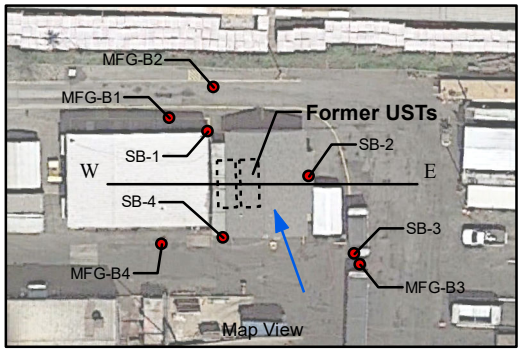

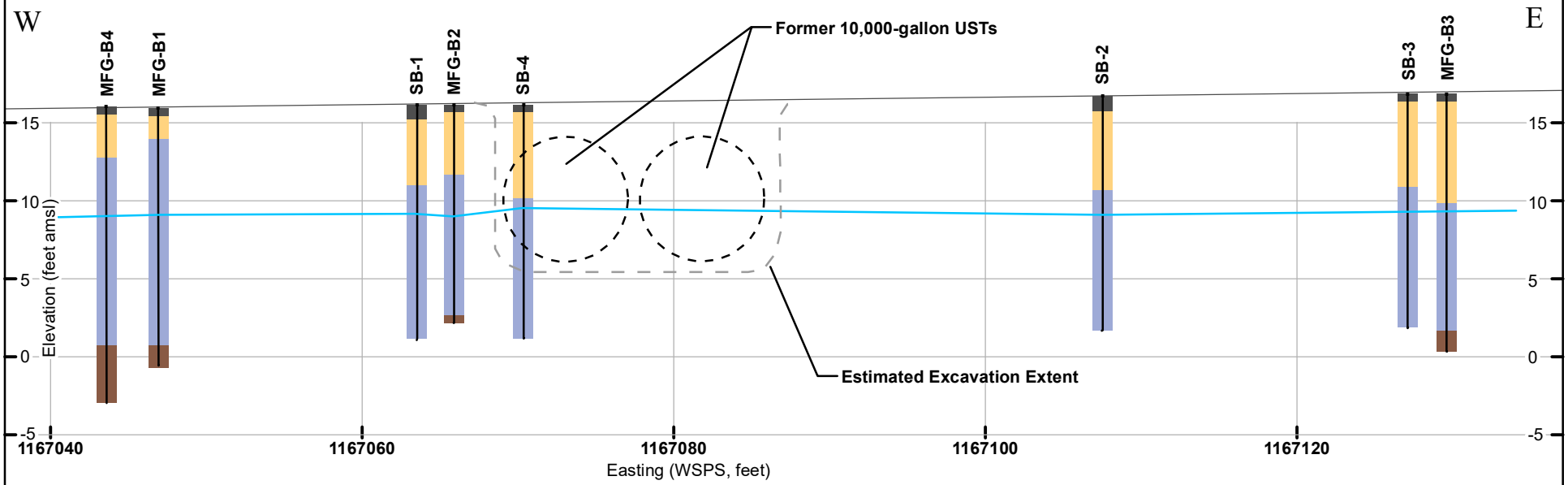

Asphalt and Road Base Gravel

GM/GP – Fill – Sandy gravel to sand and silt mixtures. Gray, dark brown, to tan

AR – Landfill Materials – Wood wastes, organic roots and "paste", metal, wire, glass, brick, and shell fragments. No to minor sand and gravel matrix. Dark brown to black.

ML – Silt. Olive gray, dark brown to black

Groundwater Elevation (Estimated, July 20, 2017)

Groundwater Flow (estimated)

UST Location and sizes are estimated

Note: Wells and borings projected to centrally located cross-section line

114-571180

4/5/2019

Figure 4
East to West Cross-Section
Darling-Tacoma
2041 Marc Avenue, Tacoma, WA

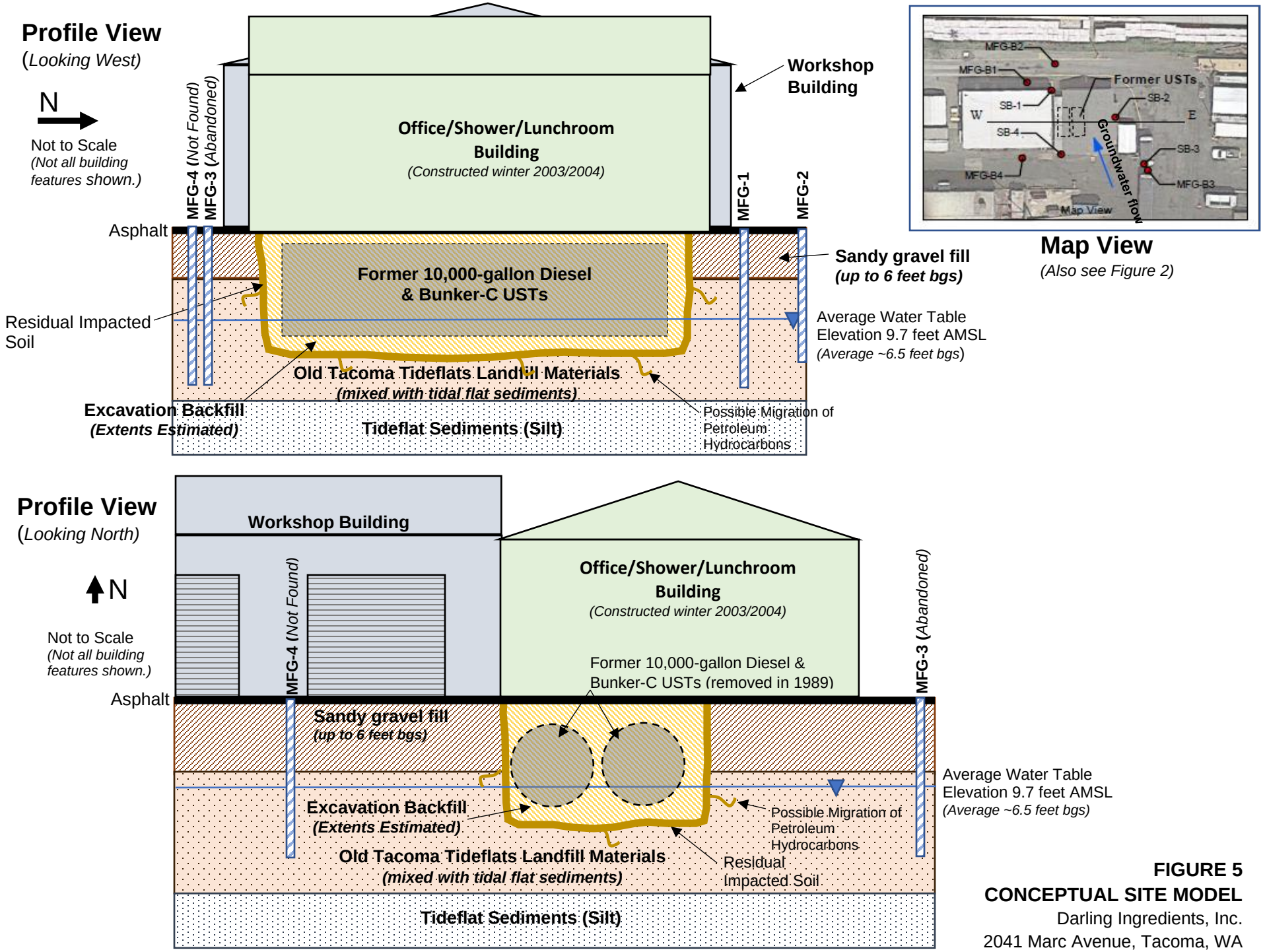

FIGURE 5
CONCEPTUAL SITE MODEL
Darling Ingredients, Inc.
2041 Marc Avenue, Tacoma, WA

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114-570494
4/5/2019

Groundwater Flow (estimated)
Groundwater Monitoring Well
Soil Boring Location
Bold - Exceeds MTCA A Cleanup Level
SGT - Silica Gel Treatment
Fence
Former USTs

Figure 5
Sampling Results
Darling-Tacome
2041 Marc Avenue
Tacoma, Washington

APPENDIX B – TABLES

TABLE 1
WELL COMPLETION SUMMARY
DARLING - TACOMA
2041 Marc Avenue, Tacoma, WA

MFG Well#	WA State Unique Well#	Soil Boring Name	Date Well Completed	Well Construction	Well Dia. (inch.)	PVC Screen Slot Size	Total Depth of Borehole (ft bgs)	Total Depth of Well (ft bgs)	Screened Interval (ft bgs)	[1,2]Measuring Point Elevation (ft AMSL)	[3]Northing Coordinate	[3]Easting Coordinate
MFG-1	AGP054	MFG-B1	2/5/2002	Sch. 40 PVC	2	0.010	16.5	15.2	5.1 - 14.4	16.01	704986.791	1167047.768
MFG-2	AGP055	MFG-B2	2/5/2002	Sch. 40 PVC	2	0.010	14	10.13	4.97 - 9.3	15.64	705002.12	1167066.675
MFG-3	AGP056	MFG-B3	2/5/2002	Sch. 40 PVC	2	0.010	16.5	15.26	5.89 - 14.43	16.85	704924.7	1167130.23
MFG-4	AGP057	MFG-B4	2/6/2002	Sch. 40 PVC	2	0.010	14.5	15.4	5.24 - 14.57	15.67	704933.66	1167044.13

Abandoned 7/20/17
Not Found 7/20/17

Sch. = Schedule
PVC = Polyvinylchloride
ft = feet
bgs = below ground surface
MFG-3 was abandoned on July 20, 2017.
AMSL = Above Mean Sea Level (NAVD88 survey datum)
[1]Measuring Point = Top of PVC casing, north side
[2]Survey datum = NAVD88
[3]Washington State Plane Coordinate System - South Zone
July 2017 - MFG-1 & MFG-2 elevation and coordinates updated to NAVD88/2012B
MFG-4 could not be found on July 20, 2017 for abandonment, the well had been paved and the metal surface protector removed.

TABLE 2
SUBSURFACE SOIL ANALYTICAL RESULTS
DARLING - TACOMA
2041 Marc Avenue, Tacoma, WA

Boring Location	MTCA Method A Soil Cleanup Levels	MFG-B2	MFG-B3		MFG-B4		SB-1	SB-2	SB-3	SB-4
Sample Depth Interval (ft bgs)		10.5-11'	3-3.5'	7-8.5'	3-3.5'	8-8.5'	4.5 - 5'	6.5 - 7.5	6.5 - 7.5	6.5 - 75'
Date Sample Collected		2/5/2002	2/5/2002	2/5/2002	2/6/2002	2/6/2002	7/20/2017	7/20/2017	7/20/2017	7/20/2017
Percent Moisture (%)		50.6	5.4	51.0	8.1	50.5	8.7	20.5	19.8	50.2
Dry weight / Percent Solids (%)		49.4[3]	94.6	49.0[3]	91.9	49.5[3]	91.3	79.5	80.2	49.8
Total Petroleum Hydrocarbons (mg/kg)										
Diesel Range (C10-C18)	2,000	**37**	<10	<820	**17**	**650**	190	1,400	1,400	**3,300**
Heavy Oil / Motor Oil Range (>C24-C36)	2,000	**120**	<20	**3,000**	**43**	**1,300**	780	1,200	**3,800**	**9,700**
Mineral Oil Range (<C10)	4,000	**180**	<25	**3,200**	**59**	**2,200**	---	---	---	---
Total Petroleum Hydrocarbons with SGT (mg/kg)										
Diesel Range (C10-C18)	2,000	---	---	---	---	---	160	1,300	**1,100**	**2,400**
Heavy Oil / Motor Oil Range (>C24-C36)	2,000	---	---	---	---	---	670	890	**3,400**	**9,500**
Mineral Oil Range (<C10)	4,000	---	---	---	---	---	---	---	---	---
Extractable Petroleum Hydrocarbons (mg/kg)										
C8-C10 Aliphatics	---	<10.1	<5	<10.2	<5	<10.1	**4.3 JB**	**6.9 JB**	**5.6 JB**	**49 JB**
C10-C12 Aliphatics	---	<10.1	<5	<10.2	<5	**23.2**	**3.3 JB**	**17 JB**	**6.5 JB**	**57 JB**
C12-C16 Aliphatics	---	<10.1	<5	<10.2	<5	**26.9**	**25 JB**	**110 J**	<24	**80 J**
C16-C21 Aliphatics	---	<10.1	<5	**22.9**	<5	**100**	<21	**110 J**	**37 J**	**310**
C21-C34 Aliphatics	---	**40.3**	<5	**176**	**8.48**	**369**	**120**	**170**	**880**	**2000**
C8-C10 Aromatics	---						<210	<50	<49	<400
C10-C12 Aromatics	---	<10.1	<5	<10.2	<5	<10.1	**25 JB**	**10 JB**	<49	<400
C12-C16 Aromatics	---	<10.1	<5	<10.2	<5	<10.1	<210	<50	<49	**85 JB**
C16-C21 Aromatics	---	<10.1	<5	**71.6**	<5	**39.6**	<210	**81 JB**	**230 JB**	**510 JB**
C21-C34 Aromatics	---	<10.1	<5	**207**	<5	**160**	<210	**94 J**	**470**	**1,400**
Total EPH	---	**40.3**	<5	**477**	**8.48**	**718**	**178**	**599**	**837**	**4,491**
Carcinogenic Polynuclear Aromatic Hydrocarbons (mg/kg)										
Benzo(a)anthracene	---	<0.020	<0.010	**4.2**	<0.010	**0.27**	---	---	---	---
Benzo(a)pyrene	0.1 (2[2])	<0.020	<0.010	**4.9**	<0.010	**0.51**	---	---	---	---
Benzo(b)fluoranthene	---	<0.020	<0.010	**4.4**	**0.01**	**0.64**	---	---	---	---
Benzo(k)fluoranthene	---	<0.020	<0.010	**1.3**	<0.010	**0.18**	---	---	---	---
Chrysene	---	<0.020	<0.010	**4.4**	<0.010	**0.34**	---	---	---	---
Dibenz(a,h)anthracene	---	<0.020	<0.010	**0.56**	<0.010	<0.020	---	---	---	---
Ideno(1,2,3-cd)pyrene	---	<0.020	<0.010	**2.7**	<0.010	**0.39**	---	---	---	---
Total Carcinogenic PAHs	0.1 (2[2])	NA	NA	**22.5**	**0.01**	**2.3**	---	---	---	---
Naphthalenes (mg/kg)										
1-Methylnaphthalene	---	<0.020	<0.010	**0.17**	<0.010	**0.084**	---	---	---	---
2-Methylnaphthalene	---	<0.020	<0.010	**0.23**	<0.010	**0.08**	---	---	---	---
Naphthalene	---	<0.020	<0.010	**0.30**	<0.010	**0.047**	---	---	---	---
Total Naphthalenes	5	NA	NA	**0.70**	NA	**0.21**	---	---	---	---
BTEX (mg/kg)										
Benzene	0.03	<0.0607	<0.0300	<0.0612	<0.0300	<0.0606	---	---	---	---
Toluene	7	<0.101	<0.0500	<0.102	<0.0500	<0.101	---	---	---	---
Ethylbenzene	6	<0.101	<0.0500	<0.102	<0.0500	<0.101	---	---	---	---
Xylenes (total)	9	<0.202	<0.100	<0.204	<0.100	<0.202	---	---	---	---

bgs = below ground surface
NA = Not Applicable.
J - Value is considered estimated.
B - Estimated due to detections in field or method blank.
Bold = Result is above method detection limit but not above MTCA Method A Soil Cleanup Levels
Result is above MTCA Method A Soil Cleanup Level for unrestricted use and industrial properties.
[2] MTCA Method A Soil Cleanup Level for Industrial Properties
[3]Low percent dry weight (high moisture content) may affect analytical results.

TABLE 3
Water Table Elevation Data
Darling International, Inc.
2041 Marc Avenue, Tacoma, Washington

Well	Date	Measuring Point Elevation (ft AMSL)	Depth to Water (top of PVC)	Potentiometric Surface Elevation (ft AMSL)
MFG-1	2/8/2002	16.27	5.06	11.21
	2/13/2002		5.30	10.97
	2/26/2002		5.20	11.07
	6/19/2002		7.09	9.18
	9/26/2002		8.33	7.94
	12/19/2002		7.46	8.81
	9/3/2003		8.27	8.00
	12/9/2003		5.75	10.52
	3/4/2004		5.50	10.77
	6/8/2004		7.06	9.21
	7/20/2017	16.01	7.02	8.99
	1/24/2019		5.47	10.54
MFG-2	2/8/2002	15.8	4.59	11.21
	2/13/2002		4.82	10.98
	2/26/2002		4.72	11.08
	6/19/2002		6.63	9.17
	9/26/2002		7.86	7.94
	12/19/2002		7.00	8.80
	9/3/2003		7.81	7.99
	12/9/2003		5.30	10.50
	3/4/2004		5.06	10.74
	6/8/2004		6.63	9.17
	7/20/2017	15.64	6.83	8.81
	1/24/2019		5.25	10.39
MFG-3	2/8/2002	16.85	5.69	11.16
	2/13/2002		5.89	10.96
	2/26/2002		5.77	11.08
	6/19/2002		7.66	9.19
	9/26/2002		8.87	7.98
	12/19/2002		8.04	8.81
	9/3/2003		8.84	8.01
	12/9/2003		6.31	10.54
	3/4/2004		6.06	10.79
	6/8/2004		7.82	9.03
	7/20/2017		7.37	9.48 (9.22*)
MFG-4	2/8/2002	15.67	4.51	11.16
	2/13/2002		4.70	10.97
	2/26/2002		4.58	11.09
	6/19/2002		6.49	9.18
	9/26/2002		7.71	7.96
	12/19/2002		6.86	8.81
	9/3/2003		7.67	8.00
	12/9/2003		5.16	10.51
	3/4/2004		4.91	10.76
	6/8/2004		6.46	9.21

Survey datum = NAVD88

Survey datum = NAVD88/2012B for 2017 elevations for MFG-1 and MFG-2

*MFG-3 value adjusted to estimate NAVD88/2012B elevation.

MFG-3 - abandoned in 2017 due to destruction during asphalt paving.

MFG-4 - could not be found in 2017, likely desroyed and paved over.

TABLE 4
GROUNDWATER ANALYTICAL RESULTS
DARLING - TACOMA
2041 Marc Avenue, Tacoma, WA

Monitoring Well	MTCA Method A Groundwater Cleanup Levels	MFG-1									
Date Sample Collected		2/13/2002	6/19/2002	9/26/2002	12/19/2002	9/3/2003	12/9/2003	3/4/2004	6/8/2004	7/20/2017	1/24/2019
Field Measurements											
Water Table Elevation (ft amsl)		10.97	9.18	7.94	8.81	8.00	10.52	10.77	9.21	8.99	10.54
Temperature (^{o}C)	---	12.8	18.7	19.4	16.4	16.9	15.3	14.2	17.7	15.8	12.7
pH (standard units)	---	6.1	6.0	5.9	5.9	6.7	6.7	6.7	7.4	6.5	6.5
Specific Conductivity (µS/cm)	---	1,043	1,311	1,133	1,081	1,830	1,284	787	751	1,980	1,258
Oxidation-Reduction Potential (mV)	---	-322	-87	-87	-81	NM	NM	NM	NM	-146.9	-86.2
Dissolved Oxygen (mg/L)	---	-322	-87	-87	-81	NM	NM	NM	NM	0.29	NM
Total Petroleum Hydrocarbons (ug/L) without Acid/Silica Gel Treatment											
Diesel Range (C10-24)	500	**3,100**	**4,160**	**3,130**	**1,350**	**2,870**	**1,350**	**3,120**	**1,270**	**990**	**800**
Heavy Oil Range / Motor Oil Range (>C24-C36)	500	**730**	**763**	**612**	**514**	<500	<500	**666**	<500	**450**	**550**
Mineral Oil Range (<C10)	500	**3,300**	**2,390**	**1,970**	**949**	**2,300**	**976**	**2,100**	**852**	---	--
Total Petroleum Hydrocarbons (ug/L) with Acid/Silica Gel Treatment											
Diesel Range (C10-24)	500	---	---	---	---	<250	<250	<250	<250	**220**	**120**
Heavy Oil Range / Motor Oil Range (>C24-C36)	500	---	---	---	---	<500	<500	<500	<500	<77	<96
Mineral Oil Range (<C10)	500	---	---	---	---	<500	<500	<500	<500	---	--
Extractable Petroleum Hydrocarbons (ug/L)											
C8-C10 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	48 U	
C10-C12 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	48 U	
C12-C16 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	48 U	
C16-C21 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	<4.4	
C21-C34 Aliphatics	---	126	<100	<50	<50	<50	<50	<50	<50	<10	
C8-C10 Aromatics										<14	
C10-C12 Aromatics	---	<100	<100	<50	<50	63.3	<50	<50	<50	47 J	
C12-C16 Aromatics	---	<100	<100	<50	82.1	<50	<50	<50	58.6	16 J	
C16-C21 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50	48 U	
C21-C34 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50	<14	
Total EPH	---	*126*	*NA*	*NA*	*82.1*	*63.3*	*NA*	*NA*	*58.6*	*63*	
Carcinogenic Polynuclear Aromatic Hydrocarbons (ug/L)											
Benzo(a)anthracene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Benzo(a)pyrene	0.1	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Benzo(b)fluoranthene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Benzo(k)fluoranthene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Chrysene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Dibenz(a,h)anthracene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Ideno(1,2,3-cd)pyrene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Total Carcinogenic PAHs	0.1	NA	NA	NA	NA	NA	NA	NA	NA		
Naphthalenes (ug/L)											
1-Methylnaphthalene	---	1.0	2.5	1.08	0.738	3.04	0.343	0.904	<0.100		
2-Methylnaphthalene	---	<0.10	0.416	<0.10	<0.10	0.170	<0.100	<0.100	<0.100		
Naphthalene	---	<0.10	0.277	<0.10	<0.10	0.321	<0.100	<0.100	<0.100		
Total Naphthalenes	160	1.0	3.19	1.08	0.738	3.53	0.343	0.904	NA		
BTEX (ug/L)											
Benzene	5	<0.5	<0.5	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500		
Toluene	1,000	<0.5	<0.5	<0.500	<2.00	<0.500	<0.500	<0.500	<0.500		
Ethylbenzene	700	<0.5	<0.5	<0.500	<1.00	<0.500	<0.500	<0.500	<0.500		
Xylenes (total)	1,000	<1.00	<1.00	<1.00	<1.50	<1.00	<1.00	<1.00	1.08		

bgs = below ground surface
Bold=At or Above MTCA Method A Groundwater Cleanup Level
< =analyte was not detected at or above the method reporting limit
NM = Not Measured
NA = Not Applicable.
--- Not Analyzed
U Qualified as non-detect at reporting limit due to blank contamination.
2003-2004 PAHs results are for dissolved PAHs
Total/Semivolatile Petroleum Hydrocarbons NWTPH-Dx with
acid/silica gel clean-up and without acid/silica gel cleanup
EPH by Modified WDOE Interim TPH Policy Method GC/MS-SIM
BTEX by EPA Method 8021B
SGT - Silica Gel Treatment

TABLE 4
GROUNDWATER ANALYTICAL RESULTS
DARLING - TACOMA
2041 Marc Avenue, Tacoma, WA

Monitoring Well	MTCA Method A Groundwater Cleanup Levels	MFG-2									
Date Sample Collected		2/13/2002	6/19/2002	9/26/2002	12/19/2002	9/3/2003	12/9/2003	3/4/2004	6/8/2004	7/20/2017	1/24/2019
Field Measurements											
Water Table Elevation (ft amsl)		10.98	9.17	7.94	8.80	7.99	10.50	10.74	9.17	8.81	10.39
Temperature (°C)	---	13.5	19.8	21.6	18.2	20.0	16.5	13.3	20.3	17.5	13.3
pH (standard units)	---	6.2	6.1	5.9	6.0	6.5	6.6	6.7	7.5	6.7	6.5
Specific Conductivity (µS/cm)	---	992	1,181	982	1,111	1,693	1,434	815	1,200	1,281	989
Oxidation-Reduction Potential (mV)	---	-331	-93	-98	-96	NM	NM	NM	NM	-87	-112
Dissolved Oxygen (mg/L)	---	-331	-93	-98	-96	NM	NM	NM	NM	0.31	NM
Total Petroleum Hydrocarbons (ug/L) without Acid/Silica Gel Trea											
Diesel Range (C10-24)	500	**2,300**	**2,920**	**1,710**	**1,630**	**2,050**	**1,430**	**2,000**	**837**	**600 B**	**510**
Heavy Oil Range / Motor Oil Range (>C24-C36)	500	<500	**992**	**634**	**620**	**1,110**	**897**	**607**	<500	**290**	**430**
Mineral Oil Range (<C10)	500	**2,500**	**1,750**	**1,120**	**1,160**	**1,790**	**1,130**	**1,390**	**615**	---	--
Total Petroleum Hydrocarbons (ug/L) with Acid/Silica Gel Treatme											
Diesel Range (C10-24)	500	---	---	---	---	<250	<250	<250	<250	**79 J**	<65
Heavy Oil Range / Motor Oil Range (>C24-C36)	500	---	---	---	---	<500	<500	<500	<500	<78	<96
Mineral Oil Range (<C10)	500	---	---	---	---	<500	<500	<500	<500	---	--
Extractable Petroleum Hydrocarbons (ug/L)											
C8-C10 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	48 U	
C10-C12 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	48 U	
C12-C16 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	48 U	
C16-C21 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	<4.4	
C21-C34 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50	<10	
C8-C10 Aromatics										<14	
C10-C12 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50	12 J	
C12-C16 Aromatics	---	<100	<100	<50	79.9	<50	<50	<50	<50	6.2 J	
C16-C21 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50	48 U	
C21-C34 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50	<14	
Total EPH	---	*NA*	*NA*	*<50*	*79.9*	*NA*	*NA*	*NA*	*NA*	*38.2*	
Carcinogenic Polynuclear Aromatic Hydrocarbons (ug/L)											
Benzo(a)anthracene	---	<0.100	<0.100	0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Benzo(a)pyrene	0.1	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Benzo(b)fluoranthene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Benzo(k)fluoranthene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Chrysene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Dibenz(a,h)anthracene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Ideno(1,2,3-cd)pyrene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
Total Carcinogenic PAHs	0.1	NA	NA	**0.100**	NA	NA	NA	NA	NA		
Naphthalenes (ug/L)											
1-Methylnaphthalene	---	0.330	0.218	0.120	<0.10	<0.10	<0.100	<0.100	<0.100		
2-Methylnaphthalene	---	0.21	<0.10	<0.10	<0.10	<0.10	<0.100	<0.100	<0.100		
Naphthalene	---	<0.10	<0.10	<0.10	<0.10	<0.10	<0.100	<0.100	<0.100		
Total Naphthalenes	160	0.54	0.218	0.12	NA	NA	NA	NA	NA		
BTEX (ug/L)											
Benzene	5	<0.5	<0.5	<0.5	<0.500	<0.500	<0.500	<0.500	<0.500		
Toluene	1,000	<0.5	<0.5	<0.5	<2.00	<0.500	<0.500	<0.500	<0.500		
Ethylbenzene	700	<0.5	<0.5	<0.5	<1.00	<0.500	<0.500	<0.500	<0.500		
Xylenes (total)	1,000	<1.00	<1.00	<1.00	<1.50	<1.00	<1.00	<1.00	<1.00		

bgs = below ground surface
Bold=At or Above MTCA Method A Groundwater Cleanup Level
< =analyte was not detected at or above the method reporting limit
NM = Not Measured
NA = Not Applicable.
--- Not Analyzed
U Qualified as non-detect at reporting limit due to blank contamination
2003-2004 PAHs results are for dissolved PAHs
Total/Semivolatile Petroleum Hydrocarbons NWTPH-Dx with
acid/silica gel clean-up and without acid/silica gel cleanup
EPH by Modified WDOE Interim TPH Policy Method GC/MS-SIM
BTEX by EPA Method 8021B
SGT - Silica Gel Treatment

TABLE 4
GROUNDWATER ANALYTICAL RESULTS
DARLING - TACOMA
2041 Marc Avenue, Tacoma, WA

Monitoring Well	MTCA Method A Groundwater Cleanup Levels	MFG-3							
Date Sample Collected		2/13/2002	6/19/2002	9/26/2002	12/19/2002	9/3/2003	12/9/2003	3/4/2004	6/8/2004
Field Measurements									
Water Table Elevation (ft amsl)		10.96	9.19	7.98	8.81	8.01	10.54	10.79	9.03
Temperature (°C)	---	13.7	23.5	20.8	15.3	20.2	16.0	12.7	19.9
pH (standard units)	---	6.6	6.4	6.1	6.2	6.7	6.8	6.9	7.5
Specific Conductivity (µS/cm)	---	689	879	777	769	1,184	1,312	1,038	1,260
Oxidation-Reduction Potential (mV)	---	-363	-159	-122	-113	NM	NM	NM	NM
Dissolved Oxygen (mg/L)	---	-363	-159	-122	-113	NM	NM	NM	NM
Total Petroleum Hydrocarbons (ug/L) without Acid/Silica Gel Trea									
Diesel Range (C10-24)	500	**6,100**	**1,760**	**1,270**	**1,670**	**1,090**	**1,290**	**1,150**	**1,090**
Heavy Oil Range / Motor Oil Range (>C24-C36)	500	**1,100**	**761**	**636**	**936**	<500	**1,040**	**562**	<500
Mineral Oil Range (<C10)	500	**7,300**	**1,150**	**904**	**1,280**	**976**	**1,080**	**834**	**859**
Total Petroleum Hydrocarbons (ug/L) with Acid/Silica Gel Treatme									
Diesel Range (C10-24)	500	---	---	---	---	<250	<250	<250	<250
Heavy Oil Range / Motor Oil Range (>C24-C36)	500	---	---	---	---	<500	<500	<500	<500
Mineral Oil Range (<C10)	500	---	---	---	---	<500	<500	<500	<500
Extractable Petroleum Hydrocarbons (ug/L)									
C8-C10 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50
C10-C12 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50
C12-C16 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50
C16-C21 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50
C21-C34 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<50
C8-C10 Aromatics									
C10-C12 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50
C12-C16 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50
C16-C21 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50
C21-C34 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<50
Total EPH	---	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Carcinogenic Polynuclear Aromatic Hydrocarbons (ug/L)									
Benzo(a)anthracene	---	<0.200	<0.100	0.182	<0.100	<0.100	<0.100	<0.100	<0.100
Benzo(a)pyrene	0.1	<0.200	<0.100	**0.182**	<0.100	<0.100	<0.100	<0.100	<0.100
Benzo(b)fluoranthene	---	<0.200	<0.100	0.121	<0.100	<0.100	<0.100	<0.100	<0.100
Benzo(k)fluoranthene	---	<0.200	<0.100	0.162	<0.100	<0.100	<0.100	<0.100	<0.100
Chrysene	---	<0.200	<0.100	0.162	<0.100	<0.100	<0.100	<0.100	<0.100
Dibenz(a,h)anthracene	---	<0.200	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Ideno(1,2,3-cd)pyrene	---	<0.200	<0.100	0.101	<0.100	<0.100	<0.100	<0.100	<0.100
Total Carcinogenic PAHs	0.1	NA	NA	**0.910**	NA	NA	NA	NA	NA
Naphthalenes (ug/L)									
1-Methylnaphthalene	---	0.39	0.24	<0.10	<0.10	<0.10	<0.100	<0.100	<0.100
2-Methylnaphthalene	---	<0.20	0.12	<0.10	<0.10	<0.10	<0.100	<0.100	<0.100
Naphthalene	---	<0.20	<0.10	0.303	<0.10	<0.10	<0.100	<0.100	<0.100
Total Naphthalenes	160	0.39	0.36	0.303	NA	NA	NA	NA	NA
BTEX (ug/L)									
Benzene	5	<0.5	<0.5	<0.5	<0.500	<0.500	<0.500	<0.500	<0.500
Toluene	1,000	0.513	<0.5	<0.5	<2.00	<0.500	<0.500	<0.500	<0.500
Ethylbenzene	700	<0.5	<0.5	<0.5	<1.00	<0.500	<0.500	<0.500	<0.500
Xylenes (total)	1,000	1.08	<1.00	<1.00	<1.50	<1.00	<1.00	<1.00	<1.00

bgs = below ground surface
Bold=At or Above MTCA Method A Groundwater Cleanup Level
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NM = Not Measured
NA = Not Applicable.
--- Not Analyzed
U Qualified as non-detect at reporting limit due to blank contamination
2003-2004 PAHs results are for dissolved PAHs
Total/Semivolatile Petroleum Hydrocarbons NWTPH-Dx with acid/silica gel clean-up and without acid/silica gel cleanup
EPH by Modified WDOE Interim TPH Policy Method GC/MS-SIM
BTEX by EPA Method 8021B
SGT - Silica Gel Treatment

TABLE 4
GROUNDWATER ANALYTICAL RESULTS
DARLING - TACOMA
2041 Marc Avenue, Tacoma, WA

Monitoring Well	MTCA Method A Groundwater Cleanup Levels	MFG-4							
Date Sample Collected		2/13/2002	6/19/2002	9/26/2002	12/19/2002	9/3/2003	12/9/2003	3/4/2004	6/8/2004
Field Measurements									
Water Table Elevation (ft amsl)		10.97	9.18	7.96	8.81	8.00	10.51	10.76	9.21
Temperature (^{o}C)	---	15.5	23.9	21.2	16.8	19.7	15.5	13.1	18.1
pH (standard units)	---	6.2	6.1	5.9	6.0	6.7	6.5	6.6	7.6
Specific Conductivity (µS/cm)	---	1,026	1,362	1,235	1,182	2,120	1,635	1,679	2,060
Oxidation-Reduction Potential (mV)	---	-345	-115	-83	-94	NM	NM	NM	NM
Dissolved Oxygen (mg/L)	---	-345	-115	-83	-94	NM	NM	NM	NM
Total Petroleum Hydrocarbons (ug/L) without Acid/Silica Gel Trea									
Diesel Range (C10-24)	500	**4,700**	**4,770**	**4,480**	**3,460**	**3,770**	**2,220**	**3,130**	**1,170**
Heavy Oil Range / Motor Oil Range (>C24-C36)	500	**1,000**	**1,590**	**1,420**	**1,190**	**1,720**	**1,040**	**747**	<500
Mineral Oil Range (<C10)	500	**5,100**	**2,680**	**2,970**	**2,450**	**3,260**	**1,680**	**2,100**	**769**
Total Petroleum Hydrocarbons (ug/L) with Acid/Silica Gel Treatme									
Diesel Range (C10-24)	500	---	---	---	---	<250	<250	<250	<250
Heavy Oil Range / Motor Oil Range (>C24-C36)	500	---	---	---	---	<500	<500	<500	<500
Mineral Oil Range (<C10)	500	---	---	---	---	<500	<500	<500	<500
Extractable Petroleum Hydrocarbons (ug/L)									
C8-C10 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<59.5
C10-C12 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<59.5
C12-C16 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<59.5
C16-C21 Aliphatics	---	<100	<100	<50	<50	<50	<50	<50	<59.5
C21-C34 Aliphatics	---	148	<100	95.9	91.4	<50	<50	<50	<59.5
C8-C10 Aromatics									
C10-C12 Aromatics	---	<100	<100	<50	50.6	<50	<50	<50	<59.5
C12-C16 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<59.5
C16-C21 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<59.5
C21-C34 Aromatics	---	<100	<100	<50	<50	<50	<50	<50	<59.5
Total EPH	---	*148*	*NA*	*NA*	*142*	*NA*	*NA*	*NA*	*NA*
Carcinogenic Polynuclear Aromatic Hydrocarbons (ug/L)									
Benzo(a)anthracene	---	<0.100	<0.100	0.139	<0.100	<0.100	<0.100	<0.100	<0.100
Benzo(a)pyrene	0.1	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Benzo(b)fluoranthene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Benzo(k)fluoranthene	---	<0.100	<0.100	0.119	<0.100	<0.100	<0.100	<0.100	<0.100
Chrysene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Dibenz(a,h)anthracene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Ideno(1,2,3-cd)pyrene	---	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Total Carcinogenic PAHs	0.1	NA	NA	**0.258**	NA	NA	NA	NA	NA
Naphthalenes (ug/L)									
1-Methylnaphthalene	---	2.5	3.27	0.97	1.47	4.23	0.712	1.96	<0.100
2-Methylnaphthalene	---	0.45	0.554	0.158	0.121	0.212	0.481	<0.100	0.254
Naphthalene	---	0.41	0.535	<0.10	0.222	0.192	0.173	<0.100	<0.100
Total Naphthalenes	160	1.6	4.36	1.13	1.81	4.63	1.37	1.36	0.254
BTEX (ug/L)									
Benzene	5	1.7	2.24	0.598	0.630	<0.500	<0.500	<0.500	<0.500
Toluene	1,000	0.648	0.504	<0.5	<2.00	<0.500	<0.500	<0.500	<0.500
Ethylbenzene	700	<0.5	<0.5	<0.5	<1.00	<0.500	<0.500	<0.500	<0.500
Xylenes (total)	1,000	1.38	<1.00	<1.00	<1.50	<1.00	<1.00	<1.00	<1.00

bgs = below ground surface
Bold=At or Above MTCA Method A Groundwater Cleanup Level
< =analyte was not detected at or above the method reporting limit
NM = Not Measured
NA = Not Applicable.
--- Not Analyzed
U Qualified as non-detect at reporting limit due to blank contamination
2003-2004 PAHs results are for dissolved PAHs
Total/Semivolatile Petroleum Hydrocarbons NWTPH-Dx with
acid/silica gel clean-up and without acid/silica gel cleanup
EPH by Modified WDOE Interim TPH Policy Method GC/MS-SIM
BTEX by EPA Method 8021B
SGT - Silica Gel Treatment

APPENDIX C – BORING & GROUNDWATER LOGS

TETRA TECH

Site Investigation
Darling - Tacoma

Tetra Tech Project No. 114-571180

Lithologic and Well Log: SB-1

Drilling Agency:	Cascade Drilling	Start/Complete Date:	7/20/17 – 7/20/17
Drill Rig & Method:	Geoprobe 660	Northing Coordinate:	47.250812
Drill Bit/Hole Size:	2-inch	Easting Coordinate:	-122.406156
Sample Method:	Direct Push	Top PVC Elevation:	
Sample Type:	5-foot cores	Logged By:	N. Morrow

Location: North side of UST basin

Northing and easting from Google Earth

Depth (feet)	Lithology	Graphic	USCS	Samples	Recovery %	PID (ppm)	Remarks	Well:
1	Asphalt and road base gravel							
2	Sandy gravel, gray to dark brown, possible very slight hydrocarbon odor. Fill.					0.8		
3	Sandy gravel, tan, no odor. Fill.		GM		70	0.9		
4						0.9		
5						0.9	Sample collected: SB-1 (4.5-5')	
6	Sandy gravel to sand, black to gray, possible slight hydrocarbon odor.							
7	Sand, black, with glass and fine wood slivers.							▼ — Water 7.4 ft bgs
8	Organic fill – Degrading wood waste, minor sand and gravel. Black. Rottng wood odor. Wet to saturated.							
9					15			
10					to			
11	Organic fill – Degrading wood waste, no to minor sand and gravel, black, degrading waste or hydrocarbon odor.		AR		30			
12								
13								
14								
15								
16	*TD Borehole = 15 feet bgs.*							
17	*Note: Tried two boreholes in area. Achieved 15 to 30% recovery from 5 to 15 feet bgs between the two boreholes. Material recovered was degrading wood waste and a no to minor sand and gravel matrix.*							
18								
19								
20								

TETRA TECH

Site Investigation
Darling - Tacoma

Tetra Tech Project No. 114-571180

Lithologic and Well Log: SB-2

Drilling Agency:	Cascade Drilling	Start/Complete Date:	7/20/17 – 7/20/17
Drill Rig & Method:	Geoprobe 660	Northing Coordinate:	47.250762
Drill Bit/Hole Size:	2-inch	Easting Coordinate:	-122.405977
Sample Method:	Direct Push	Top PVC Elevation:	
Sample Type:	5-foot cores	Logged By:	N. Morrow

Location: North side of UST basin

Northing and easting from Google Earth

Depth (feet)	Lithology	Graphic	USCS	Samples	Recovery %	PID (ppm)	Remarks
1	Asphalt and road base gravel						
2	Sandy gravel, gray to dark brown, possible very slight hydrocarbon odor, slightly moist grades to moist at 5 feet bgs. Fill.		GM		70	0.6 1.1 0.8 1.2 0.9	
6	Sandy gravel, dark brown to reddish brown, with glass, metal, wood pieces, slight hydrocarbon odor to degrading wood odor. Wet to saturated. Fill					12.0	Sample collected: SB-2 (6.5-7.5')
7					50	0.8	
8	Organic fill – Degrading wood waste, glass, few to minor sand and gravel. Dark brown to black.					1.6	
9	As above, increase in fine and large wood waste up to 2-inch long, slight hydrocarbon or degrading waste odor.						
10	Glass shards and fine gravel n shoe.		AR				
11	Organic fill – Degrading wood waste and broken glass, sand and gravel, slight degrading waste or hydrocarbon odor, possible sheen on water in core.						
12					20		
15	*TD Borehole = 15 feet bgs.*						
16	*Note: Tried two boreholes in area. Achieved 0 recovery first borehole (just glass shards in shoe) and 1 foot recovery in second borehole.*						

Well:

▼ — Water ~7 ft bgs

TETRA TECH

Site Investigation
Darling - Tacoma

Tetra Tech Project No. 114-571180

Lithologic and Well Log: SB-3

Drilling Agency:	Cascade Drilling	Start/Complete Date:	7/20/17 – 7/20/17
Drill Rig & Method:	Geoprobe 660	Northing Coordinate:	47.250685
Drill Bit/Hole Size:	2-inch	Easting Coordinate:	-122.405862
Sample Method:	Direct Push	Top PVC Elevation:	
Sample Type:	5-foot cores	Logged By:	N. Morrow

Location: North side of UST basin

Northing and easting from Google Earth

Depth (feet)	Lithology	Graphic	USCS	Samples	Recovery %	PID (ppm)	Remarks	Well:
	Asphalt and road base gravel							
1	Sandy gravel, brown to gray, broken gravel 0.5- to 1-inch size, few pieces of red brick, moist. Fill.					0.0		
2					80	1.0		
3			GM			0.9		
4	Rock layer, grades to gray sandy gravel. Fill.					1.2		
5	Sandy gravel, gray. Fill.							
	Possible slight hydrocarbon at 5.75 ft bgs.							
6	Sandy gravel, dark brown to black, with glass, brick, wood waste, broken shells, roots. Wet to saturated. Fill						Sample collected: SB-3 (6.5-7.5')	
7								▼ — Water ~7 ft bgs
8					66			
9								
10	No recovery.		AR					
11								
12								
13					0			
14								
15	*TD Borehole = 15 feet bgs.*							
16								
17								
18								
19								
20								

TETRA TECH

Site Investigation
Darling - Tacoma

Tetra Tech Project No. 114-571180

Lithologic and Well Log: SB-4

Drilling Agency:	Cascade Drilling	Start/Complete Date:	7/20/17 – 7/20/17
Drill Rig & Method:	Geoprobe 660	Northing Coordinate:	47.250686
Drill Bit/Hole Size:	2-inch	Easting Coordinate:	-122.406124
Sample Method:	Direct Push	Top PVC Elevation:	
Sample Type:	5-foot cores	Logged By:	N. Morrow

Location: North side of UST basin

Northing and easting from Google Earth

Depth (feet)	Lithology	Graphic	USCS	Samples	Recovery %	PID (ppm)	Remarks	Well:
	Asphalt and road base gravel							
1	Sandy gravel, gray to lt. brown, broken gravelto 1-inch size, no odor, moist. Fill.					0.0		
2					50	0.0		
3	Sandy gravel to sand with gravel, dark brown, no odor.		GM			0.0		
4	Gravel piece at 4.5 feet.					0.0		
5	Sandy gravel, as above at 1 ft bgs, gray.							
6						0.0		
7	Sandy gravel, dark brown to black, with very fine to fine degrading wood waste (wood “paste:), glass, moderate hydrocarbon. Wet to saturated. Fill					4.3	Sample collected: SB-4 (6.5-7.5’)	▼ — Water ~6.5 ft bgs
8					40	0.0		
9						0.0		
10	Sand, dark brown to black, small shell fragments, very fine wood waste and organics (e.g., roots), minor wood pieces up to 1-inch size.		AR					
11								
12								
13					15	1.0		
14								
15	*TD Borehole = 15 feet bgs.*							
16								
17								
18								
19								
20								

TETRA TECH

GROUNDWATER SAMPLING LOG

Project: Darling - Tacoma Project#: 114-571180 Well ID#: MFG-1

Personnel: N. Morrow Weather: Cloudy, breezy, occasional light rain 65°F

Casing Diameter/Type: 2" PVC Measuring Point Description: N side Top of PVC

Well Depth (feet below measuring point): 15.2 Depth to Water: 7.02' btoc ft water

Screen: 5.1 - 14.4' Depth to Product: —

WELL EVACUATION

Purge & Sample Method:, [ ] Low Flow [ ] Submersible Pump [ ] Hand Bail [ ] Other:

Start Time: 1220 Purge Rate: ~250 mL/min Pump Depth: 8' btoc

Comments:

EVACUATION DATA

Parameter	TIME	pH	TEMP	SC	ORP	DO	TURBIDITY	DTW	CUMULATIVE PURGE VOLUME
Units		su	°C	mS/cm	mV	ppm	—		
	1225	6.46	16.15	1812	-160.0	0.32	clear	7.04'	2L some residual
	1230	6.48	15.67	1979	-150.5	0.30	clear	7.04'	4L
	1235	6.50	15.75	1980	-148.4	0.29	clear	7.04'	5.75L
	1240	6.50	15.75	1980	-146.9	0.29	clear	7.04	7L

SAMPLE COLLECTION:

Natural Sample ID#: MFG-1 **Date:** 7/20/17 **Time:** 1245

QC Sample Type	ID#	Date / Time
Duplicate: [X]	Duplicate	~~7/20/17~~
MS/MSD: [ ]		

QC Sample Type	ID#	Date / Time
Eq. Rinse Blank: [ ]		
Field Blank: [ ]		

X	Analytical Parameter	Analytical Method	Sample Container(s)	Preservative(s)	Filtered (Y / N / NA)?
X	EPH		2-1 Liter	HCl	N
X	NWTPH-DX w+w/o SGT		2-250 mL	HCl	N
~~?~~	~~TOC~~		~~1-250mL~~	~~H2SO4~~	N

Laboratory: Test America Airbill#: Chain-of-Custody: [X] Yes, [ ] No

Meter	Serial No.	Calibration Date
Hanna	#198194	7/20/17
Turb. Dity	2100P	would not cal

Decontamination					
Potable Water:	Yes [ ]	No [ ]	10% Nitric Acid:	Yes [ ]	No [X]
Liquinox:	Yes [ ]	No [ ]	DI Water:	Yes [ ]	No [ ]
10% Methanol:	Yes [ ]	No [ ]	Steam	Yes [ ]	No [X]

Comments: Water appeared to have yellow to brown tint - possibly due to tannins in the water from degrading organics

TETRA TECH

GROUNDWATER SAMPLING LOG

Project: Darling Tacoma Project#: 114-57180 Well ID#: MFG-2

Personnel: N. Morrow Weather Pt Cloudy

Casing Diameter/Type: PVC 2" Measuring Point Description: N side Top of PVC

Well Depth (feet below measuring point): ~~10.3~~ 10.5' bgs Depth to Water 6.83' btoc ft water

Screen: 4.97-9.37' bgs Depth to Product —

WELL EVACUATION

Purge & Sample Method:, [ ] Low Flow [ ] Submersible Pump [ ] Hand Bail [ ] Other:

Start Time: ~~1343~~ would've pump 1418 Purge Rate: ~250 mL/min Pump Depth: ~7.8' btoc

Comments: New section of PVC put on old casing to raise height due to new asphalt. New top portion of well box installed on top of old well box + cemented in.

EVACUATION DATA

Parameter / Units	TIME	pH	TEMP	SC	ORP	DO	TURBIDITY	DTW	CUMULATIVE PURGE VOLUME
		SU	°C	µS/cm	mV	ppm	—		
	1420	6.72	17.20	1342	-89.0	0.33	clear		3L
	1425	6.63	17.19	1296	-83.5	0.31	clear		5L
	1430	6.65	17.07	1295	-84.5	0.31	clear		
	1433	6.66	17.11	1293	-85.3	0.31	clear		
	1436	6.68	17.09	1290	-85.8	0.30	clear	6.85	7.5L
	1441	6.69	17.55	1288	-86.5	0.30	clear		
	1445	6.71	17.53	1288	-87.4	0.30	clear	6.85	
Pump stopped 30 sec	1450	6.69	17.54	1281	-87.4	0.31	clear		

SAMPLE COLLECTION:

Natural Sample ID#: MFG-2 Date: 7/20/17 Time: 1455

QC Sample Type	ID#	Date / Time	QC Sample Type	ID#	Date / Time
Duplicate: [X]	Duplicate	7/20/17 1455	Eq. Rinse Blank: [ ]		
MS/MSD: [ ]			Field Blank: [ ]		

X	Analytical Parameter	Analytical Method	Sample Container(s)	Preservative(s)	Filtered (Y / N / NA)?
X	EPH		2 1-Liter	HCL	N
X	NWTPH-DX w+w/o SGT		2 250-Liter	HCL	N
~~X~~	~~TOC~~			H_2SO_4	N

Laboratory: Test America Airbill#: Hand deliver Chain-of-Custody: [ ] Yes, [ ] No

Meter	Serial No.	Calibration Date

Decontamination					
Potable Water:	Yes [ ]	No [ ]	10% Nitric Acid:	Yes [ ]	No [X]
Liquinox:	Yes [ ]	No [ ]	DI Water:	Yes [ ]	No [ ]
10% Methanol:	Yes [ ]	No [ ]	Steam	Yes [ ]	No [X]

Comments: Water appeared to have yellow to brown tint - possibly tannins due to degrading organic matter

TETRA TECH

GROUNDWATER SAMPLING LOG

Project: Darling-Tacoma	Well #: MFG-1
Project #: 117-8090002	Date: 1/24/19
Personnel: N. Morrow	Depth to Water (feet BMP): 5.47'
Weather: Mostly cloudy, SI. breezy 47°F	MP Location: TOP PVC N side Casing Diameter (inches): 2
Free Product? ☐ Yes ☒ No ☐ Sheen	Total Depth Well (feet): 15.2
Depth to Free Product: —	Well Screen Interval (feet): 5.1-14.4'
Laboratory: TestAmerica	Carrier & Air Bill# Hand delivered 1/24/19

WELL EVACUATION

Purge & Sample Method: ☒ Low Flow ☐ Submersible Pump ☐ Hand Bail ☐ Other:

Pump/Tubing Intake Depth: 6.5' btoc Purge Start Time: 0937 Purge End Time: 1005

Purge Rate: ~0.25 L/min ~~Min. Purge Volume~~: Final Purge Volume: 8.5 gal

Comments: Dissolved oxygen not showing up on parameter screen.

EVACUATION DATA

Parameter / Units	Time	pH	Temperature	Specific Conductance	Ox-Red Potential	Dissolved Oxygen	TURBIDITY	Depth to Water	Cumulative Purge Volume
	-	SU	°C	µS/cm	mV ORP	-	NTU	feet	Liters
	0946	6.45	12.77	1240	-73.9	-	6	5.47	3
	0950	6.46	12.76	1242	-77.2	-	3	5.47	4
	0952	6.47	12.72	1249	-80.0	-	4	5.47	5
	0955	6.48	12.77	1253	-82.5	-	3	5.47	6
	0958	6.49	12.71	1257	-84.4	-	4	5.47	7
	1000	6.49	12.67	1255	-85.5	-	3	5.47	7.5
	1002	6.50	12.66	1258	-86.1	-	3	5.47	8
	1004	6.50	12.71	1258	-86.2	-	3	5.47	8.5

SAMPLE COLLECTION

Natural Sample ID#: MFG-1 **Date:** 1/24/19 **Time:** 1005

QC Sample Type	Sample ID#	Date (Time)	QC Sample Type	Sample ID#	Date (Time)
Duplicate [ ]			Eq. Rinse Blank [ ]		
MS/MSD [ ]			Field Blank [ ]		

X	Analytical Parameter	Analytical Method	Sample Container(s)	Preservative(s)	Filtered (Y / N / NA)?
X	NWTPH-Dx w/SG	NWTPH	1L + 250mL	HCL	N
X	NWTPH-Dx w/out SG	NWTPH	1L + 250mL	HCL	~~N~~

FIELD METER

Meter	Serial No.	Calibration Date
Hach 2100P Turb.	05110D14541	1/24/19
Horiba U-51	H1978194	1/24/18

DECONTAMINATION

Decontamination	Yes	No		Yes	No
Potable Water:			10% Nitric Acid:		
Liquinox:			DI Water:		
10% Methanol:			Steam		

TETRA TECH

GROUNDWATER SAMPLING LOG

Project: Darling-Tacoma	Well #: MFG-2
Project #: 117-8090002	Date: 1/24/19
Personnel: N. Morrow	Depth to Water (feet BMP): 5.25
Weather: Overcast, sl. wind, 45°F	MP Location: Top PVC N side Casing Diameter (inches): 2
Free Product? ☐ Yes ☒ No ☐ Sheen	Total Depth Well (feet): 10.13 bgs
Depth to Free Product: —	Well Screen Interval (feet): 4.97-9.3 bgs
Laboratory: TestAmerica	Carrier & Air Bill# Hand deliver 1/24/19

WELL EVACUATION

Purge & Sample Method: ☒ Low Flow ☐ Submersible Pump ☐ Hand Bail ☐ Other:

Pump/Tubing Intake Depth: 6.3' btoc Purge Start Time: 0835 Purge End Time: 0905

Purge Rate: ~0.25 L/min Min. Purge Volume: ~~8~~ — Final Purge Volume: 8 liters

Comments: Dissolved oxygen not showing up on parameter screen.

EVACUATION DATA

Parameter / Units	Time —	pH SU	Temperature °C	Specific Conductance µS/cm	Ox-Red Potential mVORP	Dissolved Oxygen —	TURBIDITY NTU	Depth to Water Feet	Cumulative Purge Volume Liters
	0843	6.51	13.10	990	-83.4	-	3	5.25	2
	0846	6.52	13.23	989	-91.7	-	2	5.25	3
	0850	6.55	13.13	989	-107.3	-	2	5.25	5
	0854	6.55	13.19	989	-110.2	-	2	5.25	6
	0858	6.54	13.27	989	-111.0	-	1	5.25	7
	0900	6.54	13.27	989	-112.2	-	1	5.25	7.5
	0902	6.54	13.27	989	-112.4	-	1	5.25	8

SAMPLE COLLECTION

Natural Sample ID#: MFG-2 **Date:** 1/24/19 **Time:** 0905

QC Sample Type	Sample ID#	Date (Time)	QC Sample Type	Sample ID#	Date (Time)
Duplicate [X]	DUP	1/24/19 (0905)	Eq. Rinse Blank [ ]		
MS/MSD [ ]			Field Blank [ ]		

X	Analytical Parameter	Analytical Method	Sample Container(s)	Preservative(s)	Filtered (Y / N / NA)?
X	NWTPH-Dx w/SG	NWTPH	1L + 250mL	HCL	N
X	NWTPH-Dx w/out SG	NWTPH	1L + 250mL	HCL	N

FIELD METER

Meter	Serial No.	Calibration Date
Hach 2100P	05110C014541	1/24/19
Hanna	HI98194	1/20/19

DECONTAMINATION

Decontamination	Yes	No		Yes	No
Potable Water:			10% Nitric Acid:		
Liquinox:			DI Water:		
10% Methanol:			Steam		

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2-11	2017 Soil + groundwater invest.	7/18/17 - 7/20/17
12	2019 GW Sampling	1/24/19

7/18/17 Darling - Tacoma

0800 leave Hotel for site

0815 Arrive site - check in w/ Paul

1030 Done marking borehole ⊠ and possible well ★ locations, GPS appeared to be slightly off 3-5' from where metal signature was w/ metal detector.

- Photos of locations each side. Drainage appears to mostly be contained onsite. N side along scale alley drains to E to W from back part of property then W to E from scales. Sump is located at E end of scale w/ green hose. Need to ask about sump + where water pumped. Drainage along fence line goes toward center of "alley" and from buildings to center of "alley". Drainage from truck parking areas drains to west toward buildings and "alleys". 2nd alley way - drains similar to scale alley → E to W then W to E. Drains to sump in asphalt near MFG-4 and shop area. Drainage from off load ramp drains to E then South to sump area. Southern portion of lot/truck park

Darling - Tacoma 7/18/17

area drains to North to ramp sump area. Adj to ~~Sump~~ ramp is a speed bump type feature - possibly to keep drainage in that area.

Ask Brad about local lines - water sewer ~~etc~~, sumps, etc.

1100 Done at site - make phone calls, go to Bothell office to sign GPS back to Helena.

7/19/17

0655 on site - APS here to do on-site utility clearance

0710 Cascade on site - Tim

0730 Safety meeting w/ Cascade utilities done - looks like some new lines may have been installed adjacent to MFG-1 and MFG-2

0750

~~0850~~ Do walk around w/ Cascade - concerned about possible utility lines that run right next to possible well locations at MFG-1 + MFG-2. Wait for Brad to

7/19/17 Darling-Tacoma

come in to discuss what type of lines and if active, etc. Cascade taking photos + going to call others to discuss.

0800 Talked to Les - Transportation Manager Said most trucks out right now and have til 1:30 before start getting trucks back. He said no problem on blocking driveway, will work around us.

0815 Discuss utility lines w/Brad + Paul. Brad does not know anything about line closer to fence. line closer to building by MFG-1 is line electrical. Brad said new asphalt should be ~4" thick - util lines should be in soil below the pavement.

0830 Start at MFG-3. Chipped through asphalt w/ jack hammer. Asphalt ~4" thick. Tim/Cascade said it looks like well cover had been knocked off, inner lock plug looked damaged. Black residue going

Darling - Tacoma 7/19/17

down inside of well casing. Smells asphalt like. Tim ran tape down hole. well open to TD of ~15.5' but when brought tape up, appeared to have black fine gravel w/asphalt. Decision to close/abandon well due to possible compromise by asphalt sealant on gravel w/sealant.

WL = 7.37' btoc

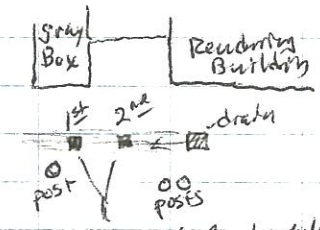
Abandon w/ bentonite chips. Surface seal of concrete/black dye - ok'd by Brad.

0920 Done at MFG-3. Move to MFG-4

First try at possible MFG-4 location - hit old metal line. Was not located by APS. Showed it to Brad - did not know about it. Does not appear to be connected to anything. End of it was in the hole - runs to south towards off load area. Used metal detector. Located one other spot ~5-6' west from first location. Second hole also not successful. Drainage trench/

7/19/17 Darling Tacoma

swale has been installed to handle drainage + direct to drain ~8' west of second location. Well may have been removed when this occurred as drain is newer than wells.



attempts to find well MFG-4

No more traces there are no more metal signatures from metal detector in the area where well should be according to GPS units and site map.

1000 Cascade filling hole w/ black-dyed cement.

1015 Done at MFG-4 area. Waiting for truck to leave so can move to MFG-1 + MFG-2 area.

~~1135~~ 1140 Move to MFG-1 - set up on ~~MFG-2~~

1050 MFG-2 found.

~~1205~~ 1105 Open + Inspect MFG-2. Appears to be in good condition. No indication that asphalt sealants ~~extend~~ well as no

Darling - Tacoma 7/19/17

black residue on PVC casing when locap removed.

- Cascade going to put extender on PVC and on surface casing to extend up to existing surface.
- appeared that a surface grinder was used before new asphalt placed. Ground up steel casing partly and could not remove. Had to break plate to get it out.

TD well ~ 10' bgs

1200
~~1300~~ Move to MFG-1

~~1310~~ 1210 Uncover well. Steel well cover broke when trying to remove. Well more shallow than MFG-2 and MFG-3. Water had filled hole - pumped out w/ hand pump then opened + removed PVC cap. Well looks clean - does not appear to have asphalt sealants in well. Will remove entire surface Completion since only about 1-2" of asphalt over top then reset new well box. MFG-2 was deeper so

7/19/17 Darling - Tacoma

could replace ~~with~~ cutting well box down and commuting around it.

1240 ~~1340~~ Well box / surface completion out of hole. Prep to install new well box.

1315 Done setting new well box for MFG-1 - Cleanup

1400 ~~Off~~ Site

7/20/17

0650 On site - prep for sampling; lt. rain, cloudy

0710 off site to get ice

0720 Cascade on site - Tim w/Geoprobe 660 Cal PID, safety meeting

0750 Set up at SB-4 on S side of tank area

0805 Collect sample 6.5-7.5'

0820 Done at SB-4 move to SB-3 (3.5'N of MFG-3)

0830 Start drilling at SB-3

0845 Done w/ SB-3 - Collect SB-3 6.5-7.5'

0900 set up at SB-2 - Eside showers by (N side) Awning

0910 Start drilling at SB-2

0930 Drilling second hole to set it

Darling Tacoma 7/20/17

0950 Collect SB-2 6.5-7.5'

1000 move to SB-1

1005 start drilling at SB-1

1140 Done drilling at SB-1

1025 Collected SB-1 4.5-5'

Couldnot obtain sample volume for sample at 6.5-7.5' due to low recovery and was all wood waste

1200 Cascade place 35 gal drums along building in scale alleyway. Then transfered soil to one + decon water to the other.

1210 start setting up at MFG-1 - calibrate meters

1220 start pumping MFG-1

1245 Collect sample MFG-1 ~~and~~ ~~Duplicate~~ - lab supplied bottles for TOC - did not request and is not in cost estimate of workplan. Ask lab about it when drop samples off.

7/20/17 Darling - Tacoma

1325 Done sampling at MFG-1

1343 Started pumping but pump not pumping
Tried to prime w/distilled water after trying to adjust tubing in pump head, checking flow direction, etc.
- was able to pump briefly then lost prime again. Replaced tubing, ~~still~~ this time water would not pump — not turning on. Took apart & replaced tubing. Still wouldn't pump but turned on after plugging into truck.
- Called Dom for suggestions - thought maybe tubing is wrong size. Tried priming tubing again w/ distilled water — was able to pump but lots of spurting of air.

1443 pumping again
Note: water in MFG-1 & MFG-2 is clear but has light brown coloring. Possible sulfidic odor but ~~seems~~ not sure. Also water is bubbly - possibly from enzymes in water from wood waste.

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1700 off site — to store to get more ice.

1720 back at hotel

7/21/17

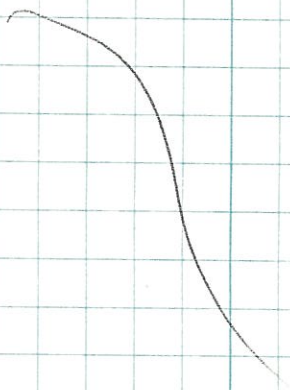
0700 pack truck, to store for ice to replenish coolers

0735 on site

0800 Walk site w/ Brad - locate general area of pipe runs, take photos

0830 off site

0930 Drop Samples at Lab



APPENDIX D – LABORATORY & DATA VALIDATION REPORTS

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-70069-1
Client Project/Site: Darling-Tacoma
Revision: 1

For:
Tetra Tech, Inc.
2525 Palmer Street
Suite 2
Missoula, Montana 59808-1744

Attn: Natalie Morrow

Authorized for release by:
8/16/2017 11:37:51 AM

Sheri Cruz, Project Manager I
(253)922-2310
sheri.cruz@testamericainc.com

Table of Contents

Job ID: 580-70069-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-70069-1

Comments
8/16/17 revised to change header for silica gel cleanup.

Receipt
The samples were received on 7/21/2017 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were -0.5º C and 0.9º C.

GC Semi VOA
Method(s) NWTPH-Dx: Surrogate recovery for the following samples was outside control limits: SB-3(6.5-7.5') (580-70069-2) and SB-2(6.5-7.5') (580-70069-3). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern in the diesel range; however, the elution pattern was later than the typical diesel fuel pattern used by the laboratory for quantitative purposes: SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-1(4.5-5') (580-70069-4) and (580-70069-1 DU).

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern in the diesel range; however, the elution pattern was earlier than the typical diesel fuel pattern used by the laboratory for quantitative purposes: SB-4(6.5-7.5') (580-70069-1), SB-1(4.5-5') (580-70069-4) and (580-70069-1 DU).

Method(s) NWTPH-Dx: The following samples was diluted to bring the concentration of target analytes within the calibration range: SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-1(4.5-5') (580-70069-4) and (580-70069-1 DU). Elevated reporting limits (RLs) are provided.

Method(s) NWTPH-Dx: The following samples were diluted due to the nature of the sample matrix: SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3) and (580-70069-1 DU). Elevated reporting limits (RLs) are provided.

Method(s) NWTPH/EPH: The below CCV had a %D of 27 for the surrogate 1-Chlorooctadecane. This met %R acceptance criteria (10-150), and all samples met acceptance criteria (except where obvious matrix interference is present), therefore the data is reported. SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3), SB-1(4.5-5') (580-70069-4), (CCVRT 580-252835/3), (590-6656-3), (590-6656-3 MS) and (590-6656-3 MSD)

Method(s) NWTPH/EPH: Surrogate 1-Chlorooctadecane recovery for the following samples was outside control limits: (590-6656-C-3-D), (590-6656-3 MS) and (590-6656-3 MSD). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) NWTPH/EPH: Due to the concentration of target analytes, the initial volumes used for the following samples prior to fractionation, but after extraction, deviated from the standard procedure. : SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3), SB-1(4.5-5') (580-70069-4), (590-6656-C-3-D), (590-6656-C-3-E MS) and (590-6656-C-3-F MSD). The reporting limits (RLs) have been adjusted proportionately.

Method(s) NWTPH/EPH: The following samples were diluted after fractionation, but prior to analysis, to bring the concentration of target analytes within the calibration range: SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3), SB-1(4.5-5') (580-70069-4), (590-6656-C-3-D), (590-6656-C-3-E MS) and (590-6656-C-3-F MSD). Elevated reporting limits (RLs) are provided.

Method(s) NWTPH/EPH: The method blank for preparation batch 580-252361 and 580-252658 and analytical batch 580-252781 contained C8-C10 Aliphatics and C10-C12 Aliphatics above the method detection limit. This target analyte concentration was less than half the reporting limit (1/2RL); therefore, re-extraction and/or re-analysis of samples was not performed.

Method(s) NWTPH/EPH: The continuing calibration verifications (CCV's) associated with batch 580-252781 recovered above the upper control limit for C21-C34 Aromatics (21.2%D, limit 20). The since only batch QC that met acceptance criteria was associated with these CCV's, the data have been reported. (CCV 580-252781/9), (CCVRT 580-252781/5), (LCS 580-252361/2-B), (LCSD 580-252361/3-B) and

Job ID: 580-70069-1 (Continued)

Laboratory: TestAmerica Seattle (Continued)

(MB 580-252361/1-B)

Method(s) NWTPH/EPH: The following samples were re-analyzed due to initial analysis failing CCV criteria for C21-C34 Aromatics. SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3), SB-1(4.5-5') (580-70069-4), (590-6656-C-3-D), (590-6656-C-3-E MS) and (590-6656-C-3-F MSD)

Method(s) NWTPH/EPH: E flag(s) for the following samples were manually removed. The upper range for EPH is defined through the peak heights and the affected samples were lower than the peak heights of the highest point in the calibration. Affected Samples: (590-6656-C-3-D), (590-6656-C-3-E MS) and (590-6656-C-3-F MSD)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Organic Prep
Method(s) EPH Frac: Because samples were too thick and dark to fractionate properly, a 20x dilution was performed. 2 mL of Hexane was added to original 4 mL vial and then 400 microliters was extracted into another 4 mL vial to which the final volume was taken up to 4 mL. SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3) and SB-1(4.5-5') (580-70069-4)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
X	Surrogate is outside control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample ID: SB-4(6.5-7.5')

Date Collected: 07/20/17 08:05
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-1

Matrix: Solid
Percent Solids: 49.8

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	**49**	**J B**	200	1.1	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	1
C8-C10 Aromatics	ND		2000	400	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	10
C10-C12 Aliphatics	**57**	**J B**	200	3.8	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	1
C10-C12 Aromatics	**85**	**J B**	2000	28	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	10
C12-C16 Aliphatics	**80**	**J**	200	40	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	1
C12-C16 Aromatics	ND		2000	400	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	10
C16-C21 Aliphatics	**310**		200	40	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	1
C16-C21 Aromatics	**510**	**J B**	2000	400	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	10
C21-C34 Aliphatics	**2000**		200	40	mg/Kg	☼	07/28/17 08:16	08/03/17 13:14	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*53*		*10 - 150*	*07/28/17 08:16*	*08/03/17 13:14*	*10*
1-Chlorooctadecane	*56*		*10 - 150*	*07/28/17 08:16*	*08/03/17 13:14*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C21-C34 Aromatics	**1400**	**J**	2000	400	mg/Kg	☼	07/28/17 08:16	08/08/17 22:25	10

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**3300**		970	240	mg/Kg	☼	07/27/17 16:12	07/31/17 14:58	10
Motor Oil (>C24-C36)	**9700**		970	180	mg/Kg	☼	07/27/17 16:12	07/31/17 14:58	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*101*		*54 - 118*	*07/27/17 16:12*	*07/31/17 14:58*	*10*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**2400**		490	120	mg/Kg	☼	07/27/17 16:12	08/02/17 12:42	5
Motor Oil (>C24-C36)	**9500**		490	88	mg/Kg	☼	07/27/17 16:12	08/02/17 12:42	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*86*		*50 - 150*	*07/27/17 16:12*	*08/02/17 12:42*	*5*

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**49.8**		0.1	0.1	%			07/24/17 15:51	1
Percent Moisture	**50.2**		0.1	0.1	%			07/24/17 15:51	1

Client Sample ID: SB-3(6.5-7.5')

Date Collected: 07/20/17 08:45
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-2

Matrix: Solid
Percent Solids: 80.2

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	**5.6**	**J B**	120	0.66	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	1
C8-C10 Aromatics	ND		240	49	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	2
C10-C12 Aliphatics	**6.5**	**J B**	120	2.3	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	1
C10-C12 Aromatics	**9.7**	**J B**	240	3.5	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	2
C12-C16 Aliphatics	ND		120	24	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	1
C12-C16 Aromatics	ND		240	49	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	2
C16-C21 Aliphatics	**37**	**J**	120	24	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	1
C16-C21 Aromatics	**230**	**J B**	240	49	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	2
C21-C34 Aliphatics	**880**		120	24	mg/Kg	☼	07/28/17 08:16	08/03/17 13:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*52*		*10 - 150*	*07/28/17 08:16*	*08/03/17 13:40*	*2*
1-Chlorooctadecane	*30*		*10 - 150*	*07/28/17 08:16*	*08/03/17 13:40*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C21-C34 Aromatics	**470**		240	49	mg/Kg	☼	07/28/17 08:16	08/08/17 22:53	2

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**1400**		610	150	mg/Kg	☼	07/27/17 16:12	07/31/17 14:35	10
Motor Oil (>C24-C36)	**3800**		610	110	mg/Kg	☼	07/27/17 16:12	07/31/17 14:35	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*138*	*X*	*54 - 118*	*07/27/17 16:12*	*07/31/17 14:35*	*10*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**1100**		310	75	mg/Kg	☼	07/27/17 16:12	08/02/17 12:01	5
Motor Oil (>C24-C36)	**3400**		310	56	mg/Kg	☼	07/27/17 16:12	08/02/17 12:01	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*206*	*X*	*50 - 150*	*07/27/17 16:12*	*08/02/17 12:01*	*5*

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**80.2**		0.1	0.1	%			07/24/17 15:51	1
Percent Moisture	**19.8**		0.1	0.1	%			07/24/17 15:51	1

Client Sample ID: SB-2(6.5-7.5')

Date Collected: 07/20/17 09:20
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-3

Matrix: Solid
Percent Solids: 79.5

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	6.9	J B	120	0.67	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	1
C8-C10 Aromatics	ND		250	50	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	2
C10-C12 Aliphatics	17	J B	120	2.4	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	1
C10-C12 Aromatics	10	J B	250	3.6	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	2
C12-C16 Aliphatics	110	J	120	25	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	1
C12-C16 Aromatics	ND		250	50	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	2
C16-C21 Aliphatics	110	J	120	25	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	1
C16-C21 Aromatics	81	J B	250	50	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	2
C21-C34 Aliphatics	170		120	25	mg/Kg	☼	07/28/17 08:16	08/03/17 14:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*93*		*10 - 150*	*07/28/17 08:16*	*08/03/17 14:07*	*2*
1-Chlorooctadecane	*63*		*10 - 150*	*07/28/17 08:16*	*08/03/17 14:07*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C21-C34 Aromatics	94	J	250	50	mg/Kg	☼	07/28/17 08:16	08/08/17 23:20	2

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	1400		300	73	mg/Kg	☼	07/27/17 16:12	07/31/17 15:42	5
Motor Oil (>C24-C36)	1200		300	54	mg/Kg	☼	07/27/17 16:12	07/31/17 15:42	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*120*	*X*	*54 - 118*	*07/27/17 16:12*	*07/31/17 15:42*	*5*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	1300		59	15	mg/Kg	☼	07/27/17 16:12	08/02/17 13:24	1
Motor Oil (>C24-C36)	890		59	11	mg/Kg	☼	07/27/17 16:12	08/02/17 13:24	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*106*		*50 - 150*	*07/27/17 16:12*	*08/02/17 13:24*	*1*

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	79.5		0.1	0.1	%			07/24/17 15:51	1
Percent Moisture	20.5		0.1	0.1	%			07/24/17 15:51	1

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70069-1

Client Sample ID: SB-1(4.5-5')
Date Collected: 07/20/17 10:35
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-4
Matrix: Solid
Percent Solids: 91.3

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	**4.3**	**J B**	110	0.57	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	1
C8-C10 Aromatics	ND		1100	210	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	10
C10-C12 Aliphatics	**3.3**	**J B**	110	2.0	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	1
C10-C12 Aromatics	**25**	**J B**	1100	15	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	10
C12-C16 Aliphatics	ND		110	21	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	1
C12-C16 Aromatics	ND		1100	210	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	10
C16-C21 Aliphatics	ND		110	21	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	1
C16-C21 Aromatics	ND		1100	210	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	10
C21-C34 Aliphatics	**120**		110	21	mg/Kg	☼	07/28/17 08:16	08/03/17 14:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*64*		*10 - 150*	*07/28/17 08:16*	*08/03/17 14:35*	*10*
1-Chlorooctadecane	*49*		*10 - 150*	*07/28/17 08:16*	*08/03/17 14:35*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C21-C34 Aromatics	ND		1100	210	mg/Kg	☼	07/28/17 08:16	08/08/17 23:48	10

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**190**	**J**	270	66	mg/Kg	☼	07/29/17 09:54	08/01/17 05:01	5
Motor Oil (>C24-C36)	**780**		270	49	mg/Kg	☼	07/29/17 09:54	08/01/17 05:01	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*73*		*54 - 118*	*07/29/17 09:54*	*08/01/17 05:01*	*5*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**160**	**J**	270	66	mg/Kg	☼	07/29/17 09:54	08/02/17 11:40	5
Motor Oil (>C24-C36)	**670**		270	49	mg/Kg	☼	07/29/17 09:54	08/02/17 11:40	5

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*80*		*50 - 150*	*07/29/17 09:54*	*08/02/17 11:40*	*5*

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**91.3**		0.1	0.1	%			07/24/17 15:51	1
Percent Moisture	**8.7**		0.1	0.1	%			07/24/17 15:51	1

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Lab Sample ID: MB 580-252361/1-B
Matrix: Solid
Analysis Batch: 252781

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 252361

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	0.156	J	5.0	0.027	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C8-C10 Aromatics	ND		5.0	1.0	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C10-C12 Aliphatics	0.0988	J	5.0	0.095	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C10-C12 Aromatics	0.199	J	5.0	0.072	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C12-C16 Aliphatics	ND		5.0	1.0	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C12-C16 Aromatics	ND		5.0	1.0	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C16-C21 Aliphatics	ND		5.0	1.0	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C16-C21 Aromatics	1.83	J	5.0	1.0	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C21-C34 Aliphatics	ND		5.0	1.0	mg/Kg		07/28/17 08:16	08/02/17 16:32	1
C21-C34 Aromatics	ND		5.0	1.0	mg/Kg		07/28/17 08:16	08/02/17 16:32	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*73*		*10 - 150*	*07/28/17 08:16*	*08/02/17 16:32*	*1*
1-Chlorooctadecane	*51*		*10 - 150*	*07/28/17 08:16*	*08/02/17 16:32*	*1*

Lab Sample ID: LCS 580-252361/2-B
Matrix: Solid
Analysis Batch: 252781

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 252361

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
C8-C10 Aliphatics	20.0	10.5		mg/Kg		53	40 - 160
C8-C10 Aromatics	6.67	4.50	J	mg/Kg		67	40 - 160
C10-C12 Aliphatics	6.67	4.86	J	mg/Kg		73	70 - 130
C10-C12 Aromatics	6.67	4.80	J	mg/Kg		72	70 - 130
C12-C16 Aliphatics	13.3	10.5		mg/Kg		79	70 - 130
C12-C16 Aromatics	20.0	15.6		mg/Kg		78	70 - 130
C16-C21 Aliphatics	20.0	16.9		mg/Kg		85	70 - 130
C16-C21 Aromatics	33.3	32.0		mg/Kg		96	70 - 130
C21-C34 Aliphatics	40.0	38.0		mg/Kg		95	70 - 130
C21-C34 Aromatics	53.3	54.0		mg/Kg		101	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*88*		*10 - 150*
1-Chlorooctadecane	*53*		*10 - 150*

Lab Sample ID: LCSD 580-252361/3-B
Matrix: Solid
Analysis Batch: 252781

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252361

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C8-C10 Aliphatics	20.0	10.6		mg/Kg		53	40 - 160	1	25
C8-C10 Aromatics	6.67	4.75	J	mg/Kg		71	40 - 160	5	25
C10-C12 Aliphatics	6.67	4.79	J	mg/Kg		72	70 - 130	1	25
C10-C12 Aromatics	6.67	5.06		mg/Kg		76	70 - 130	5	25
C12-C16 Aliphatics	13.3	10.2		mg/Kg		76	70 - 130	3	25
C12-C16 Aromatics	20.0	16.3		mg/Kg		82	70 - 130	5	25
C16-C21 Aliphatics	20.0	16.4		mg/Kg		82	70 - 130	3	25

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) (Continued)

Lab Sample ID: LCSD 580-252361/3-B
Matrix: Solid
Analysis Batch: 252781

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252361

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C16-C21 Aromatics			33.3	33.8		mg/Kg		101	70 - 130	6	25
C21-C34 Aliphatics			40.0	37.7		mg/Kg		94	70 - 130	1	25
C21-C34 Aromatics			53.3	56.8		mg/Kg		107	70 - 130	5	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*90*		*10 - 150*
1-Chlorooctadecane	*50*		*10 - 150*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: 580-70069-1 DU
Matrix: Solid
Analysis Batch: 252548

Client Sample ID: SB-4(6.5-7.5')
Prep Type: Total/NA
Prep Batch: 252340

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
#2 Diesel (C10-C24)	3300			3110		mg/Kg	☼			7	35
Motor Oil (>C24-C36)	9700			8650		mg/Kg	☼			12	35

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*100*		*54 - 118*

Lab Sample ID: MB 580-252491/1-A
Matrix: Solid
Analysis Batch: 252613

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 252491

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		50	12	mg/Kg		07/29/17 09:54	07/31/17 20:39	1
Motor Oil (>C24-C36)	ND		50	9.1	mg/Kg		07/29/17 09:54	07/31/17 20:39	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*92*		*54 - 118*	*07/29/17 09:54*	*07/31/17 20:39*	*1*

Lab Sample ID: LCS 580-252491/2-A
Matrix: Solid
Analysis Batch: 252613

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 252491

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
#2 Diesel (C10-C24)			500	434		mg/Kg		87	70 - 125		
Motor Oil (>C24-C36)			500	446		mg/Kg		89	70 - 119		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*86*		*54 - 118*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC) (Continued)

Lab Sample ID: LCSD 580-252491/3-A
Matrix: Solid
Analysis Batch: 252613

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252491

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
#2 Diesel (C10-C24)	500	479		mg/Kg		96	70 - 125	10	16
Motor Oil (>C24-C36)	500	495		mg/Kg		99	70 - 119	10	16

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*85*		*54 - 118*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Lab Sample ID: MB 580-252340/1-B
Matrix: Solid
Analysis Batch: 252731

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 252340

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		50	12	mg/Kg		07/27/17 16:12	08/02/17 10:37	1
Motor Oil (>C24-C36)	ND		50	9.1	mg/Kg		07/27/17 16:12	08/02/17 10:37	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*116*		*50 - 150*	*07/27/17 16:12*	*08/02/17 10:37*	*1*

Lab Sample ID: LCS 580-252340/2-B
Matrix: Solid
Analysis Batch: 252731

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 252340

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
#2 Diesel (C10-C24)	500	492		mg/Kg		98	64 - 127
Motor Oil (>C24-C36)	500	548		mg/Kg		110	70 - 125

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*89*		*50 - 150*

Lab Sample ID: LCSD 580-252340/3-B
Matrix: Solid
Analysis Batch: 252731

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252340

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
#2 Diesel (C10-C24)	500	503		mg/Kg		101	64 - 127	2	16
Motor Oil (>C24-C36)	500	555		mg/Kg		111	70 - 125	1	17

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*91*		*50 - 150*

Lab Sample ID: 580-70069-1 DU
Matrix: Solid
Analysis Batch: 252731

Client Sample ID: SB-4(6.5-7.5')
Prep Type: Total/NA
Prep Batch: 252340

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
#2 Diesel (C10-C24)	2400		2860		mg/Kg	☼	19	35

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup (Continued)

Lab Sample ID: 580-70069-1 DU
Matrix: Solid
Analysis Batch: 252731

Client Sample ID: SB-4(6.5-7.5')
Prep Type: Total/NA
Prep Batch: 252340

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Motor Oil (>C24-C36)	9500			9200		mg/Kg	☼			3	35

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
o-Terphenyl	*89*		*50 - 150*

Lab Sample ID: MB 580-252491/1-B
Matrix: Solid
Analysis Batch: 252731

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 252491

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		50	12	mg/Kg		07/29/17 09:54	08/02/17 08:53	1
Motor Oil (>C24-C36)	ND		50	9.1	mg/Kg		07/29/17 09:54	08/02/17 08:53	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*101*		*50 - 150*	*07/29/17 09:54*	*08/02/17 08:53*	*1*

Lab Sample ID: LCS 580-252491/2-B
Matrix: Solid
Analysis Batch: 252731

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 252491

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
#2 Diesel (C10-C24)			500	477		mg/Kg		95	64 - 127		
Motor Oil (>C24-C36)			500	523		mg/Kg		105	70 - 125		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*88*		*50 - 150*

Lab Sample ID: LCSD 580-252491/3-B
Matrix: Solid
Analysis Batch: 252731

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252491

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
#2 Diesel (C10-C24)			500	504		mg/Kg		101	64 - 127	5	16
Motor Oil (>C24-C36)			500	544		mg/Kg		109	70 - 125	4	17

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*90*		*50 - 150*

Client Sample ID: SB-4(6.5-7.5')
Date Collected: 07/20/17 08:05
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	251981	07/24/17 15:51	APR	TAL SEA

Client Sample ID: SB-4(6.5-7.5')
Date Collected: 07/20/17 08:05
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-1
Matrix: Solid
Percent Solids: 49.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550B			252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac			252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH		10	252835	08/03/17 13:14	ERZ	TAL SEA
Total/NA	Prep	3550B			252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac			252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	252835	08/03/17 13:14	ERZ	TAL SEA
Total/NA	Prep	3550B	RA		252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac	RA		252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH	RA	10	253229	08/08/17 22:25	ERZ	TAL SEA
Total/NA	Prep	3546			252340	07/27/17 16:12	DSO	TAL SEA
Total/NA	Analysis	NWTPH-Dx		10	252548	07/31/17 14:58	TL1	TAL SEA
Total/NA	Prep	3546			252340	07/27/17 16:12	DSO	TAL SEA
Total/NA	Cleanup	3630C			252541	07/31/17 10:47	REY	TAL SEA
Total/NA	Analysis	NWTPH-Dx		5	252731	08/02/17 12:42	W1T	TAL SEA

Client Sample ID: SB-3(6.5-7.5')
Date Collected: 07/20/17 08:45
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	251981	07/24/17 15:51	APR	TAL SEA

Client Sample ID: SB-3(6.5-7.5')
Date Collected: 07/20/17 08:45
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-2
Matrix: Solid
Percent Solids: 80.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550B			252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac			252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH		2	252835	08/03/17 13:40	ERZ	TAL SEA
Total/NA	Prep	3550B			252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac			252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	252835	08/03/17 13:40	ERZ	TAL SEA
Total/NA	Prep	3550B	RA		252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac	RA		252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH	RA	2	253229	08/08/17 22:53	ERZ	TAL SEA

Lab Chronicle

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70069-1

Client Sample ID: SB-3(6.5-7.5')

Lab Sample ID: 580-70069-2
Date Collected: 07/20/17 08:45
Matrix: Solid
Date Received: 07/21/17 09:30
Percent Solids: 80.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3546			252340	07/27/17 16:12	DSO	TAL SEA
Total/NA	Analysis	NWTPH-Dx		10	252548	07/31/17 14:35	TL1	TAL SEA
Total/NA	Prep	3546			252340	07/27/17 16:12	DSO	TAL SEA
Total/NA	Cleanup	3630C			252541	07/31/17 10:47	REY	TAL SEA
Total/NA	Analysis	NWTPH-Dx		5	252731	08/02/17 12:01	W1T	TAL SEA

Client Sample ID: SB-2(6.5-7.5')

Lab Sample ID: 580-70069-3
Date Collected: 07/20/17 09:20
Matrix: Solid
Date Received: 07/21/17 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	251981	07/24/17 15:51	APR	TAL SEA

Client Sample ID: SB-2(6.5-7.5')

Lab Sample ID: 580-70069-3
Date Collected: 07/20/17 09:20
Matrix: Solid
Date Received: 07/21/17 09:30
Percent Solids: 79.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550B			252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac			252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH		2	252835	08/03/17 14:07	ERZ	TAL SEA
Total/NA	Prep	3550B			252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac			252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	252835	08/03/17 14:07	ERZ	TAL SEA
Total/NA	Prep	3550B	RA		252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac	RA		252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH	RA	2	253229	08/08/17 23:20	ERZ	TAL SEA
Total/NA	Prep	3546			252340	07/27/17 16:12	DSO	TAL SEA
Total/NA	Analysis	NWTPH-Dx		5	252548	07/31/17 15:42	TL1	TAL SEA
Total/NA	Prep	3546			252340	07/27/17 16:12	DSO	TAL SEA
Total/NA	Cleanup	3630C			252541	07/31/17 10:47	REY	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	252731	08/02/17 13:24	W1T	TAL SEA

Client Sample ID: SB-1(4.5-5')

Lab Sample ID: 580-70069-4
Date Collected: 07/20/17 10:35
Matrix: Solid
Date Received: 07/21/17 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	251981	07/24/17 15:51	APR	TAL SEA

Lab Chronicle

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70069-1

Client Sample ID: SB-1(4.5-5')
Date Collected: 07/20/17 10:35
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70069-4
Matrix: Solid
Percent Solids: 91.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3550B			252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac			252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH		10	252835	08/03/17 14:35	ERZ	TAL SEA
Total/NA	Prep	3550B			252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac			252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	252835	08/03/17 14:35	ERZ	TAL SEA
Total/NA	Prep	3550B	RA		252361	07/28/17 08:16	APR	TAL SEA
Total/NA	Fraction	EPH Frac	RA		252658	08/01/17 12:23	APR	TAL SEA
Total/NA	Analysis	NWTPH/EPH	RA	10	253229	08/08/17 23:48	ERZ	TAL SEA
Total/NA	Prep	3546			252491	07/29/17 09:54	JWL	TAL SEA
Total/NA	Analysis	NWTPH-Dx		5	252613	08/01/17 05:01	CJ	TAL SEA
Total/NA	Prep	3546			252491	07/29/17 09:54	JWL	TAL SEA
Total/NA	Cleanup	3630C			252634	08/01/17 09:12	JWL	TAL SEA
Total/NA	Analysis	NWTPH-Dx		5	252731	08/02/17 11:40	W1T	TAL SEA

Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70069-1

Laboratory: TestAmerica Seattle

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Alaska (UST)	State Program	10	UST-022	03-02-18
California	State Program	9	2901	01-31-18
L-A-B	DoD ELAP		L2236	01-19-19
L-A-B	ISO/IEC 17025		L2236	01-19-19
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-05-17
US Fish & Wildlife	Federal		LE058448-0	10-31-17
USDA	Federal		P330-14-00126	02-10-20
Washington	State Program	10	C553	02-17-18

Sample Summary

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70069-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-70069-1	SB-4(6.5-7.5')	Solid	07/20/17 08:05	07/21/17 09:30
580-70069-2	SB-3(6.5-7.5')	Solid	07/20/17 08:45	07/21/17 09:30
580-70069-3	SB-2(6.5-7.5')	Solid	07/20/17 09:20	07/21/17 09:30
580-70069-4	SB-1(4.5-5')	Solid	07/20/17 10:35	07/21/17 09:30

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Loc: 580
70069

TestAmerica Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.testamericainc.com

☐ Rush
☐ Short Hold

Chain of Custody Record

Client	Client Contact	Date	Chain of Custody Number
Tetra Tech	Natalie Morrow	7/20/17	31343
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page ____ of ____**
4655 Sunnyside Dr	406-543-3045		
City	**State** / **Zip Code**	**Sampler**	**Lab Contact**
Missoula	MT / 59808	NM	Sheri Cruz
Project Name and Location (State)	**Billing Contact**		
Darling - Tacoma			
Contract/Purchase Order/Quote No.			
114-571180.100			

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: EPH	NWTPH-Dx	NWTPH-Dx w/SGT	TPC
SB-4 (6.5-7.5')	7/20/17	0805			X								X	X	X	
SB-3 (6.5-7.5')	7/20/17	0845			X								X	X	X	
SB-2 (6.5-7.5')	7/20/17	0920			X								X	X	X	
SB-1 (4.5-5')	7/20/17	1035			X								X	X	X	

Analysis (Attach list if more space is needed)

Special Instructions/ Conditions of Receipt

580-70069 Chain of Custody

TB #2 Cooler ___ Cor 0.5 Unc 0.3
Cooler Dsc Lrg Blue @Lab
Wet/Packs Packing Bubble
Clds W10

TB #2 Cooler ___ Cor 0.9 Unc 1.7
Cooler Dsc Lrg Blue @Lab
Wet/Packs Packing Bubble
Clds W10

Cooler ☐ Yes ☐ No Cooler Temp: ____

Possible Hazard Identification ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days)
☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other STD

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By Sign/Print	7/21/17	0930	1. Received By Sign/Print B. Stell B Gall SEA TA	7/21/17	0930
2. Relinquished By Sign/Print			2. Received By Sign/Print		
3. Relinquished By Sign/Print			3. Received By Sign/Print		

Comments

DISTRIBUTION: WHITE – Stays with the Samples; CANARY – Returned to Client with Report; PINK – Field Copy

Login Sample Receipt Checklist

Client: Tetra Tech, Inc.

Job Number: 580-70069-1

Login Number: 70069
List Number: 1
Creator: Ponce-McDermott, Monica

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

DATA VALIDATION REPORT

1. INTRODUCTION

General Project Information			
Project Name:	Darling-Tacoma	**Date Validated:**	8/16/17
Tetra Tech Project Number:	114-571180	**Data Validated By:**	N.Morrow
Sample Start and End Dates:	7/20/17	**Laboratory Name:**	TestAmerica
Sample Matrix:	Subsurface Soil	**Laboratory Project ID#:**	580-70069-1
Analytical Parameters:	NWTPH-Dx, NWTPH-Dx with Silica Gel Treatment (Method 3630C) and Extractable Petroleum Hydrocarbon fractionation		
Name & Date of Approved SAP, QAPP, Work Plan, Etc.	Site Investigation Work Plan, Darling-Tacoma Facility, Darling Delaware Co., Inc. (aka Puget Sound By-Products) Facility, 2041 Marc Avenue, Tacoma, WA. Facility No. 25455514, Cleanup Site No. 8475, VCP Project No. SW1317. Dated March 22, 2017		

2. LABORATORY METHODS AND SAMPLE HANDLING

Validation Criteria Used:

X USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. Dated August 2014.

X Site Investigation Work Plan, Darling-Tacoma Facility, Darling Delaware Co., Inc. (aka Puget Sound By-Products) Facility, 2041 Marc Avenue, Tacoma, WA. Facility No. 25455514, Cleanup Site No. 8475, VCP Project No. SW1317. Dated March 22, 2017

3. LIST OF SAMPLES VALIDATED IN THIS REPORT

Validated Samples		
Field Sample ID#	**Laboratory Sample ID#**	**Sample Type** (Natural, Duplicate, Field Blank, Etc.)
SB-4 (6.5-7.5')	580-70069-1	Natural
SB-3 (6.5-7.5')	580-70069-2	Natural
SB-2 (6.5-7.5')	580-70069-3	Natural
SB-1 (4.5-5')	580-70069-1	Natural

4. DATA QUALIFIERS

Data Evaluation Qualifiers	
Data Qualifier	**Qualifier Description** *(as per USEPA 2008 CLP Guidelines)*
U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
J	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
R	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

Laboratory Data Qualifiers	
Laboratory Qualifier	**Qualifier Description in Laboratory Report**
J	Estimated value. The analyte was present but less than the reporting limit.
S	Spike recovery outside of advisory limits.

5. LABORATORY NARRATIVE, CHAIN-OF-CUSTODY, AND SAMPLE RECEIPT CHECKLIST

Was a laboratory narrative provided and were there any non-conformance issues with the analytical data? *Identify and discuss.*
The laboratory noted the following:

- Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern in the diesel range; however, the elution pattern was later than the typical diesel fuel pattern used by the laboratory for quantitative purposes: SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-1(4.5-5') (580-70069-4) and (580-70069-1 DU).
- Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern in the diesel range; however, the elution pattern was earlier than the typical diesel fuel pattern used by the laboratory for quantitative purposes: SB-4(6.5-7.5') (580-70069-1), SB-1(4.5-5') (580-70069-4) and (580-70069-1 DU).
- Method(s) NWTPH/EPH: E flag(s) for the following samples were manually removed. The upper range for EPH is defined through the peak heights and the affected samples were lower than the peak heights of the highest point in the calibration. Affected Samples: (590-6656-C-3-D), (590-6656-C-3-E MS) and (590-6656-C-3-F MSD)

Other laboratory narrative notes are provided in appropriate sections throughout this report.

Were sample Chain-of-Custody (CoC) forms complete? *Describe.*
Yes. All required areas of the CoC were completed and the forms signed by DEQ and the laboratory upon transfer of the samples into laboratory custody.

Were the requested analytical methods in compliance with project requirements (i.e., QAPP, SAP, etc.)?
Explain and, if not in compliance, discuss how this affects the data.
Yes. As samples were analyzed for the methods specified in the SAP and requested by Ecology.

Were samples received in good condition within method specified requirements? *Explain any exceptions and how sample conditions may affect the results.*
Yes. The samples were hand delivered to the laboratory. The samples were received on 7/21/2017 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were -0.5º C and 0.9º C, but were not frozen.

6. LABORATORY COMPLIANCE WITH PROJECT REQUIREMENTS

Were samples analyzed within method specified or technical holding times? *Explain any exceptions and how this may affect the results.*
Yes. All samples were analyzed within the holding times specified by the analytical methods.

Do the laboratory reports include all constituents requested to be analyzed on the CoC or under the QAPP, SAP, or other applicable document? *Explain.*
Yes. The laboratory analyzed all samples for NWTPH-EPH, and NWTPH-Dx with and without silica gel treatment.

Were reported units appropriate for the associated sample matrix/matrices and method(s) of analyses?
Explain.
Yes. All results were reported in miligrams per kilogram (mg/kg) which is appropriate for these results and for comparison with water quality standards.

Were detection limits reported by the laboratory in accordance with the project requirements? *Discuss.*
The laboratory noted the following:

- Method(s) NWTPH-Dx: The following samples were diluted to bring the concentration of target analytes within the calibration range: SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-1(4.5-5') (580-70069-4) and (580-70069-1 DU). Elevated reporting limits (RLs) are provided.
- Method(s) NWTPH-Dx: The following samples were diluted due to the nature of the sample matrix: SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3) and (580-70069-1 DU). Elevated reporting limits (RLs) are provided.
- Method(s) EPH Frac: Because samples were too thick and dark to fractionate properly, a 20x dilution was performed. 2 mL of Hexane was added to original 4 mL vial and then 400 microliters was extracted into another 4 mL vial to which the final volume was taken up to 4 mL. SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3) and SB-1(4.5-5') (580-70069-4)

Despite the required dilutions, the elevated reporting limits (RLs) and method detection limits (MDLs) were at or below Ecology's soil screening level of 2,000 mg/kg for diesel and motor oil.

Detection Limits Above Project Requirements					
Analytical Parameter	**Field Sample ID#**	**Laboratory Sample ID#**	**Laboratory Reporting Limit (µg/L)**	**Soil Standard (µg/L)**	**Standard Exceeded**
--	--	--	--	--	None

Note: Laboratory reported estimated concentrations for constituents detected between the method detection limit and the laboratory reporting limit (limit of quantitation).
RSL – EPA Regional Screening Level for tap water.
n/a – not applicable.

Results qualified by the laboratory based on the laboratory reporting limit.
The following table lists the analytical results that were qualified as estimated (J) by the laboratory due to the analyte being present but was detected at concentrations between the laboratory reporting limit (laboratory's limit of quantitation) and the method detection limit.

QUALIFIED RESULTS BASED CONCENTRATIONS DETECTED BETWEEN THE METHOD DECTECTION LIMIT AND THE LABORATORY REPORTING LIMIT					
Analyte	**Natural Sample ID#**	**Laboratory ID#**	**Laboratory Result (µg/L)**	**Qualifier**	**Reason for Qualification**
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C16-C21 Aromatics	SB-4 (6.5-7.5')	580-70069-1	49 57 85 80 510	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C16-C21 Aliphatics C16-C21 Aromatics	SB-3 (6.5-7.5')	580-70669-2	5.6 6.5 9.7 37 230	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C16-C16 Aliphatics C16-C21 Aromatics	SB-2 (6.5-7.5')	580-70069-3	6.9 17 10 110 110 81	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics	SB-1 (4.5-5')	580-70069-4	4.3 3.3 25	J	Analyte detected between laboratory reporting limit and method detection limit.

7. LABORATORY QA/QC

7a. Continuing Calibration Verification (CCV) Standard

Was there indication from the laboratory that the initial or CCV results were within acceptable limits? *Explain.*

The laboratory stated the following:

- Method(s) NWTPH/EPH: The continuing calibration verifications (CCV's) associated with batch 580-252781 recovered above the upper control limit for C21-C34 Aromatics (21.2%D, limit 20). Since only batch QC that met acceptance criteria was associated with these CCV's, the data have been reported. (CCV 580-252781/9), (CCVRT 580-252781/5), (LCS 580-252361/2-B), (LCSD 580-252361/3-B) and (MB 580-252361/1-B).
- Method(s) NWTPH/EPH: The following samples were re-analyzed due to initial analysis failing CCV criteria for C21-C34 Aromatics. SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3), SB-1(4.5-5') (580-70069-4), (590-6656-C-3-D), (590-6656-C-3-E MS) and (590-6656-C-3-F MSD).

No qualification is required as the laboratory re-analyzed the samples as appropriate.

7b. Laboratory Control Samples (LCSs)

Was the reference material used for the laboratory control standard (LCSs) the correct matrix and concentration? *Explain and include a discussion on how this affects the data.*

Yes. The QA/QC sample report presented the LCS data. The sample was of the correct matrix, solid.

Was the total number of LCSs analyzed equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*

Yes. At least one LCSs was analyzed for each analytical method.

Were LCSs prepared the same way as the associated samples? *Explain and include a discussion of how this affects the data.*

Yes. The LCSs were solid samples and were prepared according to the analytical method. No issues with the LCS were noted by the laboratory.

Were LCS/LCSD percent recoveries and LCS/LCSD RPDs within laboratory QC limits? *Explain and include discussion on how this affects the data.*

All LCS % recoveries were reported as being within the specified control limits.

7c. Laboratory Blank Samples

Was the total number of method blank samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*

Yes. At least one method blank was analyzed per analytical method.

Were laboratory blank samples free of analyte contamination? *Explain.*

No. The laboratory provided the following narratives:

Method(s) NWTPH/EPH: The method blank for preparation batch 580-252361 and 580-252658 and analytical batch 580-252781 contained C8-C10 Aliphatics and C10-C12 Aliphatics above the method detection limit. This target analyte concentration was less than half the reporting limit (1/2RL); therefore, re-extraction and/or re-analysis of samples was not performed.

METHOD BLANK DETECTIONs			
Analyte	**Method Blank #**	**Batch #**	**Method Blank Result (mg/kg)**
C8-C10 Aliphatics	MB 580-252361/1-B	252361	0.158 J
C10-C12 Aliphatics			0.0988 J
C10-C12 Aromatics			0.199 J
C16-C21 Aromatics			1.83 J

QUALIFIED RESULTS DUE TO METHOD BLANK DETECTION					
Analyte	**Natural Sample ID#**	**Laboratory ID#**	**Sample Result (mg/kg)**	**Revised Result & Qualifier**	**Qualification Notes**
--	--	--	--	None	--

Analytical results were not qualified based on method blank contamination as all associated results were at least 2x greater than the associated blank result and significantly above the reporting limit specified for the method blank.

7d. Matrix Spike / Matrix Spike Duplicates

What project samples were used to prepare the MS and MSD samples?

The laboratory did not run MS/MSDs as they set the project up as Level 2, instead of Level 3, in their system.

Was the total number of MS samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*

N/A

Were MS percent recoveries and all MS/MSD relative percent differences (RPDs) within data validation or laboratory QC limits? *Explain and include a discussion on how this affects the data.*

N/A

MS/MSD RESULTS					
Analyte	**Laboratory Sample ID#**	**%R or RPD**	**Control Limits**	**Laboratory Qualifier**	**Reason for Lab Qualification**

7e. Laboratory Duplicates

Were laboratory duplicate RPD values within laboratory-specified limits? *Explain and include discussion of how this affects the data.*

No laboratory duplicates were analyzed other than those included in the laboratory control sample. All laboratory control sample duplicate RPDs were within control limits.

7f. Surrogates

Were surrogate recoveries within laboratory QC limits? *Explain and include discussion on how this affects the data.*

All surrogate recoveries were within the specified QC limits with exception of the following. No data was qualified as the laboratory control samples and laboratory control sample duplicates were within control limits.

- Method(s) NWTPH-Dx: Surrogate recovery for the following samples was outside control limits: SB-3(6.5-7.5') (580-70069-2) and SB-2(6.5-7.5') (580-70069-3). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

- Method(s) NWTPH/EPH: The below CCV had a %D of 27 for the surrogate 1-Chlorooctadecane. This met %R acceptance criteria (10-150), and all samples met acceptance criteria (except where obvious matrix interference is present), therefore the data was reported. SB-4(6.5-7.5') (580-70069-1), SB-3(6.5-7.5') (580-70069-2), SB-2(6.5-7.5') (580-70069-3), SB-1(4.5-5') (580-70069-4), (CCVRT 580-252835/3), (590-6656-3), (590-6656-3 MS) and (590-6656-3 MSD)

- Method(s) NWTPH/EPH: Surrogate 1-Chlorooctadecane recovery for the following samples was outside control limits: (590-6656-C-3-D), (590-6656-3 MS) and (590-6656-3 MSD). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

8. FIELD QA/QC

8a. Trip and Field Blanks

***Were the number of equipment, trip, or field blanks collected equal to at least 10% of the total number of samples, or as required by the project requirements, QAPP, or SAP*?** *Explain and include how this affects the data.*

Yes. One rinsate blank was collected and analyzed within laboratory report group 580-70071-1.

LIST OF TRIP AND FIELD BLANKS				
QC Sample ID#	**Blank Type**	**Corresponding Laboratory Workorder #**	**Corresponding Matrix**	**Date of Corresponding Samples**
Rinsate Blank	Equipment Rinsate Blank	580-70071	Aqueous	7-20-17

Were the trip blank, field blank, and/or equipment blank samples free of analyte contamination? *Explain and include discussion of how this affects the data.*

No. Concentrations of C8-C10 aliphatics, C10-C12 aliphatics, C12-C16 aliphatics, and C16-C21 aromatics were detected in the rinsate blank. However, the detections are related to laboratory method blank contamination. The concentrations detected in the rinsate blank were qualified as non-detect due to method blank contamination. No other qualifications are required.

8b. Field Duplicates

Were the field duplicates collected as required by the project requirements, QAPP or SAP? Include a table of duplicate samples. *Explain and include discussion of how this affects the data.*
No soil field duplicates were collected due to limited sample volume.

DUPLICATE RPD RESULTS			
Analyte	**MFG-2** *Natural Sample Result*	**Duplicate** *Duplicate Result*	**RPD (0-30%)**
--	None	None	--

Were field duplicate RPD values within data validation QC limits? *Explain and include discuss of how this affects the data.*

Not applicable.

9. OTHER

Did DEQ collect split samples? If so, explain how those results compare to the natural sample.

No, DEQ did not collect split samples.

Other comments or observations.
None.

10. SUMMARY OF QUALIFIED DATA

The following presents a summary of all data qualified during this evaluation and reason for qualification.

SUMMARY OF QUALIFIED DATA					
Analyte	**Field Sample ID#**	**Laboratory ID#**	**Laboratory Result (µg/L)**	**Qualifier**	**Reason for Qualification**
Qualified Results Based on Concentrations Between the Method Detection Limit and Laboratory Reporting Limit					
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C16-C21 Aromatics	SB-4 (6.5-7.5')	580-70069-1	49 57 85 80 510	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C16-C21 Aliphatics C16-C21 Aromatics	SB-3 (6.5-7.5')	580-70669-2	5.6 6.5 9.7 37 230	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C16-C16 Aliphatics C16-C21 Aromatics	SB-2 (6.5-7.5')	580-70069-3	6.9 17 10 110 110 81	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics	SB-1 (4.5-5')	580-70069-4	4.3 3.3 25	J	Analyte detected between laboratory reporting limit and method detection limit.

11. ACCEPTABILITY AND USABILITY OF THE DATA

Precision
The data are considered precise as all MS/MSD and duplicate results were within control limits. No qualifications were required.

Accuracy
The data are considered accurate as no data required qualification to due sample handling, preservation or preparation; analytical techniques; laboratory blanks; MS/MSD results; LCS results or surrogates.

Representativeness

The data are considered representative as the sample locations were selected for a specific purpose to meet the DQOs specified in the SAP. The samples are representative of other samples collected, handled, and preserved in the same manner under similar conditions, and analyzed using the same techniques and methods.

Completeness

The data are considered 100% complete as the data was collected per the SAP and all data are considered useable.

Comparability

The sample data are comparable to other sample data collected with similar field methods, quality assurance/quality control measures, and the same analytical methods.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-70071-1
Client Project/Site: Darling-Tacoma

For:
Tetra Tech, Inc.
2525 Palmer Street
Suite 2
Missoula, Montana 59808-1744

Attn: Natalie Morrow

Authorized for release by:
8/11/2017 10:54:03 AM

Sheri Cruz, Project Manager I
(253)922-2310
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Case Narrative

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70071-1

Job ID: 580-70071-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-70071-1

Comments
No additional comments.

Receipt
The samples were received on 7/21/2017 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were -0.5º C and 0.9º C.

Receipt Exceptions
The reference method requires samples to be preserved to a pH of 2 or less. The following samples were received with insufficient preservation at a pH of more than 2: MFG-1 (580-70071-1) and Rinsate Blank (580-70071-4). The samples were preserved to the appropriate pH in the laboratory using HCl lot #55320. This applies to all HCl containers for sample 1 and container B for sample 4.

The reference method requires samples to be preserved to a pH of 2 or less. The following samples were received with insufficient preservation at a pH of more than 2: MFG-1 (580-70071-1) and Rinsate Blank (580-70071-4). The samples were preserved to the appropriate pH in the laboratory using Sulfuric Acid Lot#0000137221. This applies to H2SO4 container for sample 1.

GC Semi VOA
Method(s) NWTPH-Dx: The method blank for preparation batch 580-252093 and analytical batch 580-252165 contained #2 Diesel (C10-C24) above the method detection limit. This target analyte concentration was less than half the reporting limit (1/2RL); therefore, re-extraction and/or re-analysis of samples was not performed.

Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern in the diesel range; however, the elution pattern was later than the typical diesel fuel pattern used by the laboratory for quantitative purposes: MFG-1 (580-70071-1), MFG-2 (580-70071-2) and Duplicate (580-70071-3).

Method(s) NWTPH-Dx: The peak profile present in this sample MFG-2 (580-70071-2) and Duplicate (580-70071-3) is atypical of a hydrocarbon pattern and consists of discrete peaks.

Method(s) NWTPH/EPH: The continuing calibration verification (CCV) associated with batch 580-253345 recovered above the upper control limit for aliphatic surrogate 1-Chlorooctadecane. The samples and batch QC associated with this CCV were within %Rec criteria for 1-Chlorooctadecane; therefore, the data have been reported.

Method(s) NWTPH/EPH: The method blank for preparation batch 580-252195 and 580-253295 and analytical batch 580-253345 contained C16-C21 Aromatics, C8-C10 Aliphatics, C10-C12 Aliphatics and C12-C16 Aliphatics above the method detection limit. This target analyte concentration was less than half the reporting limit (1/2RL); therefore, re-extraction and/or re-analysis of samples was not performed.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
Method(s) EPH Frac: A deviation from the Standard Operating Procedure (SOP) occurred. Details are as follows: With the required rework there was slightly less than the typical 1 mL volume that was used for the fractionation. It is documented for each sample the amount of extract that was used.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample ID: MFG-1

Date Collected: 07/20/17 12:45
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70071-1

Matrix: Water

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	**21**	**J B**	48	1.9	ug/L		07/26/17 14:38	08/10/17 10:49	1
C8-C10 Aromatics	ND		48	14	ug/L		07/26/17 14:38	08/10/17 10:49	1
C10-C12 Aliphatics	**8.6**	**J B**	48	2.9	ug/L		07/26/17 14:38	08/10/17 10:49	1
C10-C12 Aromatics	**47**	**J**	48	3.9	ug/L		07/26/17 14:38	08/10/17 10:49	1
C12-C16 Aliphatics	**3.3**	**J B**	48	1.4	ug/L		07/26/17 14:38	08/10/17 10:49	1
C12-C16 Aromatics	**16**	**J**	48	5.4	ug/L		07/26/17 14:38	08/10/17 10:49	1
C16-C21 Aliphatics	ND		48	4.4	ug/L		07/26/17 14:38	08/10/17 10:49	1
C16-C21 Aromatics	**13**	**J B**	48	6.7	ug/L		07/26/17 14:38	08/10/17 10:49	1
C21-C34 Aliphatics	ND		48	10	ug/L		07/26/17 14:38	08/10/17 10:49	1
C21-C34 Aromatics	ND		48	14	ug/L		07/26/17 14:38	08/10/17 10:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*77*		*64 - 114*	*07/26/17 14:38*	*08/10/17 10:49*	*1*
1-Chlorooctadecane	*76*		*49 - 114*	*07/26/17 14:38*	*08/10/17 10:49*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.99**	**B**	0.10	0.019	mg/L		07/25/17 14:28	07/26/17 19:22	1
Motor Oil (>C24-C36)	**0.45**		0.25	0.077	mg/L		07/25/17 14:28	07/26/17 19:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*83*		*43 - 119*	*07/25/17 14:28*	*07/26/17 19:22*	*1*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.22**		0.10	0.019	mg/L		07/25/17 14:28	07/26/17 22:04	1
Motor Oil (>C24-C36)	ND		0.25	0.077	mg/L		07/25/17 14:28	07/26/17 22:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*91*		*43 - 119*	*07/25/17 14:28*	*07/26/17 22:04*	*1*

Client Sample ID: MFG-2

Date Collected: 07/20/17 14:55
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70071-2

Matrix: Water

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	**4.7**	**J B**	48	1.9	ug/L		07/26/17 14:38	08/10/17 11:15	1
C8-C10 Aromatics	ND		48	14	ug/L		07/26/17 14:38	08/10/17 11:15	1
C10-C12 Aliphatics	**3.0**	**J B**	48	3.0	ug/L		07/26/17 14:38	08/10/17 11:15	1
C10-C12 Aromatics	**12**	**J**	48	3.9	ug/L		07/26/17 14:38	08/10/17 11:15	1
C12-C16 Aliphatics	**2.7**	**J B**	48	1.4	ug/L		07/26/17 14:38	08/10/17 11:15	1
C12-C16 Aromatics	**6.2**	**J**	48	5.4	ug/L		07/26/17 14:38	08/10/17 11:15	1
C16-C21 Aliphatics	ND		48	4.4	ug/L		07/26/17 14:38	08/10/17 11:15	1
C16-C21 Aromatics	**20**	**J B**	48	6.7	ug/L		07/26/17 14:38	08/10/17 11:15	1
C21-C34 Aliphatics	ND		48	10	ug/L		07/26/17 14:38	08/10/17 11:15	1
C21-C34 Aromatics	ND		48	14	ug/L		07/26/17 14:38	08/10/17 11:15	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*80*		*64 - 114*	*07/26/17 14:38*	*08/10/17 11:15*	*1*
1-Chlorooctadecane	*73*		*49 - 114*	*07/26/17 14:38*	*08/10/17 11:15*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.60**	**B**	0.10	0.019	mg/L		07/25/17 14:28	07/26/17 19:45	1
Motor Oil (>C24-C36)	**0.29**		0.25	0.078	mg/L		07/25/17 14:28	07/26/17 19:45	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*101*		*43 - 119*	*07/25/17 14:28*	*07/26/17 19:45*	*1*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.079**	**J**	0.10	0.019	mg/L		07/25/17 14:28	07/26/17 22:27	1
Motor Oil (>C24-C36)	ND		0.25	0.078	mg/L		07/25/17 14:28	07/26/17 22:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*110*		*43 - 119*	*07/25/17 14:28*	*07/26/17 22:27*	*1*

Client Sample ID: Duplicate

Date Collected: 07/20/17 00:00
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70071-3

Matrix: Water

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	**6.3**	**J B**	48	1.9	ug/L		07/26/17 14:38	08/10/17 11:40	1
C8-C10 Aromatics	ND		48	14	ug/L		07/26/17 14:38	08/10/17 11:40	1
C10-C12 Aliphatics	**4.4**	**J B**	48	3.0	ug/L		07/26/17 14:38	08/10/17 11:40	1
C10-C12 Aromatics	**12**	**J**	48	3.9	ug/L		07/26/17 14:38	08/10/17 11:40	1
C12-C16 Aliphatics	**4.2**	**J B**	48	1.4	ug/L		07/26/17 14:38	08/10/17 11:40	1
C12-C16 Aromatics	**6.7**	**J**	48	5.4	ug/L		07/26/17 14:38	08/10/17 11:40	1
C16-C21 Aliphatics	ND		48	4.4	ug/L		07/26/17 14:38	08/10/17 11:40	1
C16-C21 Aromatics	**19**	**J B**	48	6.7	ug/L		07/26/17 14:38	08/10/17 11:40	1
C21-C34 Aliphatics	ND		48	10	ug/L		07/26/17 14:38	08/10/17 11:40	1
C21-C34 Aromatics	ND		48	14	ug/L		07/26/17 14:38	08/10/17 11:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*84*		*64 - 114*	*07/26/17 14:38*	*08/10/17 11:40*	*1*
1-Chlorooctadecane	*73*		*49 - 114*	*07/26/17 14:38*	*08/10/17 11:40*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.62**	**B**	0.10	0.019	mg/L		07/25/17 14:28	07/26/17 20:08	1
Motor Oil (>C24-C36)	**0.36**		0.25	0.078	mg/L		07/25/17 14:28	07/26/17 20:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*90*		*43 - 119*	*07/25/17 14:28*	*07/26/17 20:08*	*1*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.13**		0.10	0.019	mg/L		07/25/17 14:28	07/26/17 22:50	1
Motor Oil (>C24-C36)	ND		0.25	0.078	mg/L		07/25/17 14:28	07/26/17 22:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*97*		*43 - 119*	*07/25/17 14:28*	*07/26/17 22:50*	*1*

Client Sample ID: Rinsate Blank
Date Collected: 07/20/17 15:45
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70071-4
Matrix: Water

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	**5.9**	**J B**	47	1.9	ug/L		07/26/17 14:38	08/10/17 12:06	1
C8-C10 Aromatics	ND		47	14	ug/L		07/26/17 14:38	08/10/17 12:06	1
C10-C12 Aliphatics	**3.7**	**J B**	47	2.9	ug/L		07/26/17 14:38	08/10/17 12:06	1
C10-C12 Aromatics	ND		47	3.9	ug/L		07/26/17 14:38	08/10/17 12:06	1
C12-C16 Aliphatics	**3.7**	**J B**	47	1.4	ug/L		07/26/17 14:38	08/10/17 12:06	1
C12-C16 Aromatics	ND		47	5.4	ug/L		07/26/17 14:38	08/10/17 12:06	1
C16-C21 Aliphatics	ND		47	4.4	ug/L		07/26/17 14:38	08/10/17 12:06	1
C16-C21 Aromatics	**17**	**J B**	47	6.6	ug/L		07/26/17 14:38	08/10/17 12:06	1
C21-C34 Aliphatics	ND		47	10	ug/L		07/26/17 14:38	08/10/17 12:06	1
C21-C34 Aromatics	ND		47	14	ug/L		07/26/17 14:38	08/10/17 12:06	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*91*		*64 - 114*	*07/26/17 14:38*	*08/10/17 12:06*	*1*
1-Chlorooctadecane	*80*		*49 - 114*	*07/26/17 14:38*	*08/10/17 12:06*	*1*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		0.10	0.019	mg/L		07/25/17 14:28	07/27/17 08:19	1
Motor Oil (>C24-C36)	ND		0.25	0.078	mg/L		07/25/17 14:28	07/27/17 08:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*90*		*43 - 119*	*07/25/17 14:28*	*07/27/17 08:19*	*1*

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

Lab Sample ID: MB 580-252195/1-C
Matrix: Water
Analysis Batch: 253345

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 252195

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C10 Aliphatics	6.31	J	50	2.0	ug/L		07/26/17 14:38	08/10/17 09:29	1
C8-C10 Aromatics	ND		50	15	ug/L		07/26/17 14:38	08/10/17 09:29	1
C10-C12 Aliphatics	4.27	J	50	3.1	ug/L		07/26/17 14:38	08/10/17 09:29	1
C10-C12 Aromatics	ND		50	4.1	ug/L		07/26/17 14:38	08/10/17 09:29	1
C12-C16 Aliphatics	5.19	J	50	1.5	ug/L		07/26/17 14:38	08/10/17 09:29	1
C12-C16 Aromatics	ND		50	5.7	ug/L		07/26/17 14:38	08/10/17 09:29	1
C16-C21 Aliphatics	ND		50	4.6	ug/L		07/26/17 14:38	08/10/17 09:29	1
C16-C21 Aromatics	9.53	J	50	7.0	ug/L		07/26/17 14:38	08/10/17 09:29	1
C21-C34 Aliphatics	ND		50	11	ug/L		07/26/17 14:38	08/10/17 09:29	1
C21-C34 Aromatics	ND		50	15	ug/L		07/26/17 14:38	08/10/17 09:29	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*89*		*64 - 114*	*07/26/17 14:38*	*08/10/17 09:29*	*1*
1-Chlorooctadecane	*82*		*49 - 114*	*07/26/17 14:38*	*08/10/17 09:29*	*1*

Lab Sample ID: LCS 580-252195/2-C
Matrix: Water
Analysis Batch: 253345

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 252195

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
C8-C10 Aliphatics			600	296		ug/L		49	40 - 160		
C8-C10 Aromatics			200	133		ug/L		67	40 - 160		
C10-C12 Aliphatics			200	148		ug/L		74	70 - 130		
C10-C12 Aromatics			200	142		ug/L		71	70 - 130		
C12-C16 Aliphatics			400	325		ug/L		81	70 - 130		
C12-C16 Aromatics			600	454		ug/L		76	70 - 130		
C16-C21 Aliphatics			600	530		ug/L		88	70 - 130		
C16-C21 Aromatics			1000	884		ug/L		88	70 - 130		
C21-C34 Aliphatics			1200	1150		ug/L		96	70 - 130		
C21-C34 Aromatics			1600	1250		ug/L		78	70 - 130		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*85*		*64 - 114*
1-Chlorooctadecane	*68*		*49 - 114*

Lab Sample ID: LCSD 580-252195/3-C
Matrix: Water
Analysis Batch: 253345

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252195

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C8-C10 Aliphatics			600	285		ug/L		47	40 - 160	4	25
C8-C10 Aromatics			200	136		ug/L		68	40 - 160	2	25
C10-C12 Aliphatics			200	148		ug/L		74	70 - 130	0	25
C10-C12 Aromatics			200	152		ug/L		76	70 - 130	7	25
C12-C16 Aliphatics			400	327		ug/L		82	70 - 130	1	25
C12-C16 Aromatics			600	495		ug/L		83	70 - 130	9	25
C16-C21 Aliphatics			600	536		ug/L		89	70 - 130	1	25

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) (Continued)

Lab Sample ID: LCSD 580-252195/3-C
Matrix: Water
Analysis Batch: 253345

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252195

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C16-C21 Aromatics			1000	959		ug/L		96	70 - 130	8	25
C21-C34 Aliphatics			1200	1170		ug/L		98	70 - 130	2	25
C21-C34 Aromatics			1600	1280		ug/L		80	70 - 130	3	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*88*		*64 - 114*
1-Chlorooctadecane	*73*		*49 - 114*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 580-252093/1-A
Matrix: Water
Analysis Batch: 252165

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 252093

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	0.0247	J	0.10	0.019	mg/L		07/25/17 14:28	07/26/17 12:58	1
Motor Oil (>C24-C36)	ND		0.25	0.077	mg/L		07/25/17 14:28	07/26/17 12:58	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*90*		*43 - 119*	*07/25/17 14:28*	*07/26/17 12:58*	*1*

Lab Sample ID: LCS 580-252093/2-A
Matrix: Water
Analysis Batch: 252165

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 252093

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
#2 Diesel (C10-C24)			2.00	1.53		mg/L		76	59 - 112
Motor Oil (>C24-C36)			2.00	1.60		mg/L		80	64 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*84*		*43 - 119*

Lab Sample ID: LCSD 580-252093/3-A
Matrix: Water
Analysis Batch: 252165

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252093

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
#2 Diesel (C10-C24)			2.00	1.58		mg/L		79	59 - 112	3	16
Motor Oil (>C24-C36)			2.00	1.64		mg/L		82	64 - 120	3	17

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*81*		*43 - 119*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Lab Sample ID: MB 580-252093/1-B
Matrix: Water
Analysis Batch: 252165

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 252093

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		0.10	0.019	mg/L		07/25/17 14:28	07/26/17 20:31	1
Motor Oil (>C24-C36)	ND		0.25	0.077	mg/L		07/25/17 14:28	07/26/17 20:31	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*90*		*43 - 119*	*07/25/17 14:28*	*07/26/17 20:31*	*1*

Lab Sample ID: LCS 580-252093/2-B
Matrix: Water
Analysis Batch: 252165

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 252093

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
#2 Diesel (C10-C24)			2.00	1.63		mg/L		82	59 - 112		
Motor Oil (>C24-C36)			2.00	1.75		mg/L		88	64 - 120		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*78*		*43 - 119*

Lab Sample ID: LCSD 580-252093/3-B
Matrix: Water
Analysis Batch: 252165

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 252093

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
#2 Diesel (C10-C24)			2.00	1.64		mg/L		82	59 - 112	1	16
Motor Oil (>C24-C36)			2.00	1.73		mg/L		87	64 - 120	1	17

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*86*		*43 - 119*

Lab Chronicle

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70071-1

Client Sample ID: MFG-1

Lab Sample ID: 580-70071-1
Matrix: Water
Date Collected: 07/20/17 12:45
Date Received: 07/21/17 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3520C			252195	07/26/17 14:38	MRG	TAL SEA
Total/NA	Fraction	EPH Frac			253295	08/09/17 14:37	MRG	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	253345	08/10/17 10:49	ERZ	TAL SEA
Total/NA	Prep	3510C			252093	07/25/17 14:28	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	252165	07/26/17 19:22	ERZ	TAL SEA
Total/NA	Prep	3510C			252093	07/25/17 14:28	NDB	TAL SEA
Total/NA	Cleanup	3630C			252133	07/25/17 18:40	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	252165	07/26/17 22:04	ERZ	TAL SEA

Client Sample ID: MFG-2

Lab Sample ID: 580-70071-2
Matrix: Water
Date Collected: 07/20/17 14:55
Date Received: 07/21/17 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3520C			252195	07/26/17 14:38	MRG	TAL SEA
Total/NA	Fraction	EPH Frac			253295	08/09/17 14:37	MRG	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	253345	08/10/17 11:15	ERZ	TAL SEA
Total/NA	Prep	3510C			252093	07/25/17 14:28	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	252165	07/26/17 19:45	ERZ	TAL SEA
Total/NA	Prep	3510C			252093	07/25/17 14:28	NDB	TAL SEA
Total/NA	Cleanup	3630C			252133	07/25/17 18:40	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	252165	07/26/17 22:27	ERZ	TAL SEA

Client Sample ID: Duplicate

Lab Sample ID: 580-70071-3
Matrix: Water
Date Collected: 07/20/17 00:00
Date Received: 07/21/17 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3520C			252195	07/26/17 14:38	MRG	TAL SEA
Total/NA	Fraction	EPH Frac			253295	08/09/17 14:37	MRG	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	253345	08/10/17 11:40	ERZ	TAL SEA
Total/NA	Prep	3510C			252093	07/25/17 14:28	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	252165	07/26/17 20:08	ERZ	TAL SEA
Total/NA	Prep	3510C			252093	07/25/17 14:28	NDB	TAL SEA
Total/NA	Cleanup	3630C			252133	07/25/17 18:40	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	252165	07/26/17 22:50	ERZ	TAL SEA

Client Sample ID: Rinsate Blank

Lab Sample ID: 580-70071-4
Matrix: Water
Date Collected: 07/20/17 15:45
Date Received: 07/21/17 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3520C			252195	07/26/17 14:38	MRG	TAL SEA
Total/NA	Fraction	EPH Frac			253295	08/09/17 14:37	MRG	TAL SEA

Lab Chronicle

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70071-1

Client Sample ID: Rinsate Blank

Date Collected: 07/20/17 15:45
Date Received: 07/21/17 09:30

Lab Sample ID: 580-70071-4

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	NWTPH/EPH		1	253345	08/10/17 12:06	ERZ	TAL SEA
Total/NA	Prep	3510C			252093	07/25/17 14:28	NDB	TAL SEA
Total/NA	Cleanup	3630C			252133	07/25/17 18:40	NDB	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	252165	07/27/17 08:19	ERZ	TAL SEA

Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70071-1

Laboratory: TestAmerica Seattle

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Alaska (UST)	State Program	10	UST-022	03-02-18
California	State Program	9	2901	01-31-18
L-A-B	DoD ELAP		L2236	01-19-19
L-A-B	ISO/IEC 17025		L2236	01-19-19
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-05-17
US Fish & Wildlife	Federal		LE058448-0	10-31-17
USDA	Federal		P330-14-00126	02-10-20
Washington	State Program	10	C553	02-17-18

Sample Summary

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-70071-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-70071-1	MFG-1	Water	07/20/17 12:45	07/21/17 09:30
580-70071-2	MFG-2	Water	07/20/17 14:55	07/21/17 09:30
580-70071-3	Duplicate	Water	07/20/17 00:00	07/21/17 09:30
580-70071-4	Rinsate Blank	Water	07/20/17 15:45	07/21/17 09:30

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Loc: 580
70071

TestAmerica Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.testamericainc.com

☐ Rush
☐ Short Hold

Chain of Custody Record

Client	Client Contact	Date	Chain of Custody Number
Tetra Tech	Natalie Morrow	7/20/17	31342
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page ____ of ____**
4655 Sunnyside CT	406-543-3045		
City	**State**	**Zip Code**	**Sampler**	**Lab Contact**
Missoula	MT	59808	NM	Sheri Cruz
Project Name and Location (State)	**Billing Contact**	**Contract/Purchase Order/Quote No.**
Darling - Tacoma (Washington)		114-571180.100

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	EPH	NWTPH-Dx SGC	NWTPH-Dx	Analysis (Attach list if more space is needed)
MFG-1	7/20/17	1245		X				X		X			X	X	X	
MFG-2	7/20/17	1455		X				X		X			X	X	X	
Duplicate	7/20/17	—		X				X		X			X	X	X	
Rinsate Blank	7/20/17	1545		X				X		X			X	X		

Special Instructions/ Conditions of Receipt

580-70071 Chain of Custody

TB #2 Cooler ___ Cor -0.5 Unc 0.3
Cooler Dscl by Blue @Lab ___
Wet/Packs Packing Bubble
Cr. do w/o

TB #2 Cooler ___ Cor 0.9 Unc 1.7
Cooler Dscl by Blue @Lab ___
Wet/Packs Packing Bubble
Cr. do w/o

Cooler ☐ Yes ☐ No Cooler Temp: ____

Possible Hazard Identification ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days)
☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other STD

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By Sign/Print	7/21/17	0930	1. Received By Sign/Print B. Stark R. Gell SEA TA	7/21/17	0930
2. Relinquished By Sign/Print			2. Received By Sign/Print		
3. Relinquished By Sign/Print			3. Received By Sign/Print		

Comments

DISTRIBUTION: WHITE – Stays with the Samples; CANARY – Returned to Client with Report; PINK – Field Copy

TAL-8274-580 (0210)

Login Sample Receipt Checklist

Client: Tetra Tech, Inc.

Job Number: 580-70071-1

Login Number: 70071
List Number: 1
Creator: Ponce-McDermott, Monica

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	pH adjusted
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

DATA VALIDATION REPORT

1. INTRODUCTION

General Project Information			
Project Name:	Darling-Tacoma	**Date Validated:**	8/16/17
Tetra Tech Project Number:	114-571180	**Data Validated By:**	N.Morrow
Sample Start and End Dates:	7/20/17	**Laboratory Name:**	TestAmerica
Sample Matrix:	Groundwater	**Laboratory Project ID#:**	580-70071-1
Analytical Parameters:	NWTPH-Dx, NWTPH-Dx with Silica Gel Treatment (Method 3630C) and Extractable Petroleum Hydrocarbon fractionation		
Name & Date of Approved SAP, QAPP, Work Plan, Etc.	Site Investigation Work Plan, Darling-Tacoma Facility, Darling Delaware Co., Inc. (aka Puget Sound By-Products) Facility, 2041 Marc Avenue, Tacoma, WA. Facility No. 25455514, Cleanup Site No. 8475, VCP Project No. SW1317. Dated March 22, 2017		

2. LABORATORY METHODS AND SAMPLE HANDLING

Validation Criteria Used:

X USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. Dated August 2014.

X Site Investigation Work Plan, Darling-Tacoma Facility, Darling Delaware Co., Inc. (aka Puget Sound By-Products) Facility, 2041 Marc Avenue, Tacoma, WA. Facility No. 25455514, Cleanup Site No. 8475, VCP Project No. SW1317. Dated March 22, 2017

3. LIST OF SAMPLES VALIDATED IN THIS REPORT

Validated Samples		
Field Sample ID#	**Laboratory Sample ID#**	**Sample Type** (Natural, Duplicate, Field Blank, Etc.)
MFG-1	580-70071-1	Natural
MFG-2	580-70071-2	Natural
Duplicate	580-70071-3	Duplicate
Rinsate Blank	580-70071-4	Rinsate Blank

4. DATA QUALIFIERS

Data Evaluation Qualifiers	
Data Qualifier	**Qualifier Description** *(as per USEPA 2008 CLP Guidelines)*
U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
J	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
R	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

Laboratory Data Qualifiers	
Laboratory Qualifier	**Qualifier Description in Laboratory Report**
J	Estimated value. The analyte was present but less than the reporting limit.
S	Spike recovery outside of advisory limits.

5. LABORATORY NARRATIVE, CHAIN-OF-CUSTODY, AND SAMPLE RECEIPT CHECKLIST

Was a laboratory narrative provided and were there any non-conformance issues with the analytical data? *Identify and discuss.*
The laboratory noted the following:

- Method(s) NWTPH-Dx: The method blank for preparation batch 580-252093 and analytical batch 580-252165 contained #2 Diesel (C10-C24) above the method detection limit. This target analyte concentration was less than half the reporting limit (1/2RL); therefore, re-extraction and/or re-analysis of samples was not performed.
- Method(s) NWTPH-Dx: The following samples contained a hydrocarbon pattern in the diesel range; however, the elution pattern was later than the typical diesel fuel pattern used by the laboratory for quantitative purposes: MFG-1 (580-70071-1), MFG-2 (580-70071-2) and Duplicate (580-70071-3).
- Method(s) NWTPH-Dx: The peak profile present in this sample MFG-2 (580-70071-2) and Duplicate (580-70071-3) is atypical of a hydrocarbon pattern and consists of discrete peaks.

Other narrative notes from the laboratory are provided in the applicable sections throughout this report.

Were sample Chain-of-Custody (CoC) forms complete? *Describe.*
Yes. All required areas of the CoC were completed and the forms signed by DEQ and the laboratory upon transfer of the samples into laboratory custody.

Were the requested analytical methods in compliance with project requirements (i.e., QAPP, SAP, etc.)? *Explain and, if not in compliance, discuss how this affects the data.*
Yes. As samples were analyzed for the methods specified in the SAP and requested by Ecology.

Were samples received in good condition within method specified requirements? *Explain any exceptions and how sample conditions may affect the results.*
Yes. The samples were hand delivered to the laboratory. The laboratory stated the samples were received on 7/21/2017 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 2 coolers at receipt time were -0.5º C and 0.9º C but were not frozen. Samples MFG-1 and Rinsate Blank required the laboratory to add additional acid to the bottles to attain a pH of less than 2 for samples requiring HCl and H2SO4. No qualification was required for those samples that required additional acid as acid was present in the bottles, the samples were immediately placed on ice and the temperature maintained at less than 6 ºC, and all samples were extracted/prepared for analysis within 5 days of receipt and analyzed within 6 days for NWTPH-Dx and within 20 days for EPH fractions.

6. LABORATORY COMPLIANCE WITH PROJECT REQUIREMENTS

Were samples analyzed within method specified or technical holding times? *Explain any exceptions and how this may affect the results.*
Yes. All samples were analyzed within the holding times specified by the analytical methods.

Do the laboratory reports include all constituents requested to be analyzed on the CoC or under the QAPP, SAP, or other applicable document? *Explain.*
Yes. The laboratory analyzed all samples for NWTPH-EPH, and NWTPH-Dx with and without silica gel treatment.

Were reported units appropriate for the associated sample matrix/matrices and method(s) of analyses? *Explain.*
Yes. All results were reported in micrograms per liter (µg/L) which is appropriate for these results and for comparison with water quality standards.

Were detection limits reported by the laboratory in accordance with the project requirements? *Discuss.*
No dilutions were required. All reporting limits and the method detection limit were below the required state groundwater standards.

Detection Limits Above Project Requirements					
Analytical Parameter	**Field Sample ID#**	**Laboratory Sample ID#**	**Laboratory Reporting Limit (µg/L)**	**Water Quality Standard (µg/L)**	**Standard Exceeded**
--	--	--	--	--	None

Note: Laboratory reported estimated concentrations for constituents detected between the method detection limit and the laboratory reporting limit (limit of quantitation).
RSL – EPA Regional Screening Level for tap water.
n/a – not applicable.

Results qualified by the laboratory based on the laboratory reporting limit.

The following table lists the analytical results that were qualified as estimated (J) by the laboratory due to the analyte being present but was detected at concentrations between the laboratory reporting limit (laboratory's limit of quantitation) and the method detection limit.

QUALIFIED RESULTS BASED CONCENTRATIONS DETECTED BETWEEN THE METHOD DECTECTION LIMIT AND THE LABORATORY REPORTING LIMIT					
Analyte	**Natural Sample ID#**	**Laboratory ID#**	**Laboratory Result (µg/L)**	**Qualifier**	**Reason for Qualification**
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C12-C16 Aromatics C16-C21 Aromatics	MFG-1	580-70071-1	21 8.6 47 3.3 16 13	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C12-C16 Aromatics C16-C21 Aromatics #2 Diesel	MFG-2	80-70071-2	4.7 3.0 12 2.7 6.2 20 0.079	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C12-C16 Aromatics C16-C21 Aromatics	Duplicate	580-70071-3	6.3 4.4 12 4.2 6.7 19	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C16-C21 Aromatics	Rinaste Blank	580-70071-4	5.9 3.7 17	J	Analyte detected between laboratory reporting limit and method detection limit.

7. LABORATORY QA/QC

7a. Continuing Calibration Verification (CCV) Standard

Was there indication from the laboratory that the initial or CCV results were within acceptable limits? *Explain.*

The laboratory stated the following:

Method(s) NWTPH/EPH: The continuing calibration verification (CCV) associated with batch 580-253345 recovered above the upper control limit for aliphatic surrogate 1-Chlorooctadecane. The samples and batch QC associated with this CCV were within %Rec criteria for 1-Chlorooctadecane; therefore, the data have been reported.

No qualification is required.

7b. Laboratory Control Samples (LCSs)

Was the reference material used for the laboratory control standard (LCSs) the correct matrix and concentration? *Explain and include a discussion on how this affects the data.*
Yes. The QA/QC Summary Report presented the LCS data. The sample was of the correct matrix, aqueous.

Was the total number of LCSs analyzed equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*
Yes. At least one LCSs was analyzed for each analytical method.

Were LCSs prepared the same way as the associated samples? *Explain and include a discussion of how this affects the data.*
Yes. The LCSs were aqueous and were prepared according to the analytical method. No issues with the LCS were noted by the laboratory.

Were LCS/LCSD percent recoveries and LCS/LCSD RPDs within laboratory QC limits? *Explain and include discussion on how this affects the data.*
All LCS % recoveries were reported as being within the specified control limits.

7c. Laboratory Blank Samples

Was the total number of method blank samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*
Yes. At least one method blank was analyzed per analytical method.

Were laboratory blank samples free of analyte contamination? *Explain.*
No. The laboratory provided the following narratives:

Method(s) NWTPH-Dx: The method blank for preparation batch 580-252093 and analytical batch 580-252165 contained #2 Diesel (C10-C24) above the method detection limit. This target analyte concentration was less than half the reporting limit (1/2RL); therefore, re-extraction and/or re-analysis of samples was not performed.

Method(s) NWTPH/EPH: The method blank for preparation batch 580-252195 and 580-253295 and analytical batch 580-253345 contained C16-C21 Aromatics, C8-C10 Aliphatics, C10-C12 Aliphatics and C12-C16 Aliphatics above the method detection limit. This target analyte concentration was less than half the reporting limit (1/2RL); therefore, re-extraction and/or re-analysis of samples was not performed.

METHOD BLANK DETECTIONs			
Analyte	**Method Blank #**	**Batch #**	**Method Blank Result (µg/L)**
C8-C10 Aliphatics	MB 580-252195/1-C	253345	6.31 J
C10-C12 Aliphatics			4.27 J
C12-C16 Aliphatics			5.19 J
C16-C21 Aromatics			9.53 J
#2 Diesel (C10-C24)	MB 580-252093/1-A	252165	0.0247 J

QUALIFIED RESULTS DUE TO METHOD BLANK DETECTION					
Analyte	**Natural Sample ID#**	**Laboratory ID#**	**Sample Result (mg/kg)**	**Revised Result & Qualifier**	**Qualification Notes**
C8-C10 Aliphatics C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aromatics	MFG-1	580-70071-1	21 JB 8.6 JB 3.3 JB 13 JB	48 U 48 U 48 U 48 U	Qualified as non-detect to the laboratory reporting limit due to method blank contamination.
C8-C10 Aliphatics C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aromatics	MFG-2	580-70071-2	4.7 JB 3.0 JB 2.7 JB 20 JB	48 U 48 U 48 U 48 U	Qualified as non-detect to the laboratory reporting limit due to method blank contamination.
C8-C10 Aliphatics C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aromatics	Duplicate (Duplicate of Natural Sample MFG-2)	580-70071-3	6.3 JB 4.4 JB 4.2 JB 19 JB	48 U 48 U 48 U 48 U	Qualified as non-detect to the laboratory reporting limit due to method blank contamination.
C8-C10 Aliphatics C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aromatics	Rinsate Blank	580-70071-4	5.9 JB 3.7 JB 3.7 JB 17 JB	48 U 48 U 48 U 48 U	Qualified as non-detect to the laboratory reporting limit due to method blank contamination.

Diesel was not qualified as the results were greater than the laboratory reporting limit and over 2x greater than the amount detected in the method blank.

7d. Matrix Spike / Matrix Spike Duplicates

What project samples were used to prepare the MS and MSD samples?

The laboratory did not run MS/MSDs as they set the project up as Level 2, instead of Level 3, in their system.

Was the total number of MS samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*

N/A

Were MS percent recoveries and all MS/MSD relative percent differences (RPDs) within data validation or laboratory QC limits? *Explain and include a discussion on how this affects the data.*

N/A

MS/MSD RESULTS					
Analyte	**Laboratory Sample ID#**	**%R or RPD**	**Control Limits**	**Laboratory Qualifier**	**Reason for Lab Qualification**

7e. Laboratory Duplicates

Were laboratory duplicate RPD values within laboratory-specified limits? *Explain and include discussion of how this affects the data.*

No laboratory duplicates were analyzed other than those included in the laboratory control sample. All laboratory control sample duplicate RPDs were within control limits.

7f. Surrogates

Were surrogate recoveries within laboratory QC limits? *Explain and include discussion on how this affects the data.*

All surrogate recoveries were within the specified QC limits. No data was qualified.

8. FIELD QA/QC

8a. Trip and Field Blanks

***Were the number of equipment, trip, or field blanks collected equal to at least 10% of the total number of samples, or as required by the project requirements, QAPP, or SAP*?** *Explain and include how this affects the data.*

Yes. One rinsate blank was collected.

LIST OF TRIP AND FIELD BLANKS				
QC Sample ID#	**Blank Type**	**Corresponding Laboratory Workorder #**	**Corresponding Matrix**	**Date of Corresponding Samples**
Rinsate Blank	Equipment Rinsate Blank	580-70071	Aqueous	7-20-17

Were the trip blank, field blank, and/or equipment blank samples free of analyte contamination? *Explain and include discussion of how this affects the data.*

No. Concentrations of C8-C10 aliphatics, C10-C12 aliphatics, C12-C16 aliphatics, and C16-C21 aromatics were detected in the rinsate blank. However, the detections are related to laboratory method blank contamination. The concentrations detected in the rinsate blank were qualified as non-detect due to method blank contamination. No other qualifications are required.

8b. Field Duplicates

Were the field duplicates collected as required by the project requirements, QAPP or SAP? Include a table of duplicate samples. *Explain and include discussion of how this affects the data.*

DUPLICATE RPD RESULTS			
Analyte	**MFG-2** *Natural Sample Result*	**Duplicate** *Duplicate Result*	**RPD (0-30%)**
C8-C10 Aliphatics	4.7 JB	6.3 JB	29
C8-C10 Aromatics	<14	<14	0
C10-C12 Aliphatics	3.0 JB	4.4 JB	38
C10-C12 Aromatics	12 J	12 J	0
C12-C16 Aliphatics	2.7 JB	4.2 JB	43
C12-C16 Aromatics	6.2 J	6.7 J	7.8
C16-C21 Aliphatics	<4.4	<4.4	0
C16-C21 Aromatics	20 JB	19 JB	5
C21-C34 Aliphatics	<10	<10	0
C21-C34 Aromatics	<14	<14	0
#2 Diesel (C10-C24)	0.60 B	0.62 B	3.3
Motor Oil (>C24-C36)	0.29	0.36	22
#2 Diesel (C10-C24) SGT	0.079 J	0.13	49
Motor Oil (>C24-C36) SGT	<0.25	<0.25	0

Were field duplicate RPD values within data validation QC limits? *Explain and include discuss of how this affects the data.*

All RPDs were within control limits with the exception of three results (C10-C12 aliphatics, C12-C16 aliphatics, and #2 diesel with SGT). Qualification of the data was not required as 1) results were between the MDL and RL and/or 2) results were less than 5x the reporting limit (limit of quantitation).

9. OTHER

Did DEQ collect split samples? If so, explain how those results compare to the natural sample.

No, DEQ did not collect split samples.

Other comments or observations.
None.

10. SUMMARY OF QUALIFIED DATA

The following presents a summary of all data qualified during this evaluation and reason for qualification.

SUMMARY OF QUALIFIED DATA					
Analyte	**Field Sample ID#**	**Laboratory ID#**	**Laboratory Result (µg/L)**	**Qualifier**	**Reason for Qualification**
Qualified Results Based on Concentrations Between the Method Detection Limit and Laboratory Reporting Limit					
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C12-C16 Aromatics C16-C21 Aromatics	MFG-1	580-70071-1	21 8.6 47 3.3 16 13	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C12-C16 Aromatics C16-C21 Aromatics #2 Diesel	MFG-2	80-70071-2	4.7 3.0 12 2.7 6.2 20 0.079	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C12-C16 Aromatics C16-C21 Aromatics	Duplicate	580-70071-3	6.3 4.4 12 4.2 6.7 19	J	Analyte detected between laboratory reporting limit and method detection limit.
C8-C10 Aliphatics C10-C12 Aliphatics C10-C12 Aromatics C12-C16 Aliphatics C16-C21 Aromatics	Rinsate Blank	580-70071-4	5.9 3.7 17	J	Analyte detected between laboratory reporting limit and method detection limit.

SUMMARY OF QUALIFIED DATA					
Analyte	**Field Sample ID#**	**Laboratory ID#**	**Laboratory Result (µg/L)**	**Qualifier**	**Reason for Qualification**
Qualified Results Based on Concentrations Between the Method Detection Limit and Laboratory Reporting Limit					
Qualified Results Due to Method Blank Contamination					
C8-C10 Aliphatics C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aromatics	MFG-1	580-70071-1	21 JB 8.6 JB 3.3 JB 13 JB	48 U 48 U 48 U 48 U	Qualified as non-detect to the laboratory reporting limit due to method blank contamination.
C8-C10 Aliphatics C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aromatics	MFG-2	580-70071-2	4.7 JB 3.0 JB 2.7 JB 20 JB	48 U 48 U 48 U 48 U	Qualified as non-detect to the laboratory reporting limit due to method blank contamination.
C8-C10 Aliphatics C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aromatics	Duplicate (Duplicate of Natural Sample MFG-2)	580-70071-3	6.3 JB 4.4 JB 4.2 JB 19 JB	48 U 48 U 48 U 48 U	Qualified as non-detect to the laboratory reporting limit due to method blank contamination.
C8-C10 Aliphatics C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aromatics	Rinsate Blank	580-70071-4	5.9 JB 3.7 JB 3.7 JB 17 JB	48 U 48 U 48 U 48 U	Qualified as non-detect to the laboratory reporting limit due to method blank contamination.

11. ACCEPTABILITY AND USABILITY OF THE DATA

Precision

The data are considered precise as all MS/MSD and duplicate results were within control limits. Three duplicate RPDs were outside control limits. However, the results were between the MDL and RL and/or less than 5x the RL (limit of quantitation); therefore, no qualifications were required.

Accuracy

The data are considered accurate as no data required qualification to due sample handling, preservation or preparation; analytical techniques; laboratory blanks; MS/MSD results; LCS results or surrogates.

Representativeness

The data are considered representative as the sample locations were selected for a specific purpose to meet the DQOs specified in the SAP. The samples are representative of other samples collected, handled, and preserved in the same manner under similar conditions, and analyzed using the same techniques and methods.

Completeness

The data are considered 100% complete as the data was collected per the SAP and all data are considered useable.

Comparability

The sample data are comparable to other sample data collected with similar field methods, quality assurance/quality control measures, and the same analytical methods.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-83485-1
Client Project/Site: Darling-Tacoma

For:
Tetra Tech, Inc.
2525 Palmer Street
Suite 2
Missoula, Montana 59808-1744

Attn: Natalie Morrow

Authorized for release by:
1/31/2019 9:51:44 AM

Sheri Cruz, Project Manager I
(253)922-2310
sheri.cruz@testamericainc.com

Table of Contents

Case Narrative

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-83485-1

Job ID: 580-83485-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-83485-1

Comments
No additional comments.

Receipt
The samples were received on 1/24/2019 11:03 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 13.1º C.

GC Semi VOA
Method(s) NWTPH-Dx: The following CCV standard associated with 580-293750 recovered outside acceptance criteria for %D for surrogate o-Terphenyl. Since all surrogates were within %rec acceptance criteria; the data has been reported. (CCVRT 580-293750/3)

Method(s) NWTPH-Dx: The peak profile present in this sample MFG1 (580-83485-1) is atypical of a hydrocarbon pattern and consists of discrete peaks

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Definitions/Glossary

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-83485-1

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-83485-1

Client Sample ID: MFG1
Date Collected: 01/24/19 09:05
Date Received: 01/24/19 11:03

Lab Sample ID: 580-83485-1
Matrix: Water

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	0.80		0.11	0.065	mg/L		01/25/19 09:01	01/28/19 15:00	1
Motor Oil (>C24-C36)	0.55		0.35	0.096	mg/L		01/25/19 09:01	01/28/19 15:00	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*75*		*50 - 150*	*01/25/19 09:01*	*01/28/19 15:00*	*1*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	0.12		0.11	0.065	mg/L		01/25/19 09:01	01/28/19 14:38	1
Motor Oil (>C24-C36)	ND		0.35	0.096	mg/L		01/25/19 09:01	01/28/19 14:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*96*		*50 - 150*	*01/25/19 09:01*	*01/28/19 14:38*	*1*

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-83485-1

Client Sample ID: MFG-2
Date Collected: 01/24/19 10:05
Date Received: 01/24/19 11:03

Lab Sample ID: 580-83485-2
Matrix: Water

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.51**		0.11	0.065	mg/L		01/25/19 09:01	01/28/19 15:22	1
Motor Oil (>C24-C36)	**0.43**		0.35	0.096	mg/L		01/25/19 09:01	01/28/19 15:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*71*		*50 - 150*	*01/25/19 09:01*	*01/28/19 15:22*	*1*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		0.11	0.065	mg/L		01/25/19 09:01	01/28/19 15:00	1
Motor Oil (>C24-C36)	ND		0.35	0.096	mg/L		01/25/19 09:01	01/28/19 15:00	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*90*		*50 - 150*	*01/25/19 09:01*	*01/28/19 15:00*	*1*

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-83485-1

Client Sample ID: Dup
Date Collected: 01/24/19 00:00
Date Received: 01/24/19 11:03

Lab Sample ID: 580-83485-3
Matrix: Water

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	**0.54**		0.11	0.065	mg/L		01/25/19 09:01	01/28/19 15:44	1
Motor Oil (>C24-C36)	**0.49**		0.35	0.096	mg/L		01/25/19 09:01	01/28/19 15:44	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*75*		*50 - 150*	*01/25/19 09:01*	*01/28/19 15:44*	*1*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		0.11	0.065	mg/L		01/25/19 09:01	01/28/19 15:22	1
Motor Oil (>C24-C36)	ND		0.35	0.096	mg/L		01/25/19 09:01	01/28/19 15:22	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*93*		*50 - 150*	*01/25/19 09:01*	*01/28/19 15:22*	*1*

Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Lab Sample ID: MB 580-293660/1-A
Matrix: Water
Analysis Batch: 293750

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 293660

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		0.11	0.065	mg/L		01/25/19 09:01	01/28/19 13:33	1
Motor Oil (>C24-C36)	ND		0.35	0.096	mg/L		01/25/19 09:01	01/28/19 13:33	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*58*		*50 - 150*	*01/25/19 09:01*	*01/28/19 13:33*	*1*

Lab Sample ID: LCS 580-293660/2-A
Matrix: Water
Analysis Batch: 293750

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 293660

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
#2 Diesel (C10-C24)	2.00	1.72		mg/L		86	50 - 120
Motor Oil (>C24-C36)	2.00	2.02		mg/L		101	64 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*84*		*50 - 150*

Lab Sample ID: LCSD 580-293660/3-A
Matrix: Water
Analysis Batch: 293750

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 293660

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
#2 Diesel (C10-C24)	2.00	1.55		mg/L		78	50 - 120	10	26
Motor Oil (>C24-C36)	2.00	1.93		mg/L		97	64 - 120	4	24

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*82*		*50 - 150*

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup

Lab Sample ID: MB 580-293660/1-B
Matrix: Water
Analysis Batch: 293743

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 293660

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
#2 Diesel (C10-C24)	ND		0.11	0.065	mg/L		01/25/19 09:01	01/28/19 13:33	1
Motor Oil (>C24-C36)	ND		0.35	0.096	mg/L		01/25/19 09:01	01/28/19 13:33	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*69*		*50 - 150*	*01/25/19 09:01*	*01/28/19 13:33*	*1*

Lab Sample ID: LCS 580-293660/2-B
Matrix: Water
Analysis Batch: 293743

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 293660

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
#2 Diesel (C10-C24)	2.00	1.71		mg/L		85	50 - 120

Method: NWTPH-Dx - Semi-Volatile Petroleum Products by NWTPH with Silica Gel Cleanup (Continued)

Lab Sample ID: LCS 580-293660/2-B
Matrix: Water
Analysis Batch: 293743

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 293660

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Motor Oil (>C24-C36)			2.00	2.08		mg/L		104	64 - 120		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
o-Terphenyl	*87*		*50 - 150*

Lab Sample ID: LCSD 580-293660/3-B
Matrix: Water
Analysis Batch: 293743

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 293660

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
#2 Diesel (C10-C24)			2.00	1.67		mg/L		83	50 - 120	2	26
Motor Oil (>C24-C36)			2.00	2.17		mg/L		108	64 - 120	4	24

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
o-Terphenyl	*86*		*50 - 150*

Lab Chronicle

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-83485-1

Client Sample ID: MFG1

Lab Sample ID: 580-83485-1

Date Collected: 01/24/19 09:05

Matrix: Water

Date Received: 01/24/19 11:03

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			293660	01/25/19 09:01	DCV	TAL SEA
Total/NA	Cleanup	3630C			293718	01/25/19 16:44	DCV	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	293743	01/28/19 14:38	TL1	TAL SEA
Total/NA	Prep	3510C			293660	01/25/19 09:01	DCV	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	293750	01/28/19 15:00	ERZ	TAL SEA

Client Sample ID: MFG-2

Lab Sample ID: 580-83485-2

Date Collected: 01/24/19 10:05

Matrix: Water

Date Received: 01/24/19 11:03

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			293660	01/25/19 09:01	DCV	TAL SEA
Total/NA	Cleanup	3630C			293718	01/25/19 16:44	DCV	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	293743	01/28/19 15:00	TL1	TAL SEA
Total/NA	Prep	3510C			293660	01/25/19 09:01	DCV	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	293750	01/28/19 15:22	ERZ	TAL SEA

Client Sample ID: Dup

Lab Sample ID: 580-83485-3

Date Collected: 01/24/19 00:00

Matrix: Water

Date Received: 01/24/19 11:03

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3510C			293660	01/25/19 09:01	DCV	TAL SEA
Total/NA	Cleanup	3630C			293718	01/25/19 16:44	DCV	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	293743	01/28/19 15:22	TL1	TAL SEA
Total/NA	Prep	3510C			293660	01/25/19 09:01	DCV	TAL SEA
Total/NA	Analysis	NWTPH-Dx		1	293750	01/28/19 15:44	ERZ	TAL SEA

Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-83485-1

Laboratory: TestAmerica Seattle

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Alaska (UST)	State Program	10	17-024	02-28-19
ANAB	DoD ELAP		L2236	01-19-22
ANAB	ISO/IEC 17025		L2236	01-19-22
California	State Program	9	2901	11-05-19
Montana (UST)	State Program	8	N/A	04-30-20
Nevada	State Program	9	WA000502019-1	07-31-19
Oregon	NELAP	10	WA100007	11-05-19
US Fish & Wildlife	Federal		LE058448-0	07-31-19
USDA	Federal		P330-14-00126	02-10-20
Washington	State Program	10	C553	02-17-19

Sample Summary

Client: Tetra Tech, Inc.
Project/Site: Darling-Tacoma

TestAmerica Job ID: 580-83485-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-83485-1	MFG1	Water	01/24/19 09:05	01/24/19 11:03
580-83485-2	MFG-2	Water	01/24/19 10:05	01/24/19 11:03
580-83485-3	Dup	Water	01/24/19 00:00	01/24/19 11:03

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.testamericainc.com

☐ Rush
☐ Short Hold

Chain of Custody Record

Client: Tetra Tech, Inc
Client Contact: Natalie Morrow
Date: 1/24/19
Chain of Custody Number: 35098

Address: 2525 Palmer Street, Suite 2
City: Missoula | State: MT | Zip Code: 59808
Telephone Number (Area Code)/Fax Number: 406-543-3045
Lab Number: 580/13777
Page 1 of 1

Sampler: Natalie Morrow
Lab Contact: Sheri Cruz

Project Name and Location (State): Darling - Tacoma
Billing Contact:

Contract/Purchase Order/Quote No.:

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: NWTPH-Dx w/ Silica Gel	NWTPH w/o Silica Gel
MFG1	1/24/19	0905		X									X	X
MFG-2	1/24/19	1005		X									X	X
Dup	1/24/19	—		X									X	X

Special Instructions/ Conditions of Receipt

Loc: 580
83485

580-83485 Chain of Custody

Therm. ID: IR5 Cor: 13.1 ° Unc: 13.1 °
Cooler Dsc: Lg Red
Packing: bub
Cust. Seal: Yes ___ No X
Blue Ice, Wet, Dry, None
FedEx: ___
UPS: ___
Lab Cour: ___
Other: Cido

Cooler: ☑ Yes ☐ No Cooler Temp: ___
Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown
Sample Disposal: ☐ Return To Client ☑ Disposal By Lab ☐ Archive For ___ Months
(A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days)
☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☒ Other Standard

QC Requirements (Specify)

	Date	Time
1. Relinquished By Sign/Print: Natalie Morrow	1/24/19	1103
2. Relinquished By Sign/Print:		
3. Relinquished By Sign/Print:		

	Date	Time
1. Received By Sign/Print: Blankinship	1/24/19	1103
2. Received By Sign/Print:		
3. Received By Sign/Print:		

Comments

DISTRIBUTION: WHITE – Stays with the Samples; CANARY – Returned to Client with Report; PINK – Field Copy

Login Sample Receipt Checklist

Client: Tetra Tech, Inc.

Job Number: 580-83485-1

Login Number: 83485
List Number: 1
Creator: Hobbs, Kenneth F

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

DATA VALIDATION REPORT

1. INTRODUCTION

General Project Information			
Project Name:	Darling-Tacoma	**Date Validated:**	4/3/2019
Tetra Tech Project Number:	117-8090002	**Data Validated By:**	N.Morrow
Sample Start and End Dates:	4/3/19	**Laboratory Name:**	TestAmerica
Sample Matrix:	Groundwater	**Laboratory Project ID#:**	580-83485-1
Analytical Parameters:	NWTPH-Dx, NWTPH-Dx with Silica Gel Treatment (Method 3630C) and Extractable Petroleum Hydrocarbon fractionation		
Name & Date of Approved SAP, QAPP, Work Plan, Etc.	Site Investigation Work Plan, Darling-Tacoma Facility, Darling Delaware Co., Inc. (aka Puget Sound By-Products) Facility, 2041 Marc Avenue, Tacoma, WA. Facility No. 25455514, Cleanup Site No. 8475, VCP Project No. SW1317. Dated March 22, 2017		

2. LABORATORY METHODS AND SAMPLE HANDLING

Validation Criteria Used:

X USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. Dated August 2014.

X Site Investigation Work Plan, Darling-Tacoma Facility, Darling Delaware Co., Inc. (aka Puget Sound By-Products) Facility, 2041 Marc Avenue, Tacoma, WA. Facility No. 25455514, Cleanup Site No. 8475, VCP Project No. SW1317. Dated March 22, 2017

3. LIST OF SAMPLES VALIDATED IN THIS REPORT

Validated Samples		
Field Sample ID#	**Laboratory Sample ID#**	**Sample Type** (Natural, Duplicate, Field Blank, Etc.)
MFG-1	580-83485-1	Natural
MFG-2	580-83485-2	Natural
Duplicate	580-83485-4	Duplicate

4. DATA QUALIFIERS

Data Evaluation Qualifiers	
Data Qualifier	**Qualifier Description** *(as per USEPA 2008 CLP Guidelines)*
U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
J	The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
R	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

Laboratory Data Qualifiers	
Laboratory Qualifier	**Qualifier Description in Laboratory Report**
J	Estimated value. The analyte was present but less than the reporting limit.
S	Spike recovery outside of advisory limits.

5. LABORATORY NARRATIVE, CHAIN-OF-CUSTODY, AND SAMPLE RECEIPT CHECKLIST

Was a laboratory narrative provided and were there any non-conformance issues with the analytical data? *Identify and discuss.*

The laboratory noted the following:

- The samples were received in good condition and properly preserved. The cooler temperature was 13.1ºC. *(Note: The samples were collected on 1/24/19 at 0905 and 1005. The samples were immediately placed in a cooler with wet ice contained in re-sealable bags. The samples were immediately hand delivered to the laboratory at 1103 following completion of work at the site. As such, the cooler temperature is above the 0 to 6ºC range as the cooler and samples were in the process of cooling to that range when they were received by the laboratory.)*
- Method(s) NWTPH-Dx: The following CCV standard associated with 580-293750 recovered outside acceptance criteria for %D for surrogate o-Terphenyl. Since all surrogates were within %rec acceptance criteria; the data has been reported. (CCVRT 580-293750/3)
- Method(s) NWTPH-Dx: The peak profile present in this sample MFG1 (580-83485-1) is atypical of a hydrocarbon pattern and consists of discrete peaks.

Other narrative notes from the laboratory are provided in the applicable sections throughout this report.

Were sample Chain-of-Custody (CoC) forms complete? *Describe.*

Yes. All required areas of the CoC were completed and the forms signed by the laboratory upon transfer of the samples into laboratory custody.

Were the requested analytical methods in compliance with project requirements (i.e., QAPP, SAP, etc.)? *Explain and, if not in compliance, discuss how this affects the data.*

Yes. As samples were analyzed for the methods specified in the SAP.

Were samples received in good condition within method specified requirements? *Explain any exceptions and how sample conditions may affect the results.*

Yes. All samples were received in good condition and properly preserved (see above) as per method requirements.

6. LABORATORY COMPLIANCE WITH PROJECT REQUIREMENTS

Were samples analyzed within method specified or technical holding times? *Explain any exceptions and how this may affect the results.*

Yes. All samples were analyzed within the holding times specified by the analytical methods.

Do the laboratory reports include all constituents requested to be analyzed on the CoC or under the QAPP, SAP, or other applicable document? *Explain.*

Yes. The laboratory analyzed all samples for NWTPH-EPH, and NWTPH-Dx with and without silica gel treatment.

Were reported units appropriate for the associated sample matrix/matrices and method(s) of analyses? *Explain.*

Yes. All results were reported in micrograms per liter (µg/L) which is appropriate for these results and for comparison with water quality standards.

Were detection limits reported by the laboratory in accordance with the project requirements? *Discuss.*

No dilutions were required. All reporting limits and the method detection limit were below the required state groundwater standards.

Detection Limits Above Project Requirements					
Analytical Parameter	**Field Sample ID#**	**Laboratory Sample ID#**	**Laboratory Reporting Limit (µg/L)**	**Water Quality Standard (µg/L)**	**Standard Exceeded**
--	--	--	--	--	None

Note: Laboratory reported estimated concentrations for constituents detected between the method detection limit and the laboratory reporting limit (limit of quantitation).
RSL – EPA Regional Screening Level for tap water.
n/a – not applicable.

Results qualified by the laboratory based on the laboratory reporting limit.
None of the data were qualified as estimated (J) by the laboratory due to the analyte being present but was detected at concentrations between the laboratory reporting limit (laboratory's limit of quantitation) and the method detection limit. All results were either non-detect at the associated MDL and/or were at concentrations above the laboratory's reporting limit.

QUALIFIED RESULTS BASED CONCENTRATIONS DETECTED BETWEEN THE METHOD DECTECTION LIMIT AND THE LABORATORY REPORTING LIMIT					
Analyte	**Natural Sample ID#**	**Laboratory ID#**	**Laboratory Result (µg/L)**	**Qualifier**	**Reason for Qualification**
None					

7. LABORATORY QA/QC

7a. Continuing Calibration Verification (CCV) Standard

Was there indication from the laboratory that the initial or CCV results were within acceptable limits? *Explain.*
The laboratory stated the following:
Method(s) NWTPH-Dx: The following CCV standard associated with 580-293750 recovered outside acceptance criteria for %D for surrogate o-Terphenyl. Since all surrogates were within %rec acceptance criteria; the data has been reported. (CCVRT 580-293750/3). No qualification is required.

7b. Laboratory Control Samples (LCSs)

Was the reference material used for the laboratory control standard (LCSs) the correct matrix and concentration? *Explain and include a discussion on how this affects the data.*
Yes. The QA/QC Summary Report presented the LCS data. The sample was of the correct matrix, aqueous.

Was the total number of LCSs analyzed equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*
Yes. At least one LCSs was analyzed for each analytical method.

Were LCSs prepared the same way as the associated samples? *Explain and include a discussion of how this affects the data.*
Yes. The LCSs were aqueous and were prepared according to the analytical method. No issues with the LCS were noted by the laboratory.

Were LCS/LCSD percent recoveries and LCS/LCSD RPDs within laboratory QC limits? *Explain and include discussion on how this affects the data.*
All LCS % recoveries were reported as being within the specified control limits.

7c. Laboratory Blank Samples

Was the total number of method blank samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*
Yes. At least one method blank was analyzed per analytical method.

Were laboratory blank samples free of analyte contamination? *Explain.*
Yes. All method blanks were free of contamination.

7d. Matrix Spike / Matrix Spike Duplicates

What project samples were used to prepare the MS and MSD samples?

The laboratory did not run MS/MSDs as they set the project up as Level 2, instead of Level 3, in their system. MS/MSDs were not required to be analyzed. The data was not affected. The LCS was used to evaluate precision and accuracy in addition to precision through analysis of a field duplicate.

Was the total number of MS samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*

N/A

Were MS percent recoveries and all MS/MSD relative percent differences (RPDs) within data validation or laboratory QC limits? *Explain and include a discussion on how this affects the data.*

N/A

7e. Laboratory Duplicates

Were laboratory duplicate RPD values within laboratory-specified limits? *Explain and include discussion of how this affects the data.*

No laboratory duplicates were analyzed other than those included in the laboratory control sample. All laboratory control sample duplicate RPDs were within control limits.

7f. Surrogates

Were surrogate recoveries within laboratory QC limits? *Explain and include discussion on how this affects the data.*
All surrogate recoveries were within the specified QC limits. No data was qualified.

8. FIELD QA/QC

8a. Trip and Field Blanks

Were the number of equipment, trip, or field blanks collected equal to at least 10% of the total number of samples, or as required by the project requirements, QAPP, or SAP? *Explain and include how this affects the data.*
All sample equipment was dedicated and disposable. Blanks were not collected. This does not affect the data.

Were the trip blank, field blank, and/or equipment blank samples free of analyte contamination? *Explain and include discussion of how this affects the data.*
N/A

8b. Field Duplicates

Were the field duplicates collected as required by the project requirements, QAPP or SAP? Include a table of duplicate samples. *Explain and include discussion of how this affects the data.*

Dup was a duplicate of natural sample MFG-2.

Were field duplicate RPD values within data validation QC limits? *Explain and include discuss of how this affects the data.*

DUPLICATE RPD RESULTS			
Analyte	**MFG-2** *Natural Sample Result*	**Duplicate** *Duplicate Result*	**RPD (0-30%)**
#2 Diesel (C10-C24)	0.51	0.54	5.7
Motor Oil (>C24-C36)	0.43	0.49	13
#2 Diesel (C10-C24) SGT	<0.065	<0.065	-
Motor Oil (>C24-C36) SGT	<0.096	<0.096	-

All RPDs were within control limits. No qualifications were required.

9. OTHER

Did DEQ collect split samples? If so, explain how those results compare to the natural sample.

No, DEQ did not collect split samples.

Other comments or observations.
None.

10. SUMMARY OF QUALIFIED DATA

The following presents a summary of all data qualified during this evaluation and reason for qualification.

SUMMARY OF QUALIFIED DATA					
Analyte	**Field Sample ID#**	**Laboratory ID#**	**Laboratory Result (µg/L)**	**Qualifier**	**Reason for Qualification**
None					

11. ACCEPTABILITY AND USABILITY OF THE DATA

Precision
The data are considered precise as all LCS/LCSD and duplicate results were within control limits.

Accuracy
The data are considered accurate as no data required qualification to due sample handling, preservation or preparation; analytical techniques; laboratory blanks; LCS/LCS recoveries, or surrogate recoveries.

Representativeness
The data are considered representative as the sample locations were selected for a specific purpose to meet the DQOs specified in the SAP. The samples are representative of other samples collected, handled, and preserved in the same manner under similar conditions, and analyzed using the same techniques and methods.

Completeness

The data are considered 100% complete as the data was collected per the SAP and all data are considered useable.

Comparability

The sample data are comparable to other sample data collected with similar field methods, quality assurance/quality control measures, and the same analytical methods.

APPENDIX E – MANN-KENDALL STATISTICAL ANALYSIS & RISK ASSESSMENT CALCULATIONS

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 04/08/19
Site Name: Darling
Sample Name: SB4

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6	0	0.00%
AL_EC >6-8	0	0.00%
AL_EC >8-10	49	1.58%
AL_EC >10-12	57	1.84%
AL_EC >12-16	80	2.59%
AL_EC >16-21	310	10.02%
AL_EC >21-34	0	0.00%
AR_EC >8-10	0	0.00%
AR_EC >10-12	85	2.75%
AR_EC >12-16	0	0.00%
AR_EC >16-21	510	16.49%
AR_EC >21-34	2000	64.66%
Benzene	0	0.00%
Toluene	0	0.00%
Ethylbenzene	0	0.00%
Total Xylenes	0	0.00%
Naphthalene		0.00%
1-Methyl Naphthalene		0.00%
2-Methyl Naphthalene		0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	0.27	0.01%
Benzo(b)fluoranthene	0.64	0.02%
Benzo(k)fluoranthene	0.18	0.01%
Benzo(a)pyrene	0.51	0.02%
Chrysene	0.34	0.01%
Dibenz(a,h)anthracene	0.01	0.00%
Indeno(1,2,3-cd)pyrene	0.39	0.01%
Sum	3093.34	100.00%

Notes for Data Entry | Set Default Hydrogeology

Clear All Soil Concentration Data Entry Cells

Restore All Soil Concentration Data cleared previously

REMARK:
Enter site-specific information here……..

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	500	ug/L

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date:
Site Name:
Sample Name:
Measured Soil TPH Concentration, mg/kg:

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B				
	Method C				
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection				
	Target TPH GW Conc. @ 500 ug/L		NA	NA	

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	**484.14**	**19,498.07**
Most Stringent Criterion	**Risk of cPAHs mixture= 1E-6**	**Total Risk=1E-5**

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	2.27E+03	4.69E-06	1.00E+00	*NO*	2.81E+04	1.44E-05	1.00E+00
Total Risk=1E-5	*NO*	4.84E+03	1.00E-05	2.13E+00	YES	1.95E+04	1.00E-05	6.94E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	4.84E+02	1.00E-06	2.13E-01				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	
Protective Ground Water Concentration, ug/L	
Protective Soil Concentration, mg/kg	

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1					
Total Risk = 1E-5					
Total Risk = 1E-6					
Risk of cPAHs mixture= 1E-5					
Benzene MCL = 5 ug/L					
MTBE = 20 ug/L					

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L				

SOIL RISK CALCULATIONS - DARLING-TACOMA

TPH Screening Levels Based on PAH concentrations (as calcuted by MTCA calculator)

	TPH Screening Level - Method B	TPH Screening Level Industrial Method C
Based on Carcinogenic Risk of 1E-5	484.14	19,498.07
Based on Noncarcinogenic Hazard	2270	28100

Concentrations of TPH

Analytical Parameter	*MTCA Method C Site-Specific Soil Cleanup Level	Analytical Results (mg/kg)			
		SB-1 (4.5-5')	SB-2 (6.5-7.5')	SB-3 (6.5-7.5')	SB-4 (6.5-7.5')
Total Petroleum Hydrocarbons – Without SGT					
Diesel Range (C10-C24)	19,498	190	1,400	1,400	**3,300**
Motor Oil Range (>C24-C-36)	19,498	780	1,200	**3,800**	**9,700**
Total TPH without SGT		*970*	*2,600*	*5,200*	*13,000*
	Risk:	*4.97E-07*	*1.33E-06*	*2.67E-06*	*6.67E-06*
	Hazard	*3.45E-02*	*9.25E-02*	*1.85E-01*	*4.63E-01*
Total Petroleum Hydrocarbons – With SGT					
Diesel Range (C10-C24)	19,498	160	1,300	1,100	**2,400**
Motor Oil Range (>C24-C36)	19,498	670	890	**3,400**	**9,500**
Total TPH with SGT		*830*	*2,190*	*4,500*	*11,900*
	Risk:	*4.26E-07*	*1.12E-06*	*2.31E-06*	*6.10E-06*
	Hazard	*2.95E-02*	*7.79E-02*	*1.60E-01*	*4.23E-01*

Inputs:

Extractable Hydrocarbon Range	Concentration from MFG-4 (8-8.5')
Benzo(a)anthracene	0.27 mg/kg
Benzo(a)pyrene	0.51 mg/kg
Benzo(b)fluoranthene	0.64 mg/kg
Benzo(k)fluoranthene	0.18 mg/kg
Chrysene	0.34 mg/kg
Dibenzo(a,h)anthracene	<0.2 mg/kg (entered as 0.1 mg/kg)
Indeno(1,2,3-c,d)pyrene	0.39 mg/kg

Extractable Hydrocarbon Range	Concentration from SB-4 (6.5-7.5')
Aliphatic fraction C8-C10	49 mg/kg
Aliphatic fraction C10-C12	57 mg/kg
Aliphatic fraction C12-C16	80 mg/kg
Aliphatic fraction C16-C21	310 mg/kg
Aromatic Fraction C10-C12	85 mg/kg
Aromatic Fraction C16-C21	510 mg/kg
Aromatic Fraction C21-C36	2,000 mg/kg

GROUNDWATER RISK CALCULATIONS - DARLING-TACOMA

Analytical Parameter	MTCA Method C Site-Specific Groundwater Cleanup Level (µg/L)	Analytical Results				Nondetect calculation	Hazard Quotient Calculated Using Adjusted Water Screening value	
		MFG-1		MFG-2				
		Result (µg/L)	HQ	Result (µg/L)	HQ			
Total Petroleum Hydrocarbons – Without SGT								
Diesel Range (C10-C24)	500[b] / 74,000[c]	**800**	**1.6**	**510**	**1.02**		MFG-1	MFG-2
Motor Oil Range (>C24-C-36)	500[b] / 74,000[c]	550	1.1	430	0.86			
Total TPH without SGT		*1,305*	*2.7*	*940*	*1.88*		0.017622863	0.012693863
Total Petroleum Hydrocarbons – With SGT								
Diesel Range (C10-C24)	500[b] / 74,000[c]	120	0.24	<65	<0.065[a]	0.065		
Motor Oil Range (>C24-C36)	500[b] / 74,000[c]	<96	<0.096[a]	<96	<0.096[a]	0.096		
Total TPH with SGT		*120*	*0.24*	*<96*	*<0.16*[a]	0.161	0.001620493	0.000648197

Bold – Exceeds MTCA Method A groundwater cleanup level

a – Based on ½ the reported detection limit (DL). Calculated as (1/2DL/500)*1E-6

b - Based on 2 liters per day (L/day) ingestion rate for drinking water intake.

c – Based on 53 milliliters per day (mL/d) or 0.053 L/day for incidental ingestion.

Screening value adjusted for incidental ingestion

Screening values based on daily drinking water in take of	2	L/day
Incidental water ingestion while swimming	0.053	L/day (53 mL/day)
	37.7	Drinking water intake / Incidental Water Ingestion While Swimming (Note: used to adjust water screening value)
Adjusted water screening value	**74051.53**	µg/L (note: rounded down to 74,000[c] µg/L)
Construction worker exposure:	93	days/year (high end exposure frequency)

ALL WELLS - MANN-KENDALL ANALYSIS - SUMMARY

	Last Sample Date	Diesel Range (C10-24)	Heavy Oil Range / Motor Oil Range (>C24-C36)	Mineral Oil Range (<C10)	Number of Observatons for each Concentration
MFG-1	1/24/2019	0.0092	0.0566	0.0635	10, 10, 8
MFG-2	1/24/2019	0.0042	0.0880	0.1735	10, 10, 8
MFG-3	6/8/2004	0.0248	0.1346	0.0635	8, 8, 8
MFG-4	6/8/2004	0.0094	0.1735	0.0354	8, 8, 8

MFG-1 - MANN-KENDALL ANALYSIS - SUMMARY

	Water Elevation (ft)	Diesel Range (C10-24)	Heavy Oil Range / Motor Oil Range (>C24-C36)	Mineral Oil Range (<C10)
2/13/2002	10.97	**3,100**	**730**	**3,300**
6/19/2002	9.18	**4,160**	**763**	**2,390**
9/26/2002	7.94	**3,130**	**612**	**1,970**
12/19/2002	8.81	**1,350**	**514**	**949**
9/3/2003	8.00	**2,870**	500	**2,300**
12/9/2003	10.52	**1,350**	500	**976**
3/4/2004	10.77	**3,120**	**666**	**2,100**
6/8/2004	9.21	**1,270**	500	**852**
7/20/2017	8.99	**990**	**450**	
1/24/2019	10.54	**800**	**550**	
P-value		0.00920683	0.05658968	0.06348653
		Accept Alternative	Accept Null	Accept Null

MFG-1 - MANN-KENDALL ANALYSIS - DIESEL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:32:09 AM / End time: 3/7/2019 at 10:32:10 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-1 / Range = 'MFG-1'!$C$2:$C$11 / 10 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-1 / Range = 'MFG-1'!$A$2:$A$11 / 10 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	10	0	10	800.000	4160.000	2214.000	1180.576

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.674
S	-30.000
Var(S)	124.000
p-value (Two-tailed)	0.009
alpha	0.05

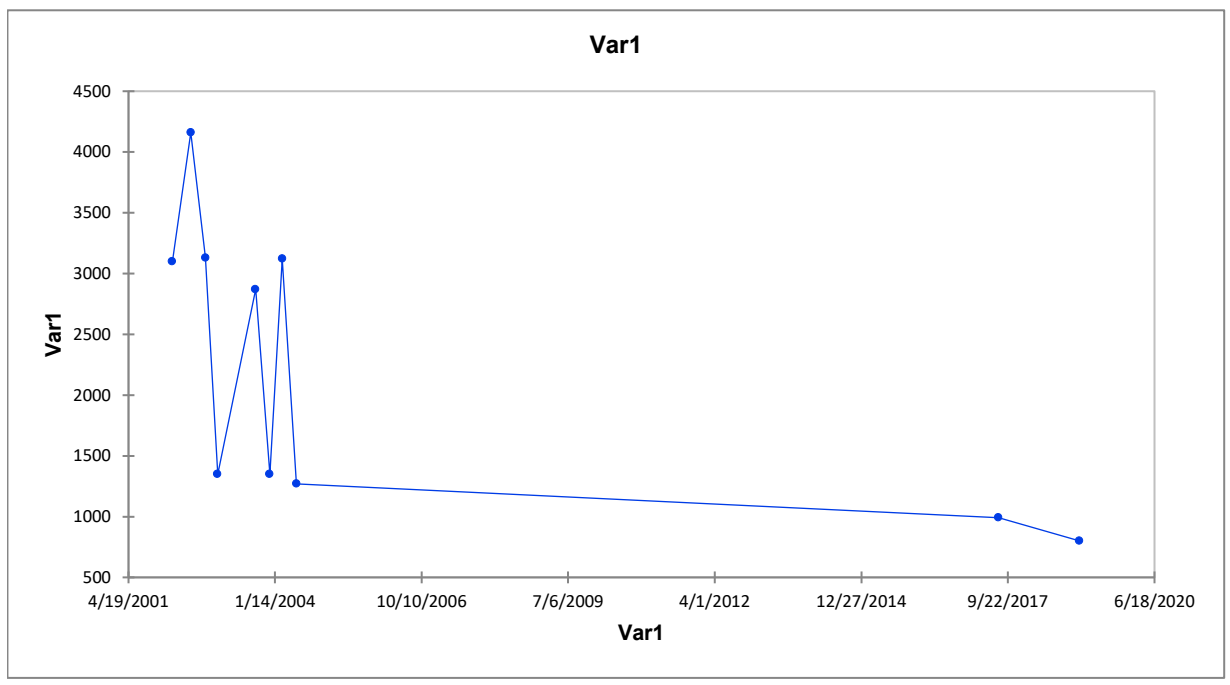
The p-value is computed using an exact method.

Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series
As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H0, and accept the alternative hypothesis Ha.
The risk to reject the null hypothesis H0 while it is true is lower than 0.92%.

The continuity correction has been applied.

Ties have been detected in the data and the appropriate corrections have been applied.

Sen's slope:	-263.75
Confidence interval:	] -285.286 , -260.841 [,-2.698 [



MFG-1 - MANN-KENDALL ANALYSIS - HEAVY OIL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:34:10 AM / End time: 3/7/2019 at 10:34:10 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-1 / Range = 'MFG-1'!$D$2:$D$11 / 10 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-1 / Range = 'MFG-1'!$A$2:$A$11 / 10 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	10	0	10	450.000	763.000	578.500	108.394

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.506
S	-22.000
Var(S)	121.333
p-value (Two-tailed)	0.057
alpha	0.05

The p-value is computed using an exact method.

Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series

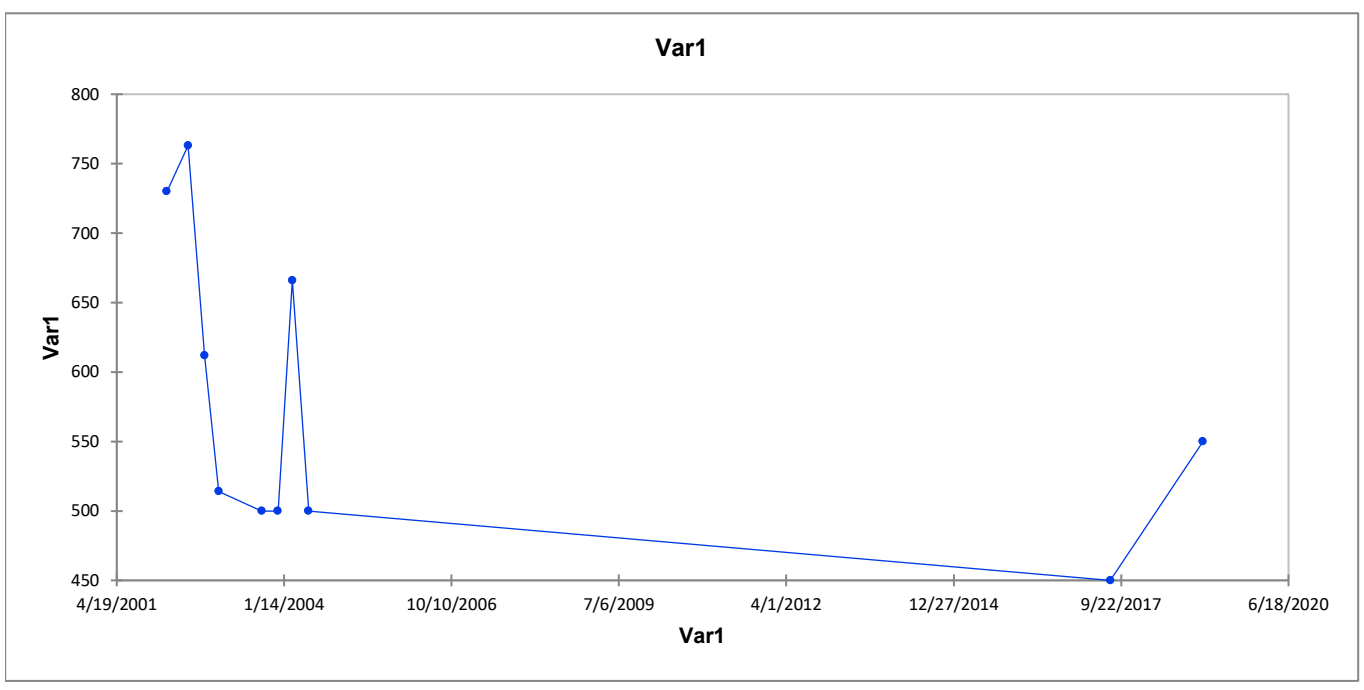
As the computed p-value is greater than the significance level alpha=0.05, one cannot reject the null hypothesis H0.

The risk to reject the null hypothesis H0 while it is true is 5.66%.

The continuity correction has been applied.

Ties have been detected in the data and the appropriate corrections have been applied.

Sen's slope:	-20
Confidence interval:	] -22.823 , -19.126 [,-6.667 [



MFG-1 - MANN-KENDALL ANALYSIS - MINERAL OIL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:36:36 AM / End time: 3/7/2019 at 10:36:36 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-1 / Range = 'MFG-1'!$E$2:$E$9 / 8 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-1 / Range = 'MFG-1'!$A$2:$A$9 / 8 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	8	0	8	852.000	3300.000	1854.625	865.614

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.571
S	-16.000
Var(S)	65.333
p-value (Two-tailed)	0.063
alpha	0.05

The p-value is computed using an exact method.

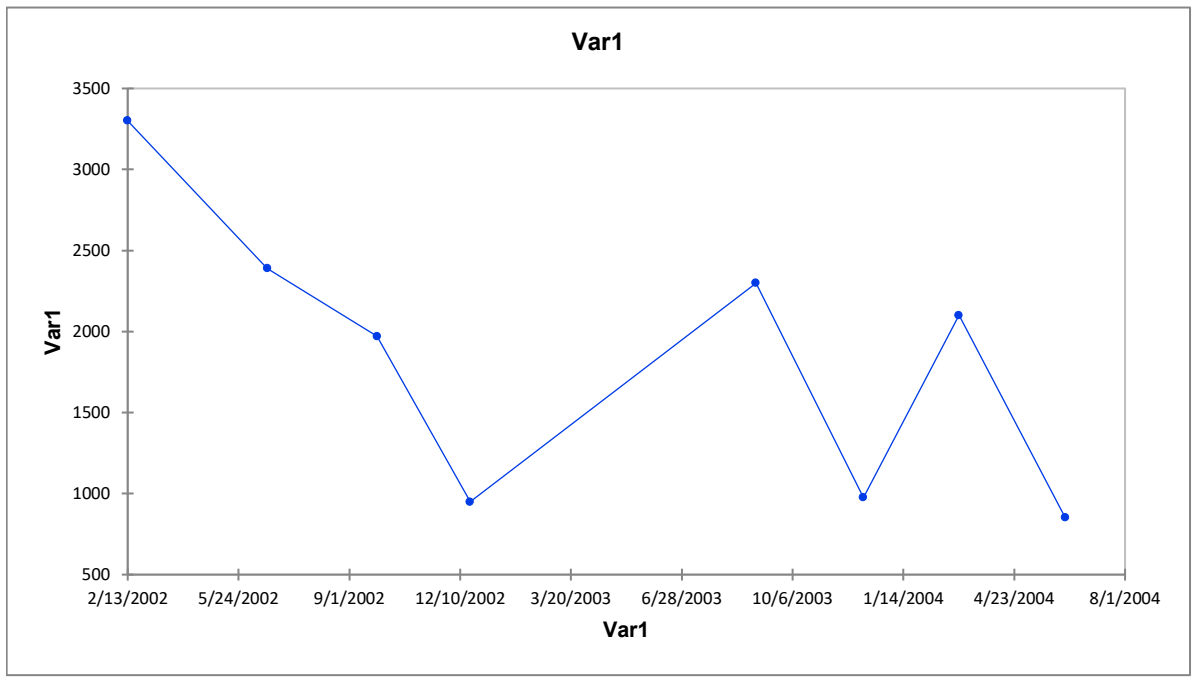
Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series

As the computed p-value is greater than the significance level alpha=0.05, one cannot reject the null hypothesis H0.

The risk to reject the null hypothesis H0 while it is true is 6.35%.

The continuity correction has been applied.

Sen's slope:	-253.167
Confidence interval:	] -269.458 , -245.380 [,-0.000 [



MFG-2 - MANN-KENDALL ANALYSIS - SUMMARY

	Water Elevation (ft)	Diesel Range (C10-24)	Heavy Oil Range / Motor Oil Range (>C24-C36)	Mineral Oil Range (<C10)
2/13/2002	10.98	**2,300**	500	**2,500**
6/19/2002	9.17	**2,920**	**992**	**1,750**
9/26/2002	7.94	**1,710**	**634**	**1,120**
12/19/2002	8.80	**1,630**	**620**	**1,160**
9/3/2003	7.99	**2,050**	**1,110**	**1,790**
12/9/2003	10.50	**1,430**	**897**	**1,130**
3/4/2004	10.74	**2,000**	**607**	**1,390**
6/8/2004	9.17	**837**	500	**615**
7/20/2017	8.81	**600**	**290**	---
1/24/2019	10.39	**510**	**430**	--
P-value		0.00420755	0.08796147	0.17354622
		Accept Alternative	Accept Null	Accept Null

MFG-2 - MANN-KENDALL ANALYSIS - DIESEL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:45:09 AM / End time: 3/7/2019 at 10:45:10 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-2 / Range = 'MFG-2'!$C$2:$C$11 / 10 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-2 / Range = 'MFG-2'!$A$2:$A$11 / 10 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	10	0	10	510.000	2920.000	1598.700	775.102

Mann-Kendall trend test / Two-tailed test (Var1):

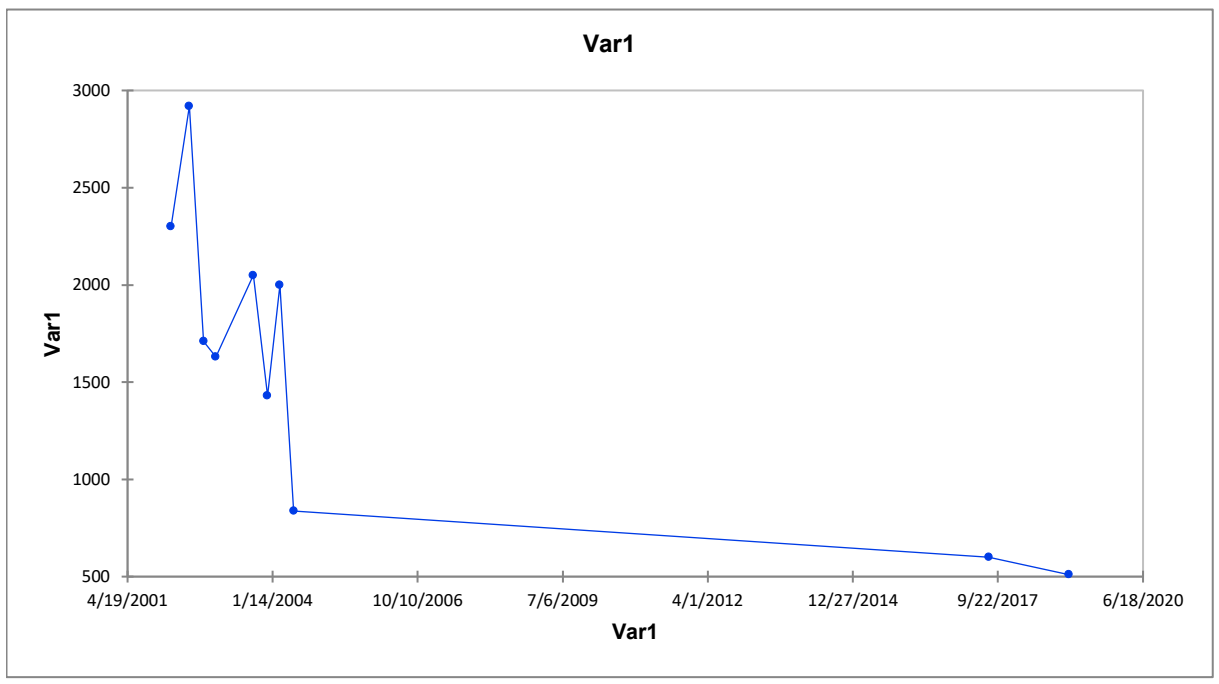
Kendall's tau	-0.733
S	-33.000
Var(S)	125.000
p-value (Two-tailed)	0.004
alpha	0.05

The p-value is computed using an exact method.

Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series
As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H0, and accept the alternative hypothesis Ha.
The risk to reject the null hypothesis H0 while it is true is lower than 0.42%.

The continuity correction has been applied.

Sen's slope:	-206
Confidence interval:	] -209.350 , -198.825 [,-0.000 [



MFG-2 - MANN-KENDALL ANALYSIS - HEAVY OIL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:46:25 AM / End time: 3/7/2019 at 10:46:25 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-2 / Range = 'MFG-2'!d2:d11 / 10 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-2 / Range = 'MFG-2'!$A$2:$A$11 / 10 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	10	0	10	290.000	1110.000	658.000	261.393

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.449
S	-20.000
Var(S)	124.000
p-value (Two-tailed)	0.088
alpha	0.05

The p-value is computed using an exact method.

Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series

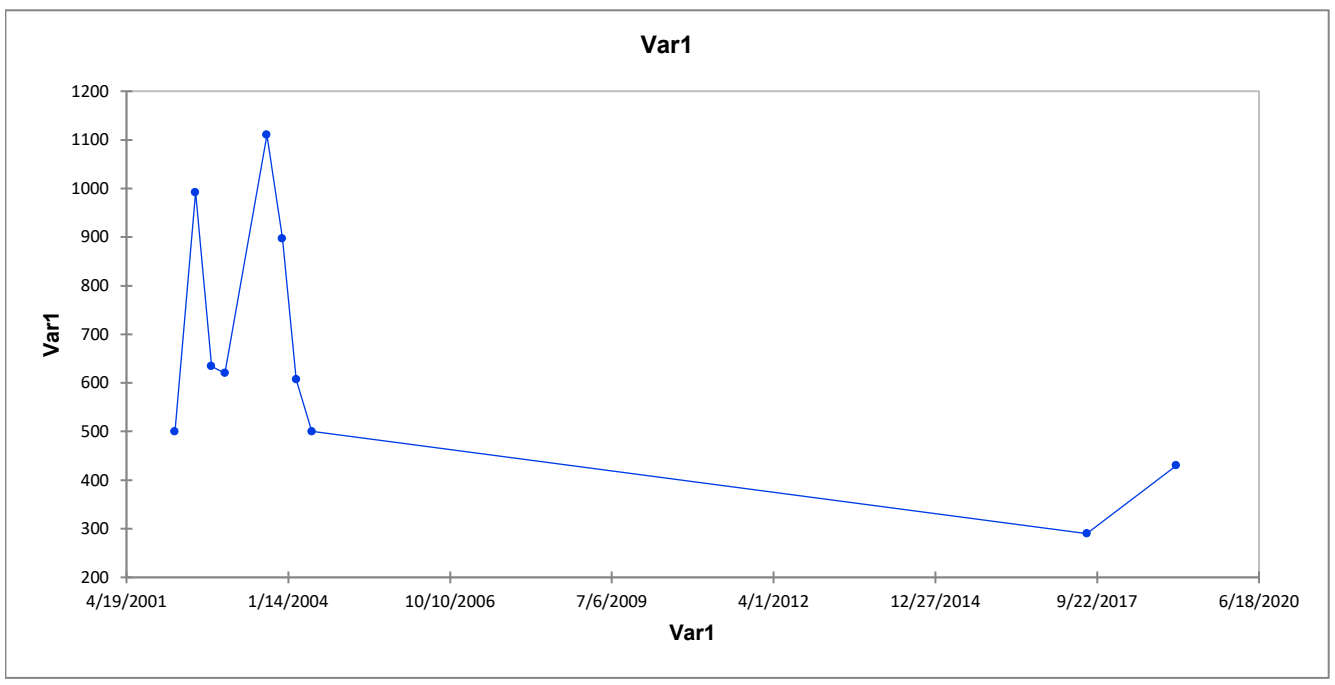
As the computed p-value is greater than the significance level alpha=0.05, one cannot reject the null hypothesis H0.

The risk to reject the null hypothesis H0 while it is true is 8.80%.

The continuity correction has been applied.

Ties have been detected in the data and the appropriate corrections have been applied.

Sen's slope:	-31.667
Confidence interval:	] -37.233 , -29.914 [,-2.857 [



MFG-2 - MANN-KENDALL ANALYSIS - MINERAL OIL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:48:02 AM / End time: 3/7/2019 at 10:48:02 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-2 / Range = 'MFG-2'!e2:e9 / 8 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-2 / Range = 'MFG-2'!$A$2:$A$9 / 8 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	8	0	8	615.000	2500.000	1431.875	573.423

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.429
S	-12.000
Var(S)	65.333
p-value (Two-tailed)	0.174
alpha	0.05

The p-value is computed using an exact method.

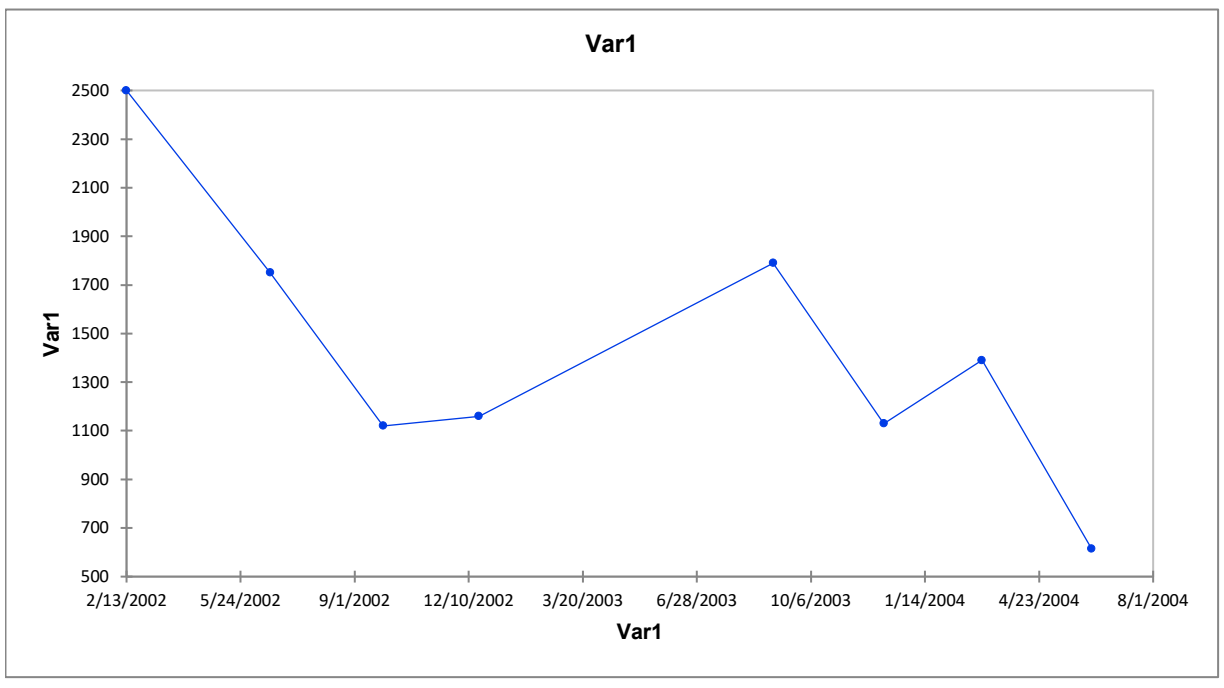
Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series

As the computed p-value is greater than the significance level alpha=0.05, one cannot reject the null hypothesis H0.

The risk to reject the null hypothesis H0 while it is true is 17.35%.

The continuity correction has been applied.

Sen's slope:	-181.25
Confidence interval:	] -185.729 , -173.562 [,-5.000 [



MFG-3 - MANN-KENDALL ANALYSIS - SUMMARY

	Water Elevation (ft)	Diesel Range (C10-24)	Heavy Oil Range / Motor Oil Range (>C24-C36)	Mineral Oil Range (<C10)
2/13/2002	10.96	**6,100**	**1,100**	**7,300**
6/19/2002	9.19	**1,760**	**761**	**1,150**
9/26/2002	7.98	**1,270**	**636**	**904**
12/19/2002	8.81	**1,670**	**936**	**1,280**
9/3/2003	8.01	**1,090**	500	**976**
12/9/2003	10.54	**1,290**	**1,040**	**1,080**
3/4/2004	10.79	**1,150**	**562**	**834**
6/8/2004	9.03	**1,090**	500	**859**
P-value		0.02482189	0.13462527	0.06348653
		Accept Alternative	Accept Null	Accept Null

MFG-3 - MANN-KENDALL ANALYSIS - DIESEL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:53:34 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-3 / Range = 'MFG-3'!$C$2:$C$9 / 8 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-3 / Range = 'MFG-3'!$A$2:$A$9 / 8 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	8	0	8	1090.000	6100.000	1927.500	1705.041

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.691
S	-19.000
Var(S)	64.333
p-value (Two-tailed)	0.025
alpha	0.05

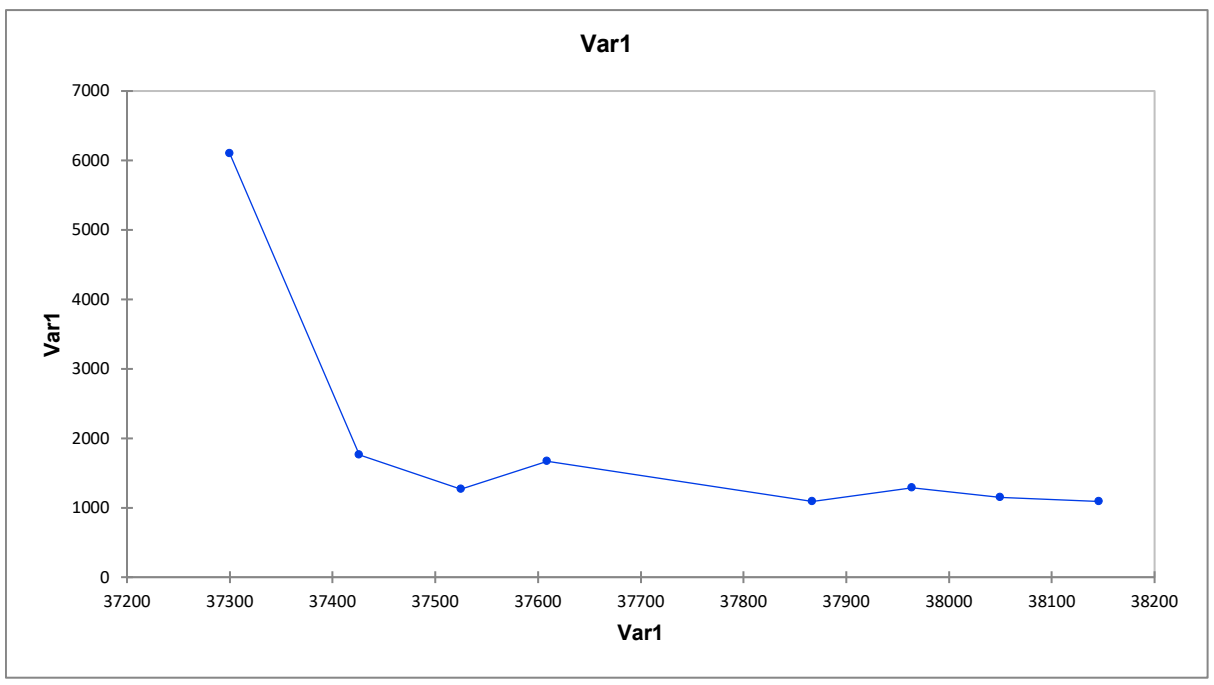
The p-value is computed using an exact method.

Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series
As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H0, and accept the alternative hypothesis Ha.
The risk to reject the null hypothesis H0 while it is true is lower than 2.48%.

The continuity correction has been applied.

Ties have been detected in the data and the appropriate corrections have been applied.

Sen's slope:	-131
Confidence interval:	] -140.875 , -121.212 [,-5.000 [



MFG-3 - MANN-KENDALL ANALYSIS - HEAVY OIL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:56:16 AM / End time: 3/7/2019 at 10:56:16 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-3 / Range = 'MFG-3'!d2:d9 / 8 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-3 / Range = 'MFG-3'!$A$2:$A$9 / 8 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	8	0	8	500.000	1100.000	754.375	243.341

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.473
S	-13.000
Var(S)	64.333
p-value (Two-tailed)	0.135
alpha	0.05

The p-value is computed using an exact method.

Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series

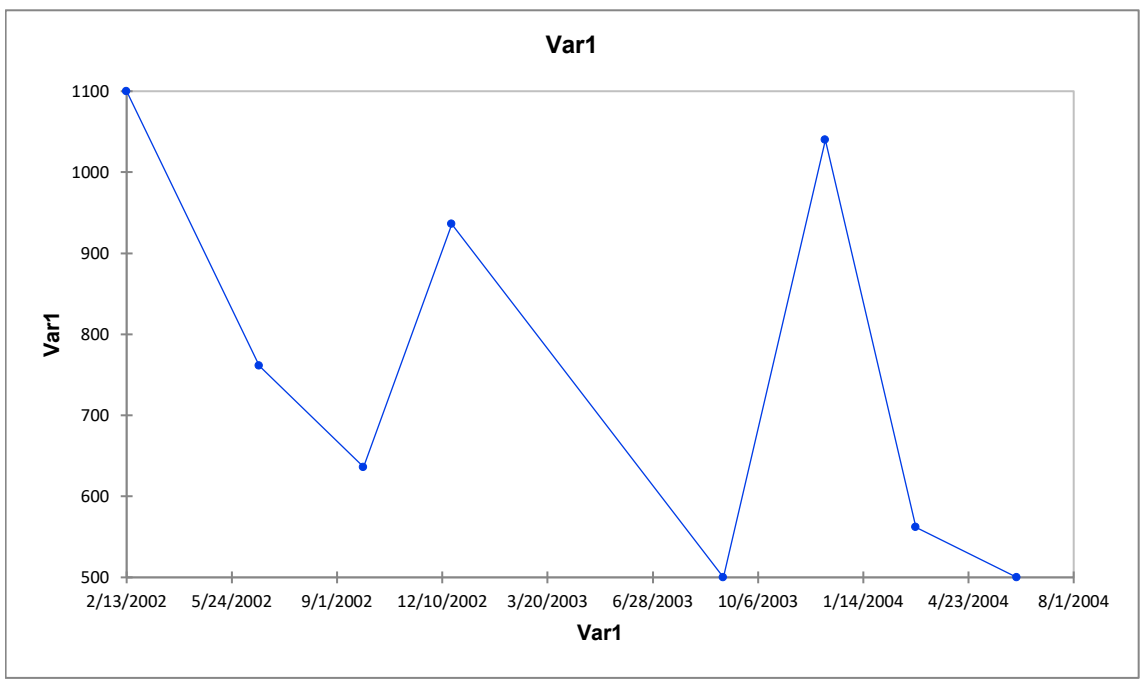
As the computed p-value is greater than the significance level alpha=0.05, one cannot reject the null hypothesis H0.

The risk to reject the null hypothesis H0 while it is true is 13.46%.

The continuity correction has been applied.

Ties have been detected in the data and the appropriate corrections have been applied.

Sen's slope:	-58.333
Confidence interval:	] -63.050 , -52.712 [,-5.000 [



MFG-3 - MANN-KENDALL ANALYSIS - MINERAL OIL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 10:57:08 AM / End time: 3/7/2019 at 10:59:22 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-3 / Range = 'MFG-3'!e2:e9 / 8 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-3 / Range = 'MFG-3'!$A$2:$A$9 / 8 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	8	0	8	834.000	7300.000	1797.875	2228.443

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.571
S	-16.000
Var(S)	65.333
p-value (Two-t	0.063
alpha	0.05

The p-value is computed using an exact method.

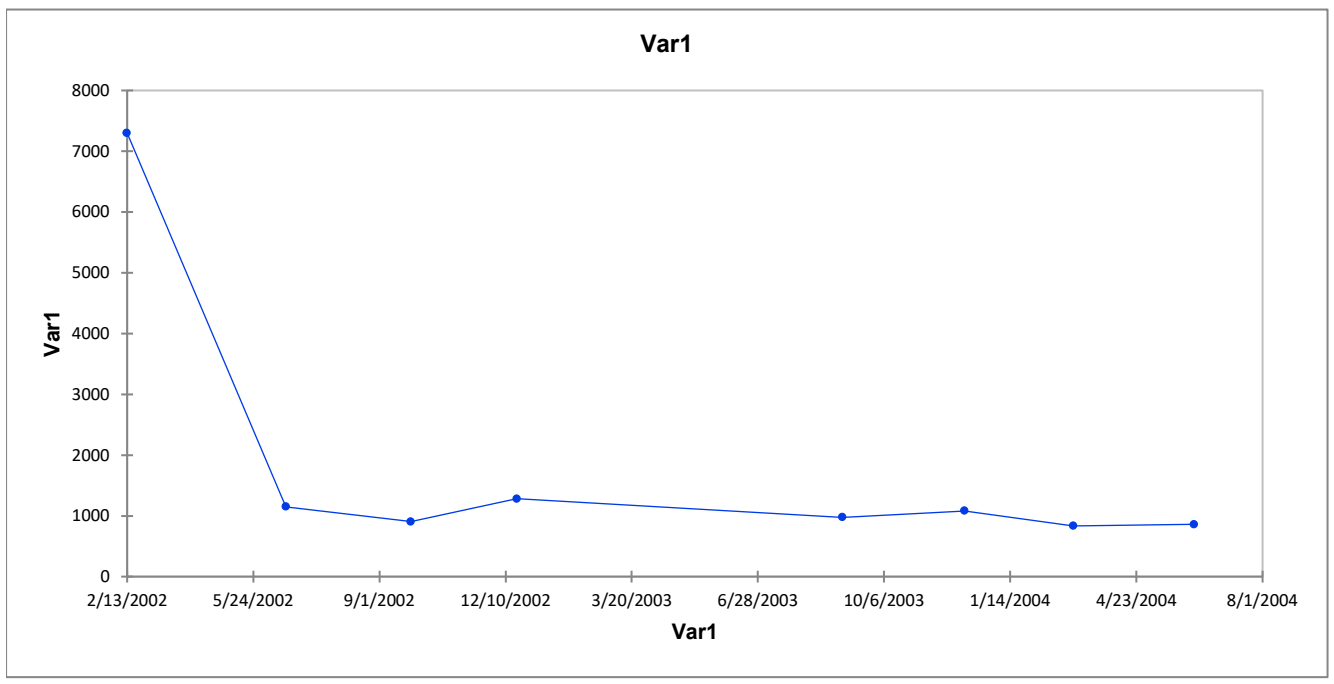
Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series

As the computed p-value is greater than the significance level alpha=0.05, one cannot reject the null hypothesis H0.

The risk to reject the null hypothesis H0 while it is true is 6.35%.

The continuity correction has been applied.

Sen's slope:	-85.5
Confidence interval:	] -100.919 , -69.635 [,-0.000 [



MFG-4 - MANN-KENDALL ANALYSIS - SUMMARY

	Water Elevation (ft)	Diesel Range (C10-24)	Heavy Oil Range / Motor Oil Range (>C24-C36)	Mineral Oil Range (<C10)
2/13/2002	10.97	**4,700**	**1,000**	**5,100**
6/19/2002	9.18	**4,770**	**1,590**	**2,680**
9/26/2002	7.96	**4,480**	**1,420**	**2,970**
12/19/2002	8.81	**3,460**	**1,190**	**2,450**
9/3/2003	8.00	**3,770**	**1,720**	**3,260**
12/9/2003	10.51	**2,220**	**1,040**	**1,680**
3/4/2004	10.76	**3,130**	**747**	**2,100**
6/8/2004	9.21	**1,170**	500	**769**
P-value		0.00937477	0.17354622	0.03544789
		Accept Alternative	Accept Null	Accept Alternative

MFG-4 - MANN-KENDALL ANALYSIS - DIESEL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 11:04:51 AM / End time: 3/7/2019 at 11:06:00 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-4 / Range = 'MFG-4'!$C$2:$C$9 / 8 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-4 / Range = 'MFG-4'!$A$2:$A$9 / 8 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	8	0	8	1170.000	4770.000	3462.500	1269.463

Mann-Kendall trend test / Two-tailed test (Var1):

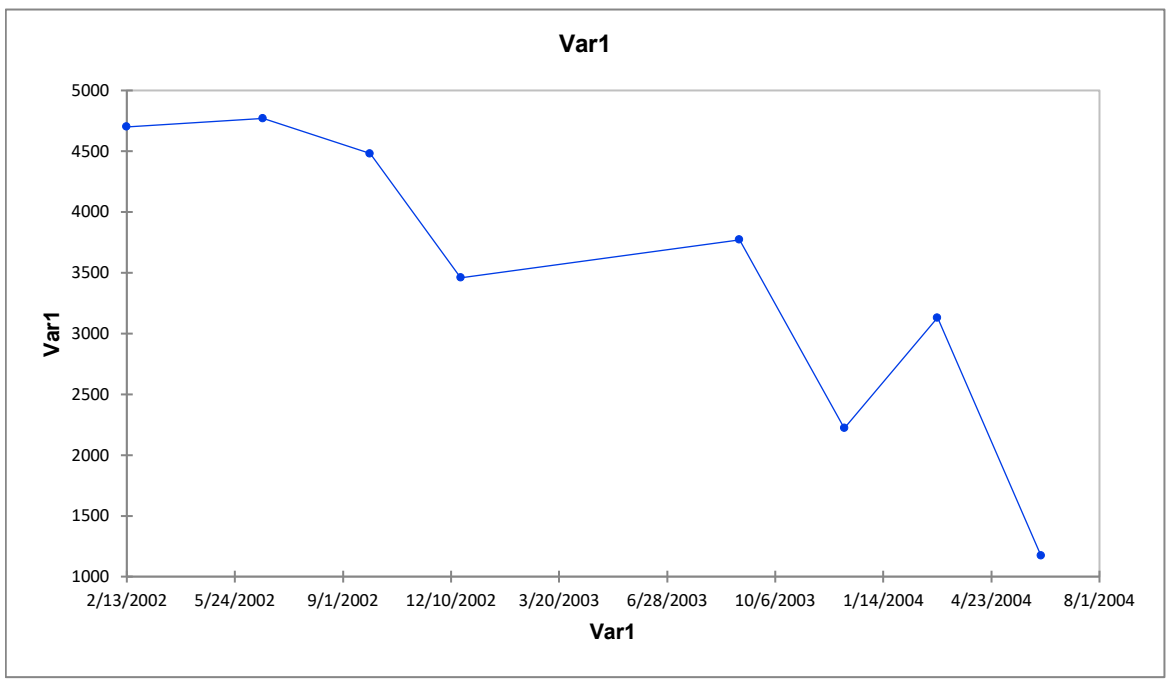
Kendall's tau	-0.786
S	-22.000
Var(S)	65.333
p-value (Two-tai	0.009
alpha	0.05

The p-value is computed using an exact method.

Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series
As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H0, and accept the alternative hypothesis Ha.
The risk to reject the null hypothesis H0 while it is true is lower than 0.94%.

The continuity correction has been applied.

Sen's slope:	-454.667
Confidence interval:	] -497.450 , -403.125 [,-0.000 [



MFG-4 - MANN-KENDALL ANALYSIS - HEAVY OIL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 11:09:45 AM / End time: 3/7/2019 at 11:10:33 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-4 / Range = 'MFG-4'!d2:d9 / 8 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-4 / Range = 'MFG-4'!$A$2:$A$9 / 8 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	8	0	8	500.000	1720.000	1150.875	416.191

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.429
S	-12.000
Var(S)	65.333
p-value (Two-tailed)	0.174
alpha	0.05

The p-value is computed using an exact method.

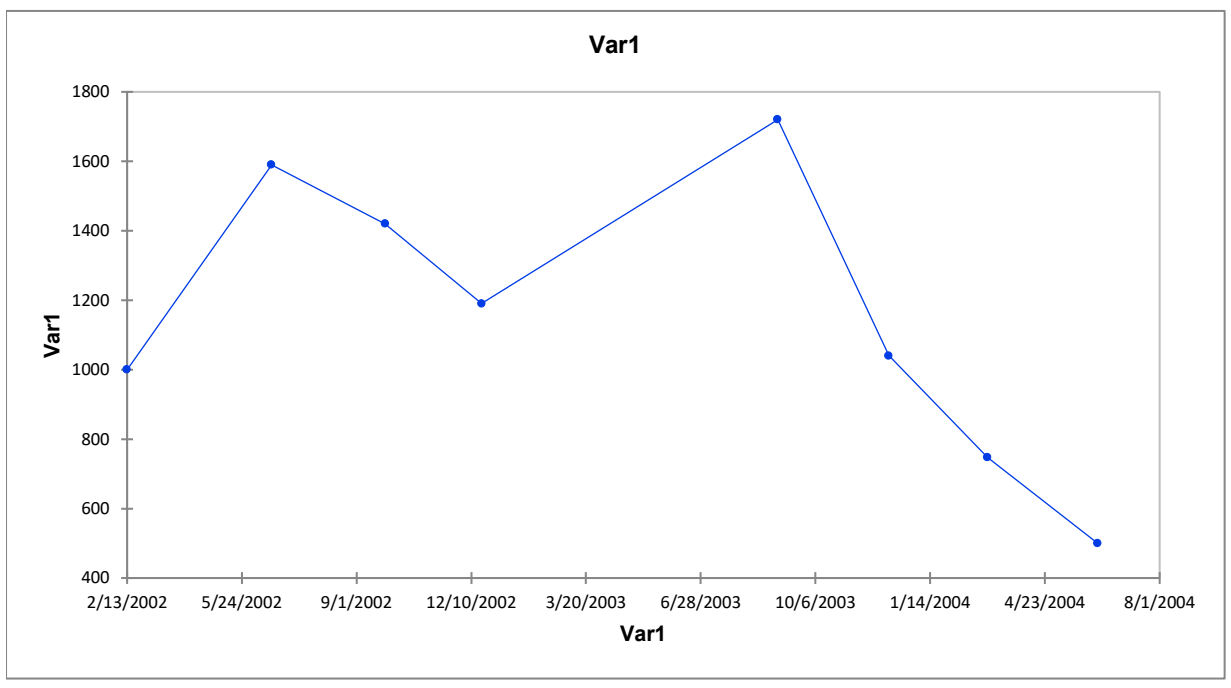
Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series

As the computed p-value is greater than the significance level alpha=0.05, one cannot reject the null hypothesis H0.

The risk to reject the null hypothesis H0 while it is true is 17.35%.

The continuity correction has been applied.

Sen's slope:	-157.958
Confidence interval:	] -168.311 , -145.887 [,-5.000 [



MFG-4 - MANN-KENDALL ANALYSIS - MINERAL OIL RANGE HYDROCARBONS

XLSTAT 2018.2.50623 - Mann-Kendall trend tests - Start time: 3/7/2019 at 11:11:23 AM / End time: 3/7/2019 at 11:11:23 AM
Time series: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-4 / Range = 'MFG-4'!e2:e9 / 8 rows and 1 column
Date data: Workbook = Mann-Kendal Tacoma Groundwater Investigation Results.xls / Sheet = MFG-4 / Range = 'MFG-4'!$A$2:$A$9 / 8 rows and 1 column
Significance level (%): 5
Continuity correction: Yes
Confidence interval (%)(Sen's slope): 95

Summary statistics

Summary statistics:

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Var1	8	0	8	769.000	5100.000	2626.125	1270.259

Mann-Kendall trend test / Two-tailed test (Var1):

Kendall's tau	-0.643
S	-18.000
Var(S)	65.333
p-value (Two-tailed)	0.035
alpha	0.05

The p-value is computed using an exact method.

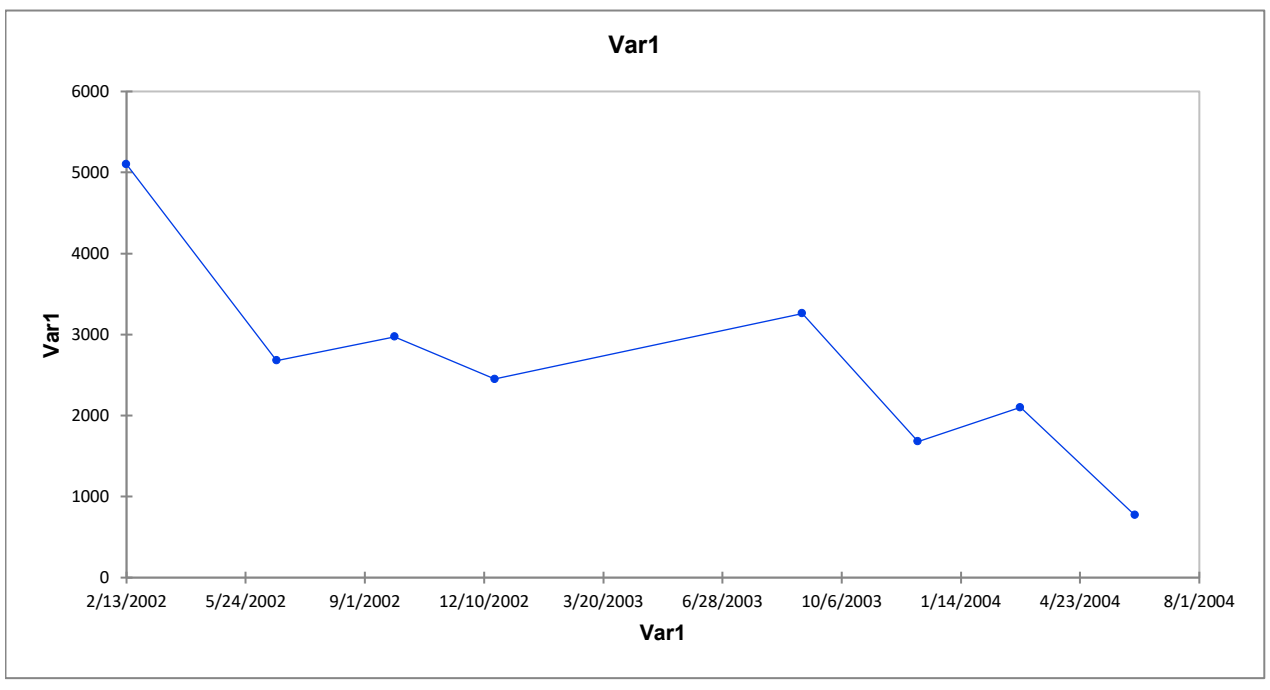
Test interpretation:
H0: There is no trend in the series
Ha: There is a trend in the series

As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis H0, and accept the alternative hypothesis Ha.

The risk to reject the null hypothesis H0 while it is true is lower than 3.54%.

The continuity correction has been applied.

Sen's slope:	-435.1
Confidence interval:	] -442.878 , -428.293 [,-7.500 [



APPENDIX F – SITE INVESTIGATION WORK PLAN

Site Investigation Work Plan
Darling-Tacoma Facility

Darling Delaware Co, Inc. (aka Puget Sound By-Products) Facility
2041 Marc Avenue, Tacoma, WA
Facility No.: 25455514 ***Cleanup Site No.: 8475*** ***VCP Project No.: SW1317***

#114-570494
March 22, 2017

PRESENTED TO

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4/10/17

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Darling Ingredients, Inc.

Date

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ACRONYMS/ABBREVIATIONS

Acronyms & Abbreviations	Definition
°C	Degrees Celsius
°F	Degrees Fahrenheit
µg/L	Micrograms per liter
µS	Micro-Siemens
amsl	Above mean sea lvel
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene and xylenes
CLP	Contract laboratory program
COPC	Contaminants of potential concern
CPLC	Cascade Pole and Lumber Company
DII	Darling Ingredients, Inc.
DOT	Department of transportation
DPT	Direct push technology
DQOs	Data quality objectives
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
EPA	Extractable petroleum hydrocarbons
FID	Flame-ionization detector
ft/ft	Feet per foot
GC/FID	Gas chromatogram/flameionization detector
GPS	Global positioning satellite
HASP	Health and safety plan
IDW	Investigation-derived waste
JSA	Job safety analysis
LUST	Leaking underground storage tank
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MNA	Monitored natural attenuation
MTCA	Model Toxics Control Act
NOAA	National Oceanic and Atmospheric Administration
OSHA	Occupational Safety and Health Administration
PAHs	Polynuclear aromatic hydrocarbons

Acronyms & Abbreviations	Definition
cPAHs	Carcinogenic polynuclear aromatic hydrocarbons
PID	Photoionization detector
POC	Points of compliance
PQL	Practical quantitation limit
PVC	Polyvinylchloride
QA/QC	Quality assurance/quality control
QC	Quality control
RZA	Rittenhouse-Zeman & Associates
SI	Site investigation
SIWP	Site Investigation Work Plan
SOPs	Standard operating procedures
TOC	Total organic carbon
UST	Underground storage tank
VCP	Voluntary Cleanup Program
WES	Whitman Environmental Services

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) prepared this Site Investigation Work Plan (SIWP) in response to comments provided on April 26, 2016 by Mr. Christopher Maurer of Washington Department of Ecology (Ecology) on the Darling Ingredients, Inc. (DII) Voluntary Cleanup Program (VCP) application. The VCP was submitted to Ecology for review in April 2012 for the DII facility located at 2041 Marc Avenue (the "Facility") in Tacoma, Pierce County, Washington (**Figure 1**, Appendix A). The Facility is listed by Ecology as a leaking underground storage tank (LUST) facility due to petroleum releases associated with two former 10,000-gallon underground storage tanks (UST) that formerly operated at the Facility.

Additional soil and groundwater investigation at the Facility is required based on Ecology's review of the VCP application (see Section 1.2). Between the last groundwater monitoring event at the Facility in 2004 and review of the VCP application, Ecology made changes to Model Toxics Control Act (MTCA; Ecology 2013) and implemented a new guidance for petroleum contaminated sites (Ecology 2011). Future work will need to comply with requirements and regulations in those documents.

This RIWP is organized as follows:

- Section 1 – Introduction
- Section 2 – Project Objectives
- Section 3 – Investigation Methods
- Section 4 – Health & Safety
- Section 5 – Project Reporting
- Section 6 - Schedule
- Section 7 - References

1.1 FACILITY LOCATION & DESCRIPTION

The Facility is located at 2041 Marc Avenue in a primarily heavy industrial area of Tacoma (**Figure 1**). DII's ingredients processing operation resides on an approximately 4-acre property owned by Port of Tacoma. (**Figures 1** and **2**, Appendix A). **Table 1-1**, below, presents Ecology's facility identification information and general facility location information.

Table 1.1-1. Facility Identification Table

Identification / Location Category	Facility Information
Facility Name	Darling Delaware Co., Inc. (aka Puget Sound By-Products)
Facility Address	2041 Marc Avenue, Tacoma, Washington
Facility Number	25455514
Cleanup Site Number	8475
VCP Project Number	SW1317
Tax Parcel Number	0320031063
Township	20 North
Range	3 East
Section	3
Quarter Sections	Southwest ¼ of the Northwest ¼ and

Table 1.1-1. Facility Identification Table

Identification / Location Category	Facility Information
	Northwest ¼ of the Southeast ¼
Latitude	47°15'20.9585" N
Longitude	-122°24'22.43035" W

Latitude and longitude based NAVD88, Washington State Plane coordinate system.

Several structures comprise DII's operation including an office, carport parking, office/storage room, work shop, office/shower/lunch room, truck shop, rendering plant, scrubbing room, waste water room, finished product load-out building, chemical storage area, and multiple silos. The remaining portions of the property are used for vehicle and equipment storage. The grounds of the facility are paved with asphalt, with the exception of the southern equipment storage area where three wastewater treatment lagoons and a clarifier previously operated. **Figure 2** (Appendix A) presents a site map.

Adjoining properties to the Facility include:

- North: Tri Pack Transloading Warehousing (property owned by Port of Tacoma).
- South: Undeveloped land.
- East: Tacoma Rail (property owned by Port of Tacoma) followed by Six Robblees' (tire and trailer business) to the northeast, MacMillan Piper container shipping facility to the east, America Promotional Events (fireworks wholesaler) to the southeast.
- West: Marc Avenue followed by undeveloped land to the west and southwest, and AAA Trailer Repair to the northwest.

1.2 PRIOR ENVIRONMENTAL WORK

Whitman Environmental Services (WES 1998) conducted a UST closure review in 1998. The WES report summarized tank closure and site investigation activities between 1989 and 1997. MFG, Inc. (now Tetra Tech) began conducting investigation work at the Facility in 2002. The following sections summarizes prior investigations conducted at the Facility. Summaries of constituents that exceed soil screening levels or groundwater standards in the following section are those that were established at the time of the investigation.

1.2.1 1989 Underground Storage Tank Removal

Two 10,000-gallon USTs were previously located at the Site. These tanks were located adjacent to the east side of the work shop. The former tank basin is currently beneath the office/shower/lunch room building (**Figure 2**). One UST held diesel fuel for use by company trucks and the other UST held Bunker C fuel oil for use in the DII boiler. The two USTs and associated piping were removed on May 22, 1989 and properly disposed (WES 1998).

Approximately 112 cubic yards of soil were excavated during the removal of the USTs (WES 1998). The soil was stockpiled and sampled. The samples were analyzed for total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylenes (BTEX). The method used to analyze for TPH was U.S. Environmental Protection Agency (EPA) method 418.1. However, this method does not differentiate between the fuel types; therefore, the results are presented as a total value for TPH. TPH results ranged from 4,672 to 8,370 milligrams per kilograms (mg/kg); ethylbenzene was detected at 0.41 mg/kg, and xylenes at 1.93 mg/kg. Benzene and toluene were not detected in the stockpile samples. The soil contained in the stockpiles was removed from the Facility and properly disposed on May 23, 1989 (WES 1998).

Ecology collected soil samples from the walls of the UST excavation and a grab sample from groundwater within the excavation (WES 1998). The excavation wall samples were analyzed for TPH only and the groundwater sample was analyzed for TPH and BTEX. Soil TPH concentrations in excavation sidewall samples ranged from 1,874 to 2,854 mg/kg. TPH in the groundwater sample had a concentration of 4,565 milligrams per liter (mg/L), and ethylbenzene and xylenes were detected at concentrations of 0.5 mg/L and 0.44 mg/L, respectively. Benzene and toluene were not detected in the groundwater sample. The soil and groundwater analytical results exceeded their respective MTCA Method A cleanup levels referenced at the time of the removal.

1.2.2 1989 Site Assessment

Rittenhouse-Zeman & Associates, Inc. (RZA) performed a subsurface investigation at the Facility in September 1989. The RZA installed three borings during the 1989 site assessment and completed the borings as groundwater monitoring wells. The wells were completed in the shallow water-bearing zone beneath the Facility.

- Boring/well MW-4 was completed adjacent to the north side of the work shop at a location northwest of the UST basin.
- Boring/well MW-5 was completed in the driving/parking area northeast of the former UST basing.
- Boring/well MW-6 was completed adjacent to the south side of the work shop at a location southwest of the UST basin.

Total depths of the borings ranged from 14 to 16.5 feet below ground surface (bgs). Groundwater was encountered approximately 7 to 8 feet bgs during drilling. Fill material was encountered to depths of 12 to 16.5 feet during drilling. RZA recorded the fill material as medium dense, gray to brown silty sand with some gravel, followed by loose to medium dense black silty sand with wood chip waste, glass, metal and organic matter. Soil material encountered below the fill material consisted of stiff to medium stiff gray silt. This soil material is likely dredged tideflat material. The inferred groundwater flow direction was to the north. All monitoring wells installed by RZA were abandoned in 1997.

RZA collected soil samples during drilling. The samples were analyzed for TPH by EPA method 418.1. TPH results ranged from 141 to 645 mg/kg (RZA 1989). RZA performed groundwater sampling in 1989 following well completion. Initial groundwater results indicated to detectable concentrations of TPH above the laboratory practical quantitation limit (PQL) of 10 mg/L. However, continued groundwater sampling from 1990 through 1993 indicated concentrations of TPH in MW-4 ranging from 1.0 to 44 mg/L and 2.2 to 82 mg/L in MW-6 (WES 1998).

The 1989 RZA map indicated three other on-site wells MW-1, MW-2 and MW-3. These wells were installed to monitor groundwater quality up-gradient and down-gradient of three former wastewater treatment lagoons and one former clarifier within the south portion of the property. The wells were completed to a depth of approximately 30 feet bgs, within the lower water-bearing zone. RZA inferred a western groundwater flow direction within the lower water-bearing zone.

1.2.3 2002 to 2004 Site Investigation & Groundwater Monitoring

MFG performed a subsurface investigation during February 2002 (MFG 2002b). MFG and Maxim Technologies (both companies of Tetra Tech) conducted quarterly groundwater monitoring from 2002 (MFG 2002b) through 2004 (Maxim 2004). The 2002 subsurface investigation was conducted in accordance with the Site Investigation Work Plan (MFG 2002a). Investigation activities included:

- A document review for the Site and surrounding properties;
- The completion of four groundwater monitoring wells (MFG-1 through MFG-4);
- Sampling and analysis of subsurface soil and groundwater to evaluate petroleum hydrocarbon impacts;
- Measurement of water levels to evaluate groundwater flow direction;
- Obtain horizontal and vertical coordinates of each monitoring well by a licensed surveyor; and

- Completion of investigation and monitoring reports.

1.2.3.1 2002 Subsurface Investigation

Surface material at the Facility is asphalt underlain by 2 to 7 feet of sand to sandy gravel fill. Fill material encountered in subsurface soil borings ranged from ground surface to 12.5 to 16.5 feet bgs. Fill material consisted of sand and gravel with landfill debris. Moisture graded from dry to slightly moist to saturated. Landfill debris included degrading fine organic paste, scrap wood, roots, and sticks; wire, glass, and metal. Underlying the landfill materials was silt ranging from light gray, dark brown to black silt with organics (e.g. rootlets). Each of the four subsurface soil borings were completed as groundwater monitoring wells. The wells were completed as follows (**Figure 2**).

- Boring/well MFG-1 was completed adjacent to the north side of the work shop at a location northwest of the former UST basin. The well was near RZA well location MW-4.
- Boring/well MFG-2 was completed adjacent to the north fence line directly north of the former UST basin.
- Boring/well MFG-3 was completed east of the former UST basin.
- Boring/well MFG-4 was completed south of the work shop at a location southwest of the former UST basin.

Subsurface soil samples collected during the investigation were analyzed for TPH by NWTPH-Dx, extractable petroleum hydrocarbons (EPH) by modified WDOE TPH Policy Method, polynuclear aromatic hydrocarbons (PAHs) and naphthalenes by GC/MS-SIM, and BTEX by SW-846 method 8021B. Soil analytical results indicated the following:

- Soil sample MFG-B3 (7.5-8') was the only subsurface soil sample collected during the 2002 investigation that exceed the 2,000 mg/kg heavy oil range MTCA Method A Soil Cleanup Levels for unrestricted land use and industrial properties with a concentration of 3,000 mg/kg.
- Soil samples MFG-B3 (7.5-8') and MFG-B4 (8-8.5') exhibited concentrations of total carcinogenic polynuclear aromatic hydrocarbons (cPAHs) above the MTCA Method A Soil Cleanup level for unrestricted land use of 0.1 mg/kg and industrial land use of 2 mg/kg. Concentrations of cPAHs in MFG-B3 (7.5-8') was 22.5 mg/kg and 2.3 mg/kg in MFG-B4 (8-8.5').

1.2.3.2 Quarterly Groundwater Monitoring

MFG completed quarterly groundwater monitoring from 2002 through 2004. Wells were sampled using low-flow purging and sampling. Field parameters monitored during purging included specific conductance, pH and temperature. Specific conductance ranged from 689 to 2,120 micro-Siemens (µS), pH ranged from 6.1 to 7.5 standard units, and temperature ranged from 12.8 to 20.3 degrees Celsius. Water table elevations ranged from 7.9 to 11.0 feet above mean sea level (amsl) with an average facility water table elevation of 9.4 feet amsl.

Groundwater flow directions ranged from northwest, north to east. Determination of groundwater flow direction and gradient is difficult at the Facility due to the minor water table elevation differences across the study area and the relatively flat groundwater gradient. Elevation differences between wells range from 0.01 to 0.05 with one outlier in June 2004 of 0.18 feet. The average elevation difference between wells, excluding the outlier, is 0.03 feet. The average groundwater gradient was 0.0009 feet per foot (ft/ft).

Diesel and mineral oil range TPH results from all wells and all monitoring events exceeded MTCA Method A Groundwater Cleanup Level of 500 micrograms per liter (µg/L) for each parameter. All heavy oil range results exceeded the MTCA Method A Groundwater Cleanup Level of 500 µg/L in all wells and all events except three events for MFG-1, two events for MFG-2 and MFG-3, and one event for MFG-4. However, diesel range, heavy oil range and mineral range TPH samples were also prepared using acid silica gel cleanup during the 2003 and 2004 monitoring events [Note: acid silica gel removes non-polar hydrocarbons (organic material other than petroleum hydrocarbons) from the sample prior to analysis and is used in situations where high concentrations of organic

matter is present.]. TPH analyzed with acid silica gel preparation resulted in no detectable diesel, heavy oil or mineral range TPH in any of the groundwater samples above the laboratory PQL. EPH carbon range results indicated non-detect to low concentrations (<150 µg/L). **Table 1.4-1**, below, presents a summary of facility groundwater data collected between 2002 and 2004.

Table 1.2-1. 2002 – 2004 Groundwater Data Summary

Parameter	MTCA Method A Groundwater Cleanup Level	Minimum	Maximum	Average
Water Table Elevation (ft amsl)		7.9	11.0	9.4
Temperature (°C)		12.7	23.9	17.5
pH (std. units)		5.9	7.6	6.5
Specific conductance (µS)		689	2,120	1,214
Diesel Range TPH (µg/L)	500	837	6,100	2,448
Heavy Oil Range TPH (µg/L)	500	514	1,720	912
Mineral Oil Range TPH (µg/L)	500	615	7,300	1,928
Diesel Range TPH w/SGC cleanup (µg/L)	500	<250	<250	<250
Heavy Oil Range TPH w/SGC (µg/L)	500	<500	<500	<500
Mineral Oil Range TPH w/SGC (µg/L)	500	<500	<500	<500
C21-C34 Aliphatics (µg/L)		91.4	148	115
C10-C12 Aromatics (µg/L)		50.6	63.3	56.9
C12-C16 Aromatics (µg/L)		58.6	82.1	73.5
Total EPHs** (µg/L)		58.6	148	100
Benzo(a)anthracene (µg/L)		0.100	0.182	0.140
Benzo(a)pyrene (µg/L)*	0.1	0.182	0.182	0.182
Benzo(b)fluoranthene (µg/L)*		0.121	0.121	0.121
Benzo(k)fluoranthene (µg/L)		0.119	0.162	0.141
Chrysene (µg/L)		0.162	0.162	0.162
Ideno(1,2,3-cd)pyrene (µg/L)*		0.101	0.101	0.101
Total cPAHs (µg/L)	0.1	0.100	0.910	0.423
1-Methylnaphthalene (µg/L)		0.120	4.23	1.37
2-Methylnaphthalene (µg/L)		0.120	0.554	0.286
Naphthalene (µg/L)		0.173	0.535	0.304
Total Naphthalenes (µg/L)	160	0.120	4.63	1.39
Benzene (µg/L)	5	0.598	2.24	1.29
Toluene (µg/L)	1,000	0.504	0.648	0.55
Xylenes (total) (µg/L)	1,000	1.08	1.38	1.18

Only those constituents detected above the laboratory PQL in groundwater are listed in the table.
cPAHs were only detected in groundwater during the September 26, 2002 monitoring event.
SGC – Silica gel cleanup
**Detected in groundwater from MFG-3 only.*
***EPH carbon ranges not listed did not have any detected concentrations above the laboratory PQL in any of the samples.*

1.2.4 2012 VCP Application

Tetra Tech prepared a VCP application for the Facility in 2012. Mr. Christopher Maurer of Ecology reviewed the document in 2016 and provided a list of deficiencies that need to be addressed prior to consideration of facility closure. **Table 1-1**, below, lists Ecology's requested work as presented in Mr. Maurer's e-mail dated April 27, 2016.

Table 1.2-2. Summary of VCP Application Deficiencies

VCP Topic	Deficiency
1. Subsurface Soil Borings	Install four new soil borings as close as possible to the former underground storage tanks location; one boring on the north, east, and south sides. A fourth boring will be drilled in the vicinity of monitoring well MFG-3. The borings are to be installed to a depth of 12 feet. Soil samples from the borings are to be analyzed for diesel and heavy oil, with and without silica gel cleanup.
2. Monitoring Well Installation	Install two new monitoring wells in place of monitoring wells MFG-1 and MFG-2 unless monitoring wells MFG-1 and MFG-2 are found to be in a fully functional condition. Groundwater samples from the two wells, either existing or replacement, are to be analyzed for diesel and heavy oil, with and without silica gel cleanup.
3. Monitoring Well Assessment	If possible, locate groundwater monitoring wells MFG-3 and MFG-4 and determine if they are fully functional. If they are not fully functional, abandon them according to State standards. If groundwater monitoring wells MFG-1 and MFG-2 are not fully functional, likewise abandon them according to State standards.
4. Tidal Groundwater Influence	If reasonable, determine if the groundwater level is tidally influenced. *November 2016 discussion between N. Morrow of Tetra Tech and C. Maurer of Ecology: There are many variables at and in the vicinity of the site that could influence groundwater levels and flow direction. Water table elevations between wells varies by 0.03 feet, on average, during most of the past monitoring events. Based on our November 2016 conversation, we discussed that the Facility is paved but the surrounding area is unpaved. Runoff from the site, large roofs on the adjoining property, the nearby wetland ponds, Puyallup River and Commencement Bay, hydrostatic rebounding from the adjoining railroad tracks, and preferential flow paths related to subsurface utility lines all may affect groundwater levels and flow direction at the Facility. Determining tidal influence would likely be difficult and require a lengthy study. As such, N. Morrow and C. Maurer agreed that DII would not need to conduct the study for this site investigation. However, we will still review precipitation events for the days leading up to the groundwater monitoring event and document, as possible, runoff patterns and infiltration areas.*
5. Cross-Section Preparation	Prepare and submit to Ecology two cross-sections of the site. Include in the cross-sections soil lithology, aquifer locations, monitoring wells, and soil borings. Include in the cross-sections the data from the new soil borings and, if installed, the new groundwater monitoring wells.
6. Site Investigation Report	Prepare and submit to Ecology a report describing the results of the above additional site characterization. At the time the report is submitted to Ecology, enter the report data into Ecology's EIMS database. This is a recent change in Ecology policy. Ecology now requires that data be entered into the EIMS database at the time of the submittal of a report rather than at the time a final opinion letter is prepared.

Based on Ecology's comments, additional investigation work at the Facility is needed to further evaluate potential impacts related to the former UST leak. Data will be compared to current MTCA screening levels and standards.

1.3 PHYSICAL ENVIRONMENT

1.3.1 Climate

Marine (or maritime) climate characterizes the Tacoma area, which generally features a mild climate with cool winters and warm summers (WRCC 2015a). Moist air moving inland from the ocean is released west of the Cascade Range due to orogenic lifting of the air over the mountains. The prevailing wind in the Puget Sound Lowlands is south or southwest during the wet season and northwest in summer.

Tetra Tech reviewed data from the Tacoma Number 1 (#1) station (WRCC 2015b). National Oceanic and Atmospheric Administration (NOAA) shows the station as being located approximately 1,700 feet southwest of the Facility near the southwestern bank of the Puyallup River. NOAA (http://www.ncdc.noaa.gov/cdo-web/results) list the latitude of the station as 47.2472° and longitude as -122.4122°. The station is at an elevation of approximately 25 feet amsl.

The Tacoma #1, Washington (458278) (WRCC 2015b) monthly climate summary indicated an average annual maximum temperature of 61.4 degrees Fahrenheit (°F) and the average minimum temperature of 45.3 °F. The summary indicated average annual rainfall for Tacoma is approximately 39.8 inches per year. The greatest monthly average precipitation occurs during the months of November (6.8 inches), December (5.7 inches), and January (6.08 inches) while the lowest average precipitation occurs during the months of June (1.6 inches), July (0.74 inches), August (0.83 inches), and September (1.27 inches).

1.3.2 Tideflats and Waterways

Commencement Bay, part of the Puget Sound waterway, resides over 1.5 miles north-northwest of the Facility. The Puyallup River is located approximately 0.3 miles east of the Facility. This river originates at Mount Rainer and generally flows to the northwest and empties into Commencement Bay where sediment carried by the river creates a large delta area, or tideflats.

The heavy industrial area in which the Facility resides is on the Tacoma Tideflats. The Tacoma Tideflats area consists of dredged sediment fill placed to allow for development of industrial land and waterways for boats and ships. Overlying the tideflats is the Tacoma Tideflats Landfill (aka Lincoln Avenue Landfill). Waste materials were placed on top of the tideflat sediment to further enable the land to be utilized for industrial and commercial development. The topography at and in the facility vicinity is relatively flat and appears to have a gradual slope to the northwest, toward Commencement Bay.

The City of Tacoma operated the Tacoma Tideflats Landfill from the 1940s through approximately 1964. The landfill is generally characterized as an unregulated dumping area for municipal waste for Tacoma residents. In addition, industries may have also deposited solid and/or hazardous waste materials in the landfill (TPCHD 2001). The landfill debris was regularly burned to reduce waste volumes. **Figure 1** presents the approximate lateral extent of the landfill; the Facility is located near the center of the former landfill.

Additional nearby waterways include the Sitcum Waterway located approximately 1 mile north of the Facility, the Blair Waterway is approximately 1.1 miles to the east, and the Hylebos Waterway is approximately 2 miles east. Gog-le-hi-te Wetlands Park resides approximately 900 feet west of the Facility. These wetlands are adjacent to and connected with the east bank of the Puyallup River. This wetland park was developed during cleanup of a portion of the Tacoma Tideflats Landfill.

1.3.3 Geologic & Hydrogeologic Conditions

1.3.3.1 Regional & Local Conditions

Commencement Bay is part of the Puget Sound waterway. The Puget Sound waterway is a large waterway carved out by glaciers during multiple ice age events. Flowing into Commencement Bay on the west is the Puyallup River. The Puyallup River flows originates at Mount Rainer and flows to the northwest, through the Puyallup Valley. The Puyallup River forms a delta as it empties into Commencement Bay (Ecology 2015). The area surrounding Commencement Bay is comprised of glacial deposits.

The hydrostatrigraphy of the Tacoma Tideflats area at nearby site, Cascade Pole and Lumber Company (hereinafter, CPLC), was reviewed to evaluate nearby subsurface conditions within the Tacoma Tideflats. The CPLC site is located 0.25 miles northwest of the Facility on Marc Street. The CPLC site is also within the footprint of the former Tacoma Tideflats Landfill. Subsurface observations at the CPLC site include: 1) a 6- to 10-foot thick shallow, unconfined water zone (shallow aquifer); 2) a 6- to 7- foot thick silty clay to clayey silt aquitard separating the shallow aquifer from a lower water zone (deep aquifer); 3) a 6- to 10-foot thick, semi-confined deep aquifer; 4) a second 3-foot thick aquitard comprised of sandy to clayey silt underlying the deep aquifer (AECOM & MFA 2014). The shallow aquifer consists of fine to medium sand with some sandy silt intervals, and silty clay beds present at some intervals. The deep aquifer consists of very fine to medium sand with trace silt. The aquifer separating the shallow aquifer from the deep aquifer was noted has containing wood and other organic matter (AECOM & MFA 2014).

Groundwater flow in the shallow aquifer at the CPLC site was primarily to the southwest, toward the Puyallup River. However, groundwater flow in the shallow aquifer at the nearby Milwaukee Railyard immediately north of the CPLC site flows to the north to northwest. Groundwater flow in the deep aquifer at the CPLC site is typically to the southwest to west, toward the Puyallup River (AECOM & MFA 2014). However, a February 2012 monitoring event indicated flow in the deep aquifer to the north. The CPLC site has an average shallow aquifer horizontal gradient of 0.001 feet per foot (ft/ft) and a 0.005 ft/ft horizontal gradient for the deep aquifer. A downward vertical gradient between 0.14 and 0.18 ft/ft was also measured at the CPLC site (AECOM & MFA 2014).

Estimated hydraulic conductivities (based on slug tests) for the shallow aquifer range from 0.059 feet per day (ft/day) to 3.71 ft/day, with a mean of 0.541 ft/day. Estimated hydraulic conductivities for the deep aquifer range from 9.87 ft/day to 25.7 ft/day, with a mean hydraulic conductivity of 19.0 ft/day (AECOM & MFA 2014). Seepage estimates for the shallow aquifer range from 0.071 to 0.001 ft/day and 0.030 to 0.078 ft/day for the deep aquifer.

AECOM & MFA (2014) conducted a 24-hour tidal study that involved installation of a tidal gauge on a piling immediately north of the 11th Street Bridge on the Puyallup Waterway coupled with hourly on-site water level measurements. AECOM & MFA concluded that tidal influence in the shallow aquifer is not significant and that groundwater flow direction and gradients were not impacted by tidal changes in the Puyallup River. However, based on the hydraulic conductivities observed at this site, potential tidal influences may not be observed in a 24-hour study due to the lag time for the potential affects to be observed at the site, and given the shallow gradient at the site, it may be difficult to distinguish tidal influence from infiltration due to precipitation and runoff in the shallow aquifer.

1.3.3.2 Site Conditions

RZA excavated three borings in 1989 and MFG (now Tetra Tech) excavated four borings in 2002 at the Facility. These borings were completed as groundwater monitoring wells. However, these wells no longer exist and may have been paved over with asphaltic concrete (asphalt).

Lithologic logs indicate fill underlies the Facility (RZA 1989 and MFG 2002). The Facility surface is paved with asphalt. Underlying the asphalt is sand to sandy gravel fill that ranges from 2 to 7 feet thick. Landfill materials underlie the sand to sandy gravel fill to depths ranging from approximately 12.5 to 16.5 feet bgs. The fill material

graded from dry to slightly moist to saturated. The fill includes debris such as degrading fine organic paste, scrap wood, roots, sticks, wire, glass, and metal. The debris is in a matrix ranging from silt to sandy gravel. Underlying the landfill materials is silt ranging from light gray, dark brown to black silt with organics (e.g. roots).

The saturated zone at the Facility is within the fill containing landfill materials. First encountered water recorded by RZA during drilling was 7 to 8 feet bgs (RZA 1989) and MFG first encountered water at 7 to 7.5 feet bgs during drilling. Static water levels recorded in well MFG-1 through MFG-4 ranged from 4.5 to 8.9 feet below top of casing (btoc) over the monitoring years of 2002 to 2004 (MFG 2004).

Based on topography and flow of the nearby Puyallup River, groundwater flow in the shallow water-bearing zone is expected to be to the north to northwest, toward Commencement Bay. RZA's report (1989) inferred a western groundwater flow direction. However, the orientation of RZA's map was incorrect as the north directional arrow on their map is actually pointing to the east. Correcting for this, the inferred flow direction would be to the north, toward Commencement Bay. MFG identified a groundwater flow primarily northward, ranging from northwest, north, to northeast . However, two of the 10 monitoring events conducted indicated a south to southwest flow direction (February 2002) and one event an eastern flow direction (June 2004).

Water table elevations for nine monitoring events conducted quarterly between February 2002 and March 2004 varied by an average of 0.03 feet over the study area and ranged. The June 2004 event showed an outlier with a slightly greater elevation difference between the wells of 0.18 feet. MFG (2004) potentiometric surface maps indicated a very flat groundwater gradient of 0.0009 feet per foot (feet/foot) at the Facility based on water table elevations. Hydraulic conductivities have not be measured in on-site wells but are likely similar to those measured at the nearby CPLC site. It is unknown whether static water levels are influenced by tidal conditions, other potential on-site or off-site conditions (e.g. storm water runoff, precipitation infiltration).

2.0 PROJECT OBJECTIVES

2.1 PURPOSE OF PROJECT

The objectives of this site investigation (SI) are to complete a soil and groundwater investigation to evaluate environmental impacts from the former USTs and support Facility closure. The goal of this investigation is to evaluate current facility conditions near the former UST basin. Based on the information obtained, Ecology may make additional recommendations for further site assessment, risk assessment and/or cleanup planning.

2.2 CONTAMINANTS OF POTENTIAL CONCERN

Mr. Maurer's of Ecology has requested analysis of petroleum hydrocarbons to evaluate potential impacts related to the former UST leak. Contaminants of Potential Concern (COPCs) for this SI include petroleum hydrocarbons associated with diesel and Bunker C fuels. **Table 2.2-1**, below, presents the COPCs based on the results of past investigations:

Table 2.2-1. Contaminants of Potential Concern

Contaminant	Origin
Petroleum Hydrocarbons	Diesel and Bunker C fuels associated with the former 10,000-gallon USTs removed in 1989.

2.3 SCOPE OF WORK

The scope of work for this SI project was developed based on prior investigations at the Facility and Ecology's list of VCP deficiencies. The following scope of work was developed to evaluate current site conditions:

- Task 1 – Assess Condition of Existing Wells: Attempt to locate MFG-1 through MFG-4 and assess whether wells are fully functional. Abandon any wells that are not found to be fully functional.
- Task 2 – Subsurface Soil Investigation: Drill and sample soil from four subsurface soil borings. Analyze soil samples for diesel and heavy oil, with and without silica gel cleanup.
- Task 3 – Groundwater Investigation: Install replacement wells for MFG-1 and MFG-2 if the original wells were found to not be fully functional. Develop the wells and sample groundwater from the four wells. Evaluate whether site and adjoining properties for areas of infiltration and runoff, and evaluate precipitation data prior to the groundwater sampling event.
- Task 4 – Investigation Report: Prepare a soil and groundwater investigation report for Ecology review. The report will include two cross-sections prepared using new subsurface soil and well data.

2.4 DATA QUALITY OBJECTIVES

This section was developed to define data quality objectives (DQOs), guide data acquisition, and data evaluation activities. Project personnel will use this section and the investigation methods section (Section 3) to guide all field data collection, data evaluation and reporting efforts.

DQOs for this SI were developed to ensure data quality and to define procedures for data collection. The DQO process allows Tetra Tech to evaluate the level of data quality required for specific data collection activities and to estimate the costs associated with the activities.

2.4.1 Problem Statement

Prior investigation work at the Facility indicated petroleum hydrocarbons in soil and groundwater associated with the former diesel and Bunker C USTs. Additional investigation is required to evaluate:

- Current soil and groundwater conditions adjacent to the former UST basin;
- Condition of existing wells and the need for installation of replacement wells and abandonment of non-functioning wells;
- Potential tidal influence of groundwater levels at the Facility;

2.4.2 Decision Statement

Ecology has requested additional investigation to evaluate current concentrations of petroleum hydrocarbons in subsurface soil and groundwater. This SI will involve collecting environmental data to assess and managing risks related to these COPCs. Facility analytical data will be compared to MTCA soil and groundwater cleanup levels. Cleanup levels will be compared with appropriate soil and groundwater screening levels and standards based on most recent versions of MTCA and Ecology's petroleum guidance document (Ecology 2013 and Ecology 2011, respectively).

Based on the results, decisions will be made based on the following statements:

- Do COPCs remain in soil and groundwater at concentrations above MTCA Method A groundwater cleanup levels and/or soil cleanup levels for industrial properties?
- Is evaluation of site data under MTCA Method B and/or C beneficial in obtaining facility closure (which may require a risk assessment)?
- Are groundwater levels tidally influenced?
- Can closure of the site occur or does additional data need to be collected prior to closure and/or cleanup planning?

2.4.3 Site Conceptual Model

Potential sources of contamination at the Facility include spills and leaks associated with the two former 10,000-gallon diesel and Bunker C USTs removed in 1989. Additional potential sources of contamination for the property are related to waste materials associated with the former Tacoma Tideflats Landfill or potential impacts from adjoining operations that may use petroleum hydrocarbons.

Current potential receptors of contaminants include on-site workers, visitors, and construction/utility workers. Investigation activities will provide information to evaluate potential exposures at the Facility. The primary exposure routes and pathways for concern for the Facility include incidental ingestion and dermal contact with soil. The city supplies water to the Facility for washing, drinking and commercial/industrial uses. However, there is the potential for incidental ingestion and dermal contact by construction workers to shallow groundwater.

The inhalation pathway for diesel-range hydrocarbons does not appear complete as more volatile petroleum hydrocarbons, such as BTEX components, were not detected in soil during the 2002 investigation or in groundwater from the 2002 through 2004 groundwater monitoring events.

Subsurface soil and groundwater samples collected during this SI will be used to help evaluate potential exposures.

2.4.4 Decision Inputs

Data required to address the decision statements may include physical and chemical characteristics of surface soil (0- to 2-foot depth interval), subsurface soil (greater than 2-feet), and groundwater. Data collected and evaluated during this assessment will be compared to applicable Ecology cleanup levels and standards. **Table 2.4-1**, below, presents the specific decision inputs for this investigation. Data parameters in the below table were selected based on Table 830-1 of the MTCA Cleanup Regulations (Ecology 2013).

Table 2.4-1. Decision Inputs

Source Material	Typical Data Parameters	Data Uses
Surface and subsurface soil	BTEX, diesel-range petroleum hydrocarbons (NWTPH-Dx) and extractable petroleum hydrocarbons (EPH)	Evalute potential contamination in relation to the former diesel and Bunker C USTs. Evaluate potential risks to human health and the environment. Compare contaminant concentrations to MTCA Ecology soil cleanup levels.
Groundwater	BTEX, diesel-range petroleum hydrocarbons (NWTPH-Dx) and extractable petroleum hydrocarbons (EPH)	Evaluate potential contamination in relation to the former diesel and Bunker C USTs. Evaluate potential risk to human health and the environment. Compare contaminant concentrations to applicable Ecology cleanup levels.

2.4.5 Study Boundary

Based on Ecology's comments on the VCP application, standard POCs are being used. The lateral study boundary is the Facility boundary and adjoining properties, where necessary and accessible. The vertical boundary is from ground surface to the lowest most depth that could potentially be affected by the Facility. This is likely the aquitard at the base of the shallow aquifer. Ecology considers human exposure via direct contact or other exposure pathways is from ground surface to 15 feet bgs.

2.4.6 Decision Rule

Ecology cleanup levels will be used to evaluate data collected during this SI. **Table 2.4-2**, below, presents the soil and groundwater analytical parameters for this project along with the analytical method, MTCA Method A groundwater and industrial soil cleanup levels, and required laboratory practical quantitation limits (PQL) for this project. The parameter list is based on Mr. Maurer's April 26, 2016 e-mail. EPH parameters were added for possible use in MTCA Method B/C calculations, if needed.

Based on the initial comparison with cleanup levels, decisions will be made as to whether additional investigation, risk assessment or corrective action is needed. This may include calculation of site-specific cleanup levels using MTCA Method B and C. Calculation of cleanup levels would include incorporation of EPH results.

Table 2.4-2. Soil & Groundwater Analytical Methods & Cleanup Levels

Parameter	Analytical Method	Required Lab PQL Soil	Required Lab PQL GW	MTCA Method A Soil Cleanup Level for Industrial Properties (mg/kg)	MTCA Method A Groundwater Cleanup Levels (µg/L)
Diesel-Range Petroleum Hydrocarbons (Analyzed With & Without Silica Gel Cleanup)	NWTPH-Dx				
Diesel Range Hydrocarbons		25	250	2,000	500
Heavy Oil Range Hydrocarbons		100	500	2,000	500
Mineral Oil Range Hydrocarbons		--	--	4,000	500
Extractable Petroleum Hydrocarbons	WA MTCA-EPH				
C8 – C10 Aliphatics		5	50	--	--
C10 – C12 Aliphatics		5	50	--	--
C12 – C16 Aliphatics		5	50	--	--
C16 – C21 Aliphatics		5	50	--	--
C21 – C34 Aliphatics		5	50	--	--
C10 – C12 Aromatics		5	50	--	--
C12 – C16 Aromatics		5	50	--	--
C16 – C21 Aromatics		5	50	--	--
C21 – C34 Aromatics		5	50	--	--
Total Organic Carbon	Lloyd Kahn	--		--	--
Moisture		--		--	--

EPH results used for MTCA B and MTCA C evaluations, if needed.
-- no cleanup level

2.4.7 Tolerable Limits of Decision Errors

Decision errors are incorrect conclusions about a site caused by using data that are not representative of site conditions due to sampling or analytical error. Limits on decision error are typically established to control the effect of sampling and measurement errors on decisions regarding a site, thereby reducing the likelihood that an incorrect decision is made. The null hypothesis is that a site is contaminated. A false positive decision error is one that decides a site is clean when, in actuality, it is not clean. A false negative decision error is one that decides a site requires cleanup when, in actuality, it requires no cleanup. False positive and negative decision errors should be minimized as much as possible during this project.

Formal limits on decision error are not necessary in areas where the goal of the assessment is to define the boundaries of known contamination (EPA 1998). This SIWP identifies specific field and laboratory methods and sampling strategies that reduce sampling error. The total study error will be reduced by collecting an appropriate number of environmental samples deemed necessary by the assessment team that are intended to represent the range of concentrations present at the Site. The sampling program is designed to reduce sampling error by specifying an adequate number and distribution of samples to meet project objectives.

2.4.8 Sampling Design

Section 3 outlines the assessment design for this SI. It specifies sampling protocols, analytical methods and the types and numbers of samples to be collected during the investigation. The assessment design is based on requested investigation by Ecology following a review of historical data and previous investigations completed at this Facility.

3.0 INVESTIGATION METHODS

The following sections present the methods of investigation for this SIWP to evaluate the nature, extent and magnitude of potential contamination associated with the former 10,000-gallon diesel and Bunker C fuel USTs.

3.1 STANDARD OPERATING PROCEDURES

Field personnel will review and use this SIWP and Standard Operating Procedures (SOPs) as guidelines for conducting the field investigation. SOPs will be reviewed prior to implementing the field effort and referred to, as needed, during the investigation. The SOPs are general in nature and not meant to be site-specific. Therefore, not all information and techniques in the SOPs will apply to this project. In the case where there are discrepancies between the SOP and this SIWP, the SIWP supersedes the SOP.

Field personnel will also follow laboratory direction with respect to field, storage and shipment preservation requirements. Field personnel will follow manufacturer guidelines for calibrating and maintaining equipment; all equipment will be calibrated daily unless otherwise specified by the equipment manufacturer (e.g. manufacturer-only calibration). Field personnel will document any calibration procedures, deviations from this RIWP, and any other pertinent information in the field notebook.

Table 3.1-1, below, presents a list of SOPs that will be used for guidance during this project. In addition to the below SOPs, Tetra Tech will generally follow EPA's low-flow purging and sampling guidelines (EPA 2010).

Table 3.1-1. List of Standard Operating Procedures

SOP#	SOP
5	Field Measurement of Electric or Specific Conductance
6	Field Measurement of pH
7	Field Measurement of Water Temperature
8	Field Measurement of Dissolved Oxygen
9	Sample Packaging and Shipping
10	Field Forms
11	Equipment Decontamination
12	Sample Documentation
13	QC Samples

Table 3.1-1. List of Standard Operating Procedures

SOP#	SOP
16	Monitoring Well Construction
17	Monitoring Well Development
18	Groundwater Sampling
20	Field Measurement of Groundwater Level.
22	Soil Sample Collection
27	Field Measurement of Volatile Organic Compounds Headspace
28	Field Measurement of Redox Potential (Eh)
35	Field Measurement of Turbidity
44	Ionization Device (PID or FID) Operation
51	Low-Flow Groundwater Sampling

3.2 ACCESS & UTILITY CLEARANCES

Utilities will require clearance prior to conducting subsurface activities. The drilling subcontractor also requires verification at least 3 days prior to field work that all utilities at the Facility have been cleared. Work will not be conducted within 20 feet of overhead utility lines, as per driller safety requirements. If needed, field personnel will mark all proposed boring/well locations with white paint and/or wood stakes with flagging or pin flags prior to the utility locate work. Field personnel will also document the location of overhead utility lines and notify the project manager of any borings that require re-location. All locations will be located and documented with a resource-grade global positioning satellite (GPS) unit. Field personnel will coordinate this work with the work proposed for locating wells MFG-1 through MFG-4 (see Section 3.3).

To accommodate driller requirements, field personnel will submit a utility locate request at least 1 work week prior to the field effort(s) and after/in conjunction with marking of drilling locations. A private on-site utility locate will also be conducted by Applied Professional Services, Inc. to clear any on-site, local utilities that may have been installed by Port of Tacoma or DII. Location of utilities may also require coordination with personnel familiar with the Facility to help locate any additional underground lines or structures.

3.3 ASSESS CONDITION OF EXISTING WELLS

Site personnel reported the wells installed in 2002 by MFG no longer exist – these wells were likely covered with a new asphalt layer. Upon DII approval, Tetra Tech will attempt to find and uncover these wells. This work will be conducted prior to and/or in conjunction with the subsurface soil investigation (see Section 3.4). Tetra Tech personnel will use a resource-grade global positioning satellite (GPS) unit and metal detector in the attempt to locate the wells.

If Tetra Tech personnel are able to find the wells. Cascade Drilling personnel will assist with uncovering these wells using a jackhammer or similar means to uncover and assess the well condition and whether or not the well can be repaired or requires abandonment. Cascade Drilling is experienced in this type of work and will use caution to limit damage to the surface casing.

The wells will be inspected for damage related to factors such as truck traffic, placement of asphalt or asphalt sealants, damage from removing the asphalt, or other factors. Field personnel will also evaluate whether the well has remained open over the total depth of the well by lowering a probe in the well. The well will also be bailed to

evaluate whether there is potential evidence that asphalt sealants have entered the well. Additional re-habilitation measures may be needed if the well has become filled with fine-grained material. Tetra Tech will provide recommendations as to what repairs are needed or whether the wells needed to be abandoned for those that cannot be salvaged.

3.4 MONITORING WELL ABANDONMENT

Cascade Drilling will abandon any of the existing monitoring wells that cannot be salvaged and deemed non-functional. If required, well abandonment will be conducted as per State of Washington requirements. If the well has remained open through the entire screened interval, the well will be abandoned in-place by filling the well with bentonite chips to the surface. The surface will be backfilled with soil, as needed, and capped with asphalt patch.

If the well screen is not open over its entirety, the well will require over-drilling using a hollow stem auger drill rig. The well would then be abandoned by backfilling with bentonite chips.

3.5 SUBSURFACE SOIL INVESTIGATION

Tetra Tech will conduct a subsurface soil investigation at the Facility using a direct-push technology (DPT) drill rig. The purpose is to evaluate current conditions adjacent to the former UST tank basin and the soil adjacent to well MFG-3. Replacement wells may be required if existing wells have been compromised or cannot be found. These replacement wells will be drilled and installed during the subsurface soil investigation. Soil sampling during installation of these wells will be consistent with those borings completed during the subsurface soil investigation.

3.5.1 Subsurface Soil Borings

Field personnel will excavate four subsurface soil borings adjacent to the former UST basin on the north, east and south. The fourth location will be excavated adjacent to MFG-3. If needed, up to two additional subsurface soil borings will be excavated adjacent to existing/former wells MFG-1 and MFG-2 as part of well replacement. **Figure 2** (**Appendix A**) shows the location of the proposed soil borings and existing wells.

The three closest borings to the former UST basin are approximately 10 feet north, 30 feet east, and 20 feet south. The boring adjacent to MFG-3 is approximately 50 feet southeast of the former UST basin (**Figure 2**). The exact location of each boring will be determined in the field based on site conditions. Ecology specified that soil borings should be drilled to 12 feet bgs. Total depths will likely be between 12 to 15 feet bgs, depending on the specific DPT equipment used. Multiple borings may be drilled in each of the investigation locations to obtain enough soil for laboratory samples if soil recovery is low.

Tetra Tech will document each boring location in the field using a hand-held, resource grade GPS unit. The boreholes will be backfilled using bentonite once all soil and groundwater samples have been collected from the boring. Asphalt patch will be used to repair the pavement at each investigation location.

3.5.2 DPT Soil Sampling & Analysis

Continuous soil cores will be extracted from each boring for logging and soil sampling. A portion of each soil core will be preserved for possible laboratory analysis. Volume permitting, the remaining portion will be used for on-site screening of volatile organic vapors using a photoionization detector (PID) or flame ionization detector (FID). Field screening results will be documented on the field boring logs. Field personnel will document the subsurface lithology in each boring, particularly intervals of staining, and where landfill debris and/or degrading organics are encountered. Field personnel will document the depth at which first water is encountered, total depth of the boring and the following characteristics for each soil core, as pertinent:

- Percent of soil/debris recovered in the core;
- Lithology (including grain sizes);
- Debris characteristics;
- Soil color;
- Relative moisture content;
- Staining;
- Odor; and
- PID/FID readings.

Up to two soil samples will be collected from each soil borings. One soil sample will be collected from the interval(s) exhibiting the worst-case conditions as identified through field soil screening and logging procedures. The second soil sample will be collected from the approximate air-water interface. However, if a worst-case interval(s) is not identified through field screening or the worst-case conditions are observed at the approximate air-water interface, then only one soil sample will be collected from the approximate air-water interface.

Soil samples will be analyzed as per **Table 3.4-1**, below. **Table 3.4-2**, below, presents the field QC sample requirements for the DPT soil investigation. Field QC samples will be analyzed for Diesel-Range Petroleum Hydrocarbons – Without Silica Gel Cleanup.

Test America laboratory in Tacoma, Washington was selected for analysis of the subsurface soil samples. Field personnel will provide Test America with 2 weeks notice prior to conducting the field effort for preparation of sample jars. The jar order will be picked up by field personnel.

Table 3.5-1. Subsurface Soil Analytical Requirements

Parameter	Analytical Method	Laboratory Required Reporting Limit (mg/kg)	[1]Soil Jar & Preservation Requirements	Holding Time
Diesel-Range Petroleum Hydrocarbons – With Silica Gel Cleanup	NWTPH-Dx	Diesel – 25 Heavy Oil – 100 Mineral Oil - NR	1 – 4oz. glass jar Cool to 4°C	7 days (40 days after extraction)
Diesel-Range Petroleum Hydrocarbons – Without Silica Gel Cleanup	NWTPH-Dx	Diesel – 25 Heavy Oil – 100 Mineral Oil - NR	1 – 4oz. glass jar Cool to 4°C	7 days (40 days after extraction)
Moisture	SM-2540G-1997 (or similar)	NA	--	7 days

1- The actual number and type of jars required by the laboratory may vary.

Table 3.5-2. DPT Soil Field QC Sample Requirements

QC Sample	Purpose	Frequency	Number of QC Samples	QA Objective
Field Soil Duplicate	Measure analytical precision	None proposed due to limited volume of soil from DPT cores.	0	35% RPD for soil
Equipment Rinsate Blanks	Measure of accuracy and representativeness. Quantify artifacts introduced during sampling, decontamination, transport from ambient air, and in decontamination water supply, or analysis of sample.	1 per 20 soil samples	1	Target analytes not detected
Field Blank	Measure of accuracy and	None proposed –	0	Target analytes not

Table 3.5-2. DPT Soil Field QC Sample Requirements

QC Sample	Purpose	Frequency	Number of QC Samples	QA Objective
	representativeness. Quantify artifacts introduced during sampling, decontamination, transport from ambient air, and in decontamination water supply, or analysis of sample.	Collected as part of DPT groundwater QC (using same source of water).		detected

RPD – Relative percent difference

3.6 GROUNDWATER INVESTIGATION

Tetra Tech will sample groundwater at the Facility following the DPT soil investigation. The groundwater investigation will include: 1) groundwater sampling of wells MFG-1 and MFG-2; and 2) an assessment to evaluate tidal influence of groundwater. If necessary, replacement monitoring wells will be installed prior to groundwater sampling.

3.6.1 Replacement Monitoring Well Installation & Development

Replacement monitoring wells will be installed for MFG-1 and/or MFG-2 if they are deemed as not fully functional. The replacement wells will be installed by Cascade Drilling using a DPT drill rig. The lithology in each well will be documented as per Section 3.4.2 (above). However, Ecology did not specify soil sampling during well installation and as per DII direction, no soil samples will be collected for laboratory analysis during well installation. Lithology in the replacement wells are expected to be the same as the original well.

The replacement wells will be installed 5 to 10 feet from the existing well it replaces. The well(s) will be installed as flush-mount wells with 2-inch diameter polyvinylchloride (PVC) well casing. Well depths are expected to be up to approximately 15 feet for MFG-1 and up to 10 feet for MFG-2 but will ultimately depend upon site conditions encountered. Well screens will include a pre-pack silica sand filter pack. The well screen will be 2-inch diameter, 0.010-slot, PVC well screen and measure 5 to 10 feet in length. Wells will be constructed by a licensed Washington well installer and as per Ecology requirements and regulations.

Field personnel will develop the replacement wells after the wells have at least stabilized overnight. Development will include surging each well with a surge block, bailer and/or submersible pump, as needed to clear sediment from each well. Field personnel will monitor and record temperature, pH, specific conductance, and turbidity during development. Development will cease once field parameters are relatively stable and/or 1 hour has passed since start of development. Well sampling will occur at least 24 hours following development.

3.6.2 Well Sampling

Tetra Tech will conduct one round of groundwater sampling for wells MFG-1 and MFG-2 (either existing or replacement wells). The sampling will be conducted following the DPT soil investigation and installation and development of any replacement monitoring wells. Prior to groundwater sampling, field personnel will remove the locking well caps for all wells to allow the wells to vent and pressures to stabilize prior to collecting depth to water measurements.

Groundwater sampling will be performed MFG-1 and MFG-2 wells at the Facility. Field personnel will generally follow EPA's low-flow groundwater purging and sampling technique. Wells will be purged and sampled using a peristaltic pump and dedicated, disposable tubing. For sampling consistency, the tubing intake location will be within the top 2 feet of the saturated screen interval.

Field personnel will monitor and record temperature, pH, specific conductance, dissolved oxygen, oxidation-reduction potential, and turbidity during purging using a multi-parameter meter and flow-through cell. Field personnel will use a 5-gallon bucket, graduated in liters to track purge rate and volume. The wells will be purged at a consistent rate between 0.1 and 0.5 liters per minute, and such that well drawdown is less than 0.3 feet. Wells will be sampled following field parameter stabilization. Field parameters will generally be considered stable when three successive readings are within the following (EPA 2010):

- pH +/- 0.1 pH units
- Temperature +/- 3%
- Specific conductance +/- 3%
- Dissolved oxygen +/- 10% if >0.5 mg/L, or stable if three values less than 0.5 mg/kg
- Oxidation-reduction potential +/- 10 millivolts
- Turbidity <5 NTUs or +/- 10.0% (when turbidity is 5 NTUs or greater)

Table 3.5-3, below, presents the required laboratory analytical parameters for the groundwater samples. Test America laboratory in Tacoma, Washington was selected for analysis of the subsurface soil samples. Field personnel will provide Test America with 2 weeks notice prior to conducting the field effort for preparation of sample jars. The jar order will be picked up by field personnel. **Table 3.4-4**, below, defines the QC samples to be collected for the quarterly groundwater sampling.

Table 3.6-1.Quarterly Groundwater Sampling - Analytical Requirements

Parameter	Analytical Method	Laboratory Required Reporting Limit (µg/L)	Bottle & Preservation Requirements	Holding Time
Diesel-Range Petroleum Hydrocarbons – With Silica Gel Cleanup	NWTPH-Dx	Diesel – 250 Heavy Oil – 250 Mineral Oil - NR	2 – 500 mL Amber glass HCl to pH<2, Cool to 4°C	7 days (40 days after extraction)
Diesel-Range Petroleum Hydrocarbons – Without Silica Gel Cleanup	NWTPH-Dx	Diesel – 250 Heavy Oil – 250 Mineral Oil – NR	2 – 500 mL Amber glass HCl to pH<2, Cool to 4°C	7 days (40 days after extraction)

The actual number and size of bottles required by the laboratory may vary from the above depending on individual laboratory needs. Multiple parameters will likely be analyzed from the same bottle(s).

Table 3.5-3, below, presents the field QC sample requirements for quarterly sampling events. Field QC samples will be analyzed for all parameters listed in **Table 3.5-2**, above.

Table 3.6-2**.** Quarterly Groundwater QC Sample Requirements

QC Sample	Purpose	Frequency	Total Number of QC Samples for Project	QA Objective
Field Groundwater Duplicate	Measure analytical precision	1 per event	1	30% RPD for water
Equipment Rinsate Blank	Measure of accuracy and representativeness. Quantify artifacts introduced during sampling, decontamination, transport from ambient air, and in decontamination water supply, or analysis of sample.	1 per event (collected using new dedicated tubing)	1	Target analytes not detected

RPD – Relative percent difference

3.7 TIDAL INFLUENCE STUDY

Ecology initially requested an assessment to evaluate whether tides influence groundwater at the Facility. The tidal study was suggested by Ecology due to varying groundwater flow directions observed at the Facility, which ranged from northwest to northeast based on the potentiometric surface maps from 2002 through 2004 monitoring events. However, one of the 10 monitoring events indicated an eastern flow direction and one event showed a southern flow direction. Tetra Tech discussed the tidal study request further with Mr. Christopher Maurer in November 2016. The discussion considered:

- The shallow gradient across the Facility (0.0009 feet/foot).
- Minimal elevation difference between wells (0.01 to 0.05 feet, with an average of 0.03 feet). The average does not include one outlier (0.18 feet between wells) measured in June 2004.
- Potential tidal influences associated with Commencement Bay (over 1 mile north); however, the CPLP tidal study was inconclusive and is much closer to the bay.
- Precipitation, runoff and infiltration from the site and adjoining properties. Of note, the Facility is paved while all surrounding adjoining properties are mostly unpaved, except where buildings are present.
- Surface water flow in Puyallup River (1,500 feet west of the Facility).
- On-site drains or conveyance lines (e.g., sewer, water, etc.) that may contribute water due to leaks or create preferential flow paths.
- Localized variations in groundwater flow directions due to variable hydraulic conductivities (e.g., landfill materials and voids versus sands) and preferential flow paths within the shallow aquifer.
- Well construction.
- Periodic compression and hydrostatic rebound of subsurface materials due to rail car traffic in the adjoining rail yard and on-site truck traffic.

Because of the number of variables that could affect groundwater levels and flow direction, Ecology agreed the tidal study does not need to be conducted at the time of this investigation.

However, Tetra Tech will conduct a limited qualitative assessment of possible sources of infiltration at and adjoining the Facility, as observed from the Facility or public rights-of-way. The evaluation will not include physical collection of precipitation or runoff data, rather it is meant to evaluate likely areas of potential runoff and infiltration

that could influence static water levels. Collection of this information will be conducted in conjunction with other on-site field activities described in Sections 3.3 through 3.6, as precipitation events may not always be occurring during each field event.

Features to consider may include:

- Building roof runoff;
- Surface runoff pathways;
- Infiltration points from paved areas, unpaved areas of infiltration, and storm drains;
- Facility discharge points (e.g. floor drains, conveyance pipes); and
- Other potential sources observed by field or site personnel.

Field personnel will document these features on a current aerial photograph of the site and surrounding area, in field notebooks, and through photographs. Field personnel will also document in the field notebook any precipitation events within 7 days of the groundwater monitoring event.

Tetra Tech will also obtain and review daily precipitation data for the Tacoma #1 station through NOAA's website at http://www.ncdc.noaa.gov/cdo-web/results over the duration data is collected by the pressure transducers and the days surrounding groundwater sampling events. Tacoma #1 station is approximately 1,700 feet southwest of the Facility.

3.8 WELL SURVEY

Tetra Tech will contract with APS Surveying & Mapping to survey the coordinates for each well following completion. If no wells are replaced, we still propose to conduct a survey to ensure that settlement due to site landfill degradation conditions, heavy truck traffic or other factors have not affected the elevation of the well measuring points. The groundwater monitoring wells will be surveyed based on Washington State Plan Coordinates, South Zone as expressed in U.S. survey feet and to the NAD83/2011 horizontal datum. Elevations will be measured at the ground, surface casing rim, and top of north side of PVC. Elevations will be recorded to 0.01-foot accuracy.

3.9 ECOLOGY EIM DATABASE MANAGEMENT

Ecology now requires that all analytical data collected at the Facility be incorporated into the Environmental Information Management (EIM) database prior to submitting site investigation reports. Tetra Tech will incorporate all existing and new data collected from past investigations and this investigation into the EIM database, as per Ecology requirements.

3.10 QUALITY ASSURANCE / QUALITY CONTROL

This section discusses quality assurance/quality control (QA/QC) requirements for this project including collection of QC field samples, field documentation, sample handling, decontamination, and data evaluation procedures. The project manager and field team lead(s) will coordinate all field efforts and be responsible for QA/QC for the project. The project manager will manage all data for the project once it has been collected. The data will be maintained in the project file in Missoula, Montana.

3.10.1 Field Documentation

Field personnel will use field notebooks, field logs, and maps to document all activities conducted at the Facility. SOP-10 will be used for guidance. Field personnel will also document any deviations to this SIWP and any other concerns or issues and how these issues were addressed.

3.10.2 Field & Laboratory QA/QC

Field personnel will collect QA/QC samples to evaluate precision, accuracy, representativeness, completeness, and comparability. Sections 3.4 and 3.5 discuss the number and types of QC field samples that will be collected for each investigation and media sampled. Field personnel will use SOP 13 for guidance.

The analytical laboratory will perform laboratory QA/QC in addition to the field QA/QC conducted by Tetra Tech. Laboratory QA/QC will include documenting the condition of the coolers and samples received, temperature of the samples, any discrepancies noted, and perform analysis of laboratory control samples, method blanks, matrix spike/matrix spike duplicates, laboratory duplicates, and other QA/QC analyses as per method requirements to ensure data quality.

3.10.3 Equipment Management

The field team leader will be responsible for inspection of all field equipment prior to each use and ensure the equipment has been properly maintained as per manufacturer requirements and calibration standards are current (e.g. not expired). Calibration of field equipment will be performed on a daily basis. Additional calibration will be performed based on instrument use and observed fluctuation. Calibration dates and times will be noted in the field logs.

Rental equipment will be inspected to ensure it is in working condition and fully charged prior to and during the field effort, as required. For equipment that requires batteries, field personnel will carry spare batteries for all events.

3.10.4 Decontamination

Field personnel will decontaminate all re-useable equipment prior to use at the Facility, between all soil sample intervals, and between each well (if re-useable equipment is used). SOP 11 will be used as guidance for equipment decontamination. Decontamination will generally include:

- Removing visible soil material with a stiff brush;
- Wash equipment with environmental degreasing detergent (e.g. Liquinox);
- Rinse with deionized or distilled water;
- Rinse with 10% dilute methanol; and
- Rinse with deionized or distilled water.

Additional scrubbing and rinsing maybe necessary to ensure the equipment is free of soil and contaminants. The equipment will be air dried or wiped with clean paper towels. All disposable decontamination equipment (e.g., paper towels and nitrile gloves) will be placed in a trash bag and disposed in a waste receptacle.

3.10.5 Sample Handling & Shipping

Field personnel will collect soil, groundwater, and QA/QC samples in laboratory-provided containers. The samples will be preserved as specified by the laboratory according to analytical methods. Samples will be handled and transferred under standard chain-of-custody procedures. Field personnel will stored samples in coolers containing doubled re-sealable bags filled with ice for preservation. Ice will be replenished as needed during the investigation, temporary storage, and prior to shipment to the laboratory.

Field personnel will document all samples in the field notebooks and field logs, and on the laboratory chain-of-custody documents (SOP-12). The chain-of-custody will remain with the samples throughout storage and transportation. Field personnel will ship samples as soon as feasible following sample collection. Samples will be shipped via overnight carrier to the analytical laboratory for analysis. Field personnel will sign, date, and document the time on the chain-of-custody upon transfer of the samples to the overnight courier and laboratory.

Field personnel will use SOP 9 as guidance for sample packing and shipping. All coolers will be packaged to protect against breakage and ensure samples will arrive at the laboratory within the temperature requirement of 4±2 degrees Celsius (°C). Even if samples are collected in the field and immediately hand-delivered to the laboratory, ice and a temperature blank will be included in each cooler to help preserve samples until logged in by the laboratory.

The chain-of-custody will be placed in re-sealable bag, the bag sealed, and the package securely taped to the lid of the cooler. Custody seals will be signed and placed on the outside of the cooler, crossing the lid opening. Any coolers being shipped for Saturday delivery will be marked “Saturday Delivery” with courier supplied labels.

Shipping labels will be securely adhered to the cooler lid, or if a large shipping label tag is used, the tag will be secured to the inside of the cooler with the label portion of the sticking out of the cooler. Field personnel shall not adhere the large label tag to the cooler handles as these are known to break off during shipping.

3.10.6 Data Evaluation

Tetra Tech will perform a limited data evaluation on all laboratory and field QC. The purpose of data evaluation will be to assess the accuracy, precision, representativeness, and completeness of the data collected. Data evaluation will be performed using EPA National Function Guidelines, Contract Laboratory Program (CLP) documents for guidance for both inorganic and organic data review (EPA 2011 and 2008, respectively). Data requiring qualification will be identified in data tables and the investigation report. A data evaluation summary will be included in the investigation report.

3.11 INVESTIGATION-DERIVED WASTE

All soil and water investigation-derived wastes (IDW) will be containerized in Department of Transportation (DOT)-approved 55-gallon drums. Tetra Tech will assist DII make arrangements for proper transportation and disposal of the wastes following receipt of final analytical data. Depending on the analytical results, additional sampling may be required by the disposal contractor prior to pick up and disposal.

Wastes such as paper towels, sampling gloves, and pump tubing will be placed in trash bags then into a waste receptacle for disposal in a solid waste landfill.

4.0 HEALTH & SAFETY PLAN

Tetra Tech will prepare a site-specific health and safety plan (HASP) for use during completion of this project. The HASP will be prepared in accordance to Occupational Safety and Health Administration (OSHA) requirements. Prior to implementation of the field work, site-specific project personnel will be identified in the HASP and the HASP finalized. All personnel selected to work on this project will have OSHA 40-hour HAZWOPER training and be current with OSHA 8-hour HAZWOPER refresher training.

Truck traffic through the work area is expected during on-site investigation work. Tetra Tech will coordinate with site personnel prior to and during each investigation event to ensure worker safety. Field personnel will review the HASP and conduct a tailgate safety meeting prior to each field investigation and sampling event. JSAs will be prepared and reviewed, as needed, to identify any additional site-specific concerns. Any job safety analyses (JSAs), tailgate safety meeting, or other forms completed during the project will be kept in the project file.

5.0 PROJECT REPORTING

Tetra Tech will prepare the following reports:

- General Communications – Tetra Tech will provide e-mail and/or updates as needed over the duration of the project regarding project schedule, project status, any issues that arise, etc.
- Site Investigation Report – The SI report will present and evaluate all data collected during this investigation. The report will include a list of any deviations from this work plan, provide a summary of the data validation effort, and discuss the results. The report appendices will include data tables, figures, laboratory analytical reports, and copies of field notes, boring and well logs.

6.0 SCHEDULE

Tetra Tech anticipates the field work will be conducted during the summer/fall 2016. The schedule may vary depending timing of notice to proceed, subcontractor and field personnel availability, weather, or other unforeseen delays. Personnel from Tetra Tech's Montana and Washington offices will provide field support during the project.

We anticipate the work will be conducted over a 1 to 2 week time period for the initial inspection and soil and groundwater sampling work. Exceptions will include instances such as well rehabilitation or abandonment that will require additional work. Additional time and equipment may be needed if wells require clearing of sediment from the wells or over-drilling of the wells with a hollow stem auger in cases where wells are not fully open over their entire screen length (see associated cost estimate).

The work schedule is based on a standard, Monday through Friday, 8-hour workweek. The schedule does not include after hours or weekend work, or delays such as inclement weather, equipment breakdown, on-site truck traffic or other unforseen delays. For field work, special arrangements will need to be made with field personnel and the drilling subcontractor if evening or weekend work is required due to special facility requirements (e.g. to accommodate facility truck traffic). The driller costs are based on an 8-hour on-site workday. Field personnel labor is based on 8 hours on-site time plus field preparation/demobilization, paperwork, sample handling and packaging (e.g., icing coolers, transport to laboratory, etc.).

The analytical laboratory requires 2-weeks advance notice for bottle/jar order preparation. Laboratory analytical report turn-around-times are typically 10 to 15 workdays. However, turn-around-times could be longer depending on number of project samples received and/or during peak field times when the laboratory is receiving abundant samples for other projects.

We anticipate submitting the report to DII approximately 15 work days following receipt of all final laboratory reports, tidal and precipitation data.

7.0 REFERENCES

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APPENDIX A
FIGURES

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Topographic Quad Background: Tacoma North 1993 (North Half) / Tacoma South 1978 (South Half)

January 2017

Figure 1 - Location Map
Darling International, Inc. LUST Site 2041
Marc Avenue
Tacoma, Washington
114-570494

G:\Projects\TTMissoula\114-570494.100 Darling-Tacoma\GIS\ArcMap\Figure2.mxd

Background Aerial Photograph: ESRI Maps Online - Bing Imagery Hybrid: 2011 (http://www.bing.com/maps)

January 2017

Groundwater Monitoring Wells

Fence

Former USTs

Proposed Subsurface Soil Boring

Proposed Replacement Well (if needed)

Figure 2 - Site Map

Darling International, Inc. LUST Site
2041 Marc Avenue
Tacoma, Washington