MEMORANDUM

To: Mary Monahan
Washington State Department of Ecology
Toxics Cleanup Program, Central Regional Office

Date: March 2, 2017

From: Justin L. Clary, PE
Carolyn Wise, GIT

Project: 0818.02.01

RE: Amended Compliance Monitoring Plan
Former Tiger Oil Site
Facility Site ID: 469; Cleanup Site ID: 4919
2312 West Nob Hill Boulevard, Yakima, Washington 98902

On behalf of the City of Yakima (City), Maul Foster & Alongi, Inc. (MFA) has been conducting post-remedial action quarterly groundwater monitoring at the former Tiger Oil site (the Site), located at 2312 West Nob Hill Boulevard in Yakima, Washington. Since groundwater monitoring activities began in November 2015, monitoring has been conducted in accordance with the activities described in the Washington State Department of Ecology (Ecology)-approved groundwater monitoring plan (GMP) for the Site prepared by MFA dated August 26, 2015 and with monitoring requirements outlined in the Washington State Model Toxics Control Act (MTCA) (Washington Administrative Code 173-340-410).

Following the completion of five quarterly groundwater events at the Site, sampling of additional monitoring wells and inclusion of biannual analyses at a selection of monitoring wells was recommended to further evaluate the bioremediation of the petroleum hydrocarbons in groundwater. With Ecology's concurrence and the City's approval, the following sections of the GMP are amended through this memorandum to reflect the additional monitoring parameters. Revisions to the applicable GMP sections are reflected in underline (addition) and strikeout (deletion) mode for ease of revision identification.

GROUNDWATER MONITORING PLAN MAIN TEXT

4.3 Groundwater Monitoring Network

To meet the groundwater monitoring requirements stipulated in WAC 173-340-410, quarterly groundwater monitoring activities will be conducted at the following types of wells: 1) a monitoring

well located upgradient of the known dissolved phase plume; 2) monitoring wells within the confirmed dissolved phase plume; and 3) sentry monitoring wells located beyond the leading edge of the dissolved phase plume (see Figure 5). Groundwater monitoring will be conducted at the following site-specific wells:

- **Upgradient/background well:** MW-10
- **Dissolved phase plume monitoring wells:** YMW-1, YMW-2, YMW-3, S-2, MW-7, MW-9, MW-11, MW-13, KMW-5, KMW-6, KMW-7, KMW-16, MWG-2, and MWG-3
- **Sentry wells:** KMW-14 and KMW-15

Tables 2 and 3 present a summary of the most recently observed conditions of each of the network wells. Construction logs for the recently constructed monitoring wells YMW-1 through YMW-3 are included in Appendix A.

4.4 Sampling and Analysis

Groundwater monitoring will include measuring the presence and thickness of LNAPL, water levels, and water quality parameters (e.g., dissolved oxygen, pH, temperature, specific conductance, and oxygen reduction potential), and collection and analysis of groundwater samples, which will be conducted in accordance with the methods and protocol outlined in the Sampling and Analysis Plan (see Appendix B).

Groundwater samples will be analyzed for IHSs using the following analytical methods, or other comparable analytical methods deemed to be suitable alternatives and as approved for use by Ecology:

- Gasoline-range organics by Northwest Method NWTPH-Gx.
- Petroleum-associated volatile organic compounds, specifically benzene, toluene, ethylbenzene, and xylenes by United States Environmental Protection Agency (USEPA) Method 8260 or 8021.

Groundwater samples from three source area wells (YMW-2, YMW-3, and MW-9) will be analyzed for geochemical parameters biannually to better evaluate the natural attenuation of the dissolved-phase petroleum hydrocarbon plume:

- Nitrate by USEPA Method 353.2.
- Sulfate by American Society for Testing and Materials D516-07

- Ferrous iron by Iron (Ferrous) Color Disc Test Kit, Model IR-18C, 0.2-7 mg/L
- Total manganese by USEPA Method 200.8

The following activities will be conducted during each groundwater monitoring event:

- Groundwater sample collection and analysis from each applicable monitoring well for evaluating compliance with CULs
- Water level measurements in each applicable monitoring well (see Table 2 and Figure 5) for evaluating hydraulic gradient trends
- Analysis of IHS concentration trends relative to associated CULs, and geochemical parameter monitoring to assess the efficacy of in situ bioremediation and assessment of the trend of biodegradation of IHSs

FIGURE 5
Figure 5 has been revised to include monitoring wells KMW-5, MWG-2, and S-2 as groundwater monitoring network wells (see attached Figure 5).

TABLE 2
Table 2 has been revised in underline (addition) and strikeout (deletion) mode to include monitoring wells KMW-5, MWG-2, and S-2 as groundwater monitoring network wells (see attached Table 2).

APPENDIX B – SAMPLING AND ANALYSIS PLAN

5.2 Laboratory Test Methods and Reporting Limits

5.2.1 Groundwater

In accordance with the QA/QC requirements set forth in this SAP, a Washington State-accredited laboratory will perform the following analyses. Laboratory methods are summarized below and in the attached table

- Gasoline-range total petroleum hydrocarbons by Northwest Method NWTPH-Gx
- Petroleum associated VOC specifically benzene, toluene, ethylbenzene, and xylenes by United States Environmental Protection Agency (USEPA) Method 8260 or 8021
- Nitrate by USEPA Method 353.2.
- Sulfate by American Society for Testing and Materials D516-07

- Ferrous iron by Hach 26672-88
- Total manganese by USEPA Method 200.8

5.7 Instrumentation

5.7.1 Field Instrumentation

Field instruments will be used during the investigations. The following field equipment may require calibration before use and periodically during sampling activities:

- pH meter
- Conductivity meter
- Dissolved-oxygen meter
- Oxygen/reduction potential meter
- Turbidity meter
- Thermometer
- Photoionization detector
- Electronic water-level probe
- Iron (Ferrous) Color Disc Test Kit, Model IR-18C, 0.2-7 mg/L

Field-instrument calibration and preventive maintenance will follow the manufacturers' guidelines, and any deviations from the established guidelines will be documented.

TABLE

The table included in Appendix B of the GMP has been revised in underline (addition) and strikeout (deletion) mode to include biannual analyses of geochemical parameters including: nitrate, sulfate, ferrous iron, and total manganese (see attached Table).

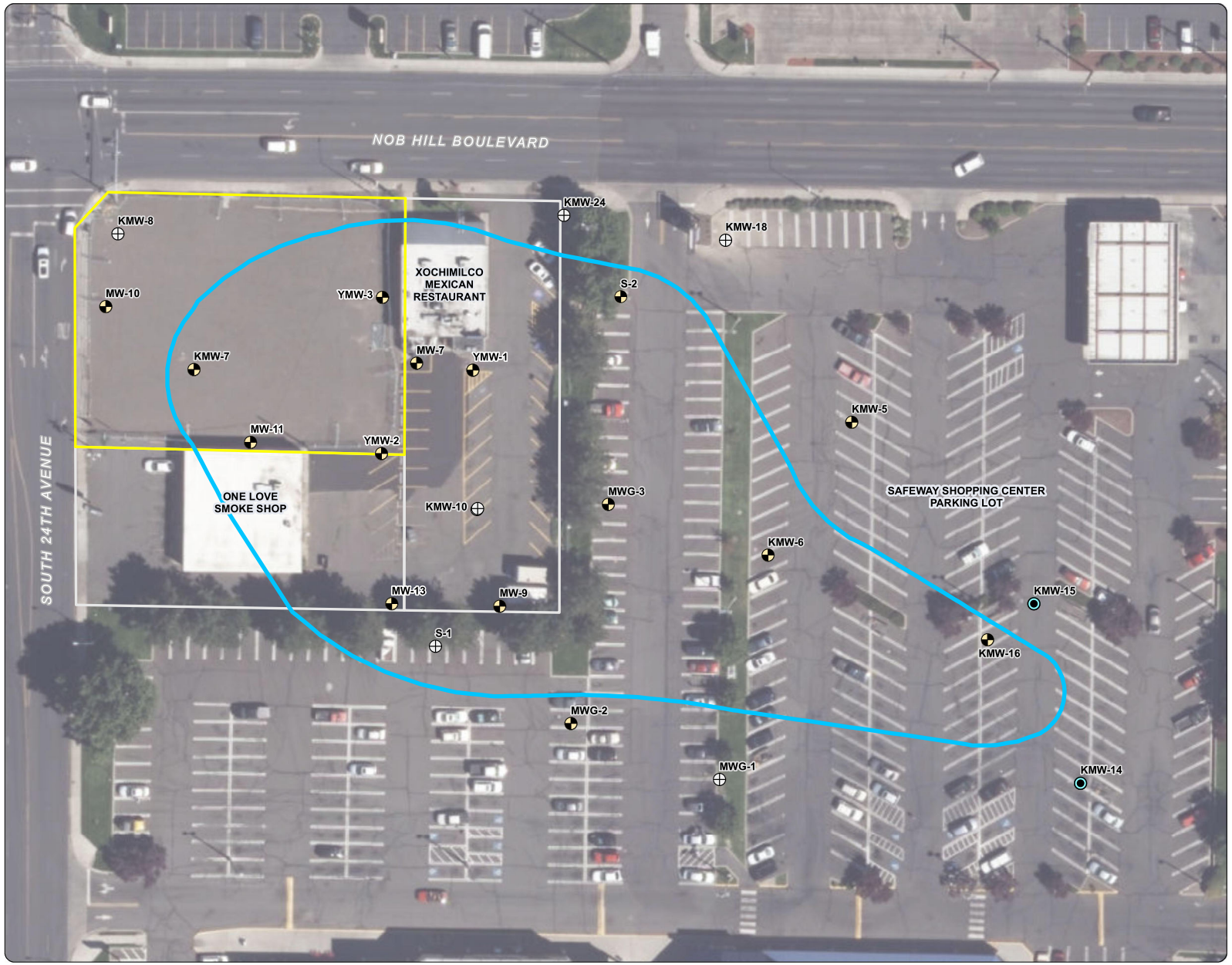

Figure 5
Groundwater Monitoring Well Network

City of Yakima
Former Tiger Oil Site
Yakima, Washington

Legend

- GW Monitoring Network Well
- Monitoring Well
- Sentry Monitoring Well
- Approximate Dissolved Phase Plume, 2013
- Former Tiger Oil Property Boundary
- Adjacent Taxlot Boundaries

0 25 50
Feet

Sources: Aerial photograph obtained from Esri ArcGIS Online; Infiltration Gallery delineated by Maul Foster & Alongi, Inc.; stormwater line and taxlot boundaries obtained from City of Yakima; all other features obtained from PLSA Engineering & Surveying.

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Print Date: 3/1/2017
Approved By: jdary
Produced By: cwise
Project: 0818.02.01.06

Table 2
Groundwater Monitoring Well Network - Groundwater Analytical Results 2013
Former Tiger Oil Site
Yakima, Washington

Well ID	IHSs Above CULs[a]	Gasoline TPH Concentration (ug/L)[a]	Benzene Concentration (ug/L)[a]	Location Description	Notes
KMW-5	--	15	<0.1	Downgradient of historical source area. On Safeway parking lot property.	Analytical results from TerraGraphics, April 2013.
KMW-6	Benzene	<50	**5.8**	Downgradient of historical source area. On Safeway parking lot property.	Analytical results from TerraGraphics, April 2013.
KMW-7	Benzene	230	**6.0**	Located within historical source area.	Analytical results from TerraGraphics, April 2013.
KMW-14	--	130	2.5	Sentry well. Adjacent east-southeast of dissolved phase plume.	Analytical results from TerraGraphics, April 2013.
KMW-15	--	15	<0.1	Sentry well. Adjacent east-southeast of dissolved phase plume.	Analytical results from TerraGraphics, April 2013.
KMW-16	Benzene	250	**5.5**	Downgradient of historical source area. Leading edge of dissolved phase plume. On Safeway parking lot property.	Analytical results from TerraGraphics, April 2013.
S-2	Gasoline TPH & benzene	**3,900**	**3,100.0**	Downgradient of historical source area. On Safeway parking lot property.	Analytical results from TerraGraphics, April 2013.
MW-7	Gasoline TPH & benzene	**LNAPL**	**LNAPL**	Located adjacent and downgradient of historical source area.	LNAPL (2.34 feet thick) recorded by TerraGraphics in April 2013.
MW-9	Gasoline TPH & benzene	**6,000**	**25**	Downgradient of historical source area.	Analytical results from TerraGraphics, April 2013.
MW-10	--	No LNAPL	No LNAPL	Upgradient monitoring well.	No analytical results from G-Logics, March 2010. Report showed no LNAPL measured.

Table 2
Groundwater Monitoring Well Network - Groundwater Analytical Results 2013
Former Tiger Oil Site
Yakima, Washington

Well ID	IHSs Above CULs[a]	Gasoline TPH Concentration (ug/L)[a]	Benzene Concentration (ug/L)[a]	Location Description	Notes
MW-11	Gasoline TPH & benzene	**LNAPL**	**LNAPL**	Located within historical source area.	LNAPL (1.46 feet thick) recorded by TerraGraphics in April 2013.
MW-13	Gasoline TPH	**1,800**	1.9	Downgradient of historical source area.	Analytical results from TerraGraphics, April 2013.
MWG-2	--	<50	<0.1	Downgradient of historical source area. On Safeway parking lot property.	Analytical results from TerraGraphics, April 2013.
MWG-3	Benzene	470	**600**	Downgradient of historical source area. On Safeway parking lot property.	Analytical results from TerraGraphics, April 2013.
YMW-1	Gasoline TPH & benzene	**34,000**	**4,900**	Located adjacent and downgradient of historical source area.	YMW-1 replaced previous well KMW-22 which was decommissioned during Interim Remedial Action. Analytical results from TerraGraphics, April 2013.
YMW-2	Gasoline TPH & benzene	**LNAPL**	**LNAPL**	Located adjacent and downgradient of historical source area.	YMW-2 replaced previous well MW-8 which was decommissioned during Interim Remedial Action. LNAPL noted by TerraGraphics in April 2013.
YMW-3	Gasoline TPH & benzene	**LNAPL**	**LNAPL**	Located adjacent and downgradient of historical source area.	YMW-3 replaced previous well KMW-20 which was decommissioned during Interim Remedial Action. LNAPL (0.01 feet thick) recorded by TerraGraphics in April 2013.

Table 2
Groundwater Monitoring Well Network - Groundwater Analytical Results 2013
Former Tiger Oil Site
Yakima, Washington

Notes:

Bold indicates concentration exceeds the gasoline range organics TPH CUL of 800 ug/L, and/or benzene CUL of 5 ug/L (MTCA Method A CUL), or have free product. Monitoring well with exceedance is shown in bold.

CUL = cleanup level.

IHS = indicator hazardous substance.

LNAPL = light non-aqueous phase liquid

MTCA = Model Toxics Control Act

TPH = total petroleum hydrocarbons

ug/L = micrograms per liter.

[a]Data from TerraGraphic's Final Groundwater Sampling Report (dated June 12, 2013) for all listed wells except MW-10. Data from G-Logics' Quarterly Monitoring (dated March 1, 2010) for well MW-10.

Table
Groundwater Sample Handling Summary
Former Tiger Oil Site
Yakima, Washington

Analyte	Method	Suggested Volume	Container	Number of Containers	Preservative	Storage Temperature	Holding Time from Collection
Gasoline-range organics	NWTPH-Gx	40 milliliter	VOA	3	HCL pH < 2	4 degrees C	14 days
BTEX	USEPA 8021B/8260	40 milliliter	VOA	3	HCL pH < 2	4 degrees C	14 days
Nitrate	USEPA 353.2	250 milliliter	HDPE	1	none	4 degrees C	48 hours
Sulfate	ASTM D516-07	250 milliliter	HDPE	1	none	4 degrees C	28 days
Total Manganese	USEPA Method 200.8	500 milliliter	HDPE	1	HNO_3, pH < 2	4 degrees C	6 months
Ferrous Iron[a]	Hach 26672-88	NA	NA	NA	NA	NA	NA

NOTES:
--- = no preservative
ASTM = American Society for Testing and Materials.
BTEX = benzene, toluene, ethylbenzene, xylenes.
C = Celsius.
HCL = hydrochloric acid.
HDPE = high-density polyethylene.
HNO_3 = nitric acid.
NA = not applicable.
NWTPH = Northwest Total Petroleum Hydrocarbons.
USEPA = U.S. Environmental Protection Agency.
VOA = volatile organic analysis vial.
VOC = volatile organic compound.
[a]Ferrous iron will be measured in the field using a Iron (Ferrous) Color Disc Test Kit, Model IR-18C, 0.2-7 mg/L kit.