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Flint Hills Resources Alaska, LLC

Long-Term Monitoring Plan

North Pole Refinery
North Pole, Alaska
DEC File Number: 100.38.090

FINAL October 2014

ARCADIS

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Long-Term Monitoring Plan

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DEC File Number: 100.38.090

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Figures

Attachment

Acronyms and Abbreviations

ADEC	Alaska Department of Environmental Conservation
ARCADIS	ARCADIS U.S., Inc.
COC	constituent of concern
CSM	conceptual site model
FHRA	Flint Hills Resources Alaska, LLC
LNAPL	light nonaqueous phase liquid
LTM	Long-Term Monitoring
NPR	North Pole Refinery
OCP	Final Onsite Cleanup Plan
OMM	Operations Maintenance and Monitoring
RSAP	Revised Sampling and Analysis Plan
site	Flint Hills Resources Alaska, LLC North Pole Refinery, an idled petroleum refinery located on H and H Lane in North Pole, Alaska
SMP	Onsite Soil Management Plan
VPT	vertical profiling transect
µg/L	micrograms per liter

1. Introduction

On behalf of Flint Hills Resources Alaska, LLC (FHRA), ARCADIS U.S., Inc. (ARCADIS) prepared this Long-Term Monitoring (LTM) Plan, as part of the Final Onsite Cleanup Plan (OCP), for the FHRA North Pole Refinery (NPR), located on H and H Lane in North Pole, Alaska (site). This LTM Plan includes the following items:

- Groundwater sampling program objectives and schedule.
- Groundwater sampling and analysis plan including all constituents of concern (COCs) and the appropriate frequencies based on concentration.
- Description and maps showing the alternative point of compliance monitoring wells along with major site features.
- List and figures of all monitoring wells to be included in LTM including alternative point of compliance wells and selected upgradient and downgradient wells for trend analysis.
- The framework to determine future modifications to monitoring network and/or frequency.
- Onsite Soil Management Plan (SMP).

Groundwater COCs for the site were identified by comparing detected concentrations with Alaska Department of Environmental Conservation (ADEC) cleanup levels presented in 18 AAC 75.345 Table C. Sulfolane is currently under ADEC review to determine a sulfolane cleanup number for the site.

This LTM plan adopts and references information, work, and analysis described in more detail in the Revised Sampling and Analysis Plan (RSAP, ARCADIS 2014).

2. Groundwater Sampling Program Objectives

As of August 2014, 306 monitoring wells are currently present onsite at the NPR site. Periodic monitoring of many of these wells has been ongoing since 1987. The groundwater concentration data have been integral in developing a conceptual site model (CSM) and documenting current site groundwater conditions. A LTM Plan is proposed for use in conjunction with onsite remedial activities, as documented in the

OCP (ARCADIS 2014). The objectives of the scope of monitoring summarized in this LTM Plan are to:

- Monitor the nature and extent of COCs onsite.
- Evaluate the potential exposure to COCs.
- Evaluate groundwater remediation system effectiveness.
- Monitor residual sulfolane concentrations between the groundwater recovery system and the property boundary.
- Evaluate contaminant trends.

3. Groundwater Sampling Frequency and Schedule

The most recent revision of the RSAP was included as Appendix A to the Fourth Quarter 2013 Groundwater Monitoring Report (ARCADIS 2014). This plan adopts and references information, work, and analysis described in more detail in the RSAP. The groundwater monitoring schedules and frequencies outlined in this LTM Plan supersede those of the RSAP for work beyond fourth quarter 2014; however procedures for conducting the activities included in this plan, such as groundwater level gauging and monitoring well purging, remain the same as outlined in the RSAP. The groundwater elevation monitoring network is summarized in Table 3-1 and shown on Figures 3-1 through 3-4. The sampling schedule to begin in first quarter 2015 is summarized in Tables 3-2, 3-3, 3-4, and 3-5 and is shown on Figures 3-5 through 3-11. The following annual schedule is proposed for monitoring based on the assigned monitoring frequencies:

Frequency	Monitoring Schedule
Monthly	Monthly
Quarterly	Quarterly
Semiannual	First and third quarters
Annual	Third quarter

Semi-annual light nonaqueous phase liquid (LNAPL) monitoring will target the water table minima (typically in March and late October). Groundwater levels will be recorded during LNAPL monitoring events and compared to seasonal water levels in the

monitoring reports. A representative graph of groundwater table elevation from a nearby well with a pressure transducer will be provided to show relative water level, if available. Semiannual groundwater monitoring will be completed in the first and third quarters. Annual monitoring will be completed in the third quarter to allow the greatest chance for thawed conditions and to minimize cold weather limitations. Note that the MW-355 nest will be included in the Groundwater Elevation Monitoring Network through 2015, then evaluated for the value the data provide in future LTM Plan revisions.

Due to the extreme seasonal cold occasionally preventing field work in the winter months, field staff may not be able to complete the scope of work. If the scope of work identified for the first quarter cannot be complete in the quarter, it will continue into the second quarter.

4. Alternative Points of Compliance and Monitoring Networks

Alternative Points of Compliance will be established to monitor the effectiveness of the groundwater remediation system and to document that applicable cleanup levels or performance standards (as defined in the OCP) are being achieved. The alternative point of compliance wells are:

- Vertical profiling (VPT) wells (MW-301 through MW-306 well clusters)
- Monitoring well MW-141-20.

Numerous monitoring wells were retained for LTM and the monitoring networks are summarized in Tables 3-1 through 3-5 and shown on Figures 3-1 through 3-11. The routine groundwater elevation network is generally unchanged from the network presented in the Revised Sampling and Analysis Plan Version 6 (RSAP, ARCADIS 2014) other than the inclusion of new groundwater monitoring wells installed since RSAP submittal and the changes discussed in Section 5.1. Groundwater elevation measurements are collected periodically to evaluate hydrologic capture as described in the Operations Maintenance and Monitoring (OMM) Plan (Barr 2014).

The monitoring well networks were selected through the methods presented in Section 5.

5. Framework for Determining Monitoring Well Networks and Modifications

The following frameworks were used to determine the appropriate monitoring frequencies for individual wells within the monitoring networks. These methods were used to establish the monitoring frequency presented in this LTM plan and are anticipated to be used to guide future adjustments of the monitoring network. Monitoring frequencies from the OMM Plan (Barr 2014) are included below.

5.1 Groundwater Elevation Monitoring

The groundwater elevation monitoring well network previously presented in the RSAP is retained with the exception of one change. Several Phase 8 monitoring wells are now included in the groundwater elevation monitoring network. Monitoring wells MW-177-90, O-1, O-29 and S-54 were removed from the network due to redundancy. The monitoring well network is summarized in Table 3-1.

5.2 Light Nonaqueous Phase Liquid

The LNAPL criteria and corresponding monitoring frequency are summarized in Table 5-1. Because LNAPL is largely limited to the developed portion of the site there are numerous groundwater monitoring wells located between the LNAPL footprint and the VPT. Therefore, the groundwater recovery system and the known extent of LNAPL impacts are used as reference points for identifying the monitoring frequencies. Monitoring wells without LNAPL present are assigned a decreasing monitoring frequency with increasing distance downgradient of the groundwater recovery system. For example, wells further downgradient of the groundwater recovery system will be monitored less frequently than those proximate to the system.

Table 5-1: LNAPL Migration and Thickness Monitoring Criteria

Category	Monitoring Frequency
Active groundwater recovery wells in the LNAPL impacted area	Monthly
Wells located immediately downgradient of GAC East without LNAPL present	Quarterly
Wells where LNAPL recovery was conducted within the last year	Quarterly
Wells with LNAPL present, but recovery was not possible within the last year[1]	Semiannual[3]
Wells located further downgradient of GAC East (no LNAPL present)[2]	Semiannual[3]

Category	Monitoring Frequency
Wells located upgradient/cross-gradient of GAC East (no LNAPL present)	Annual[3]

Notes:
[1]An exception to the above monitoring frequency is monitoring well MW-334-15, which will continue to be monitored on a monthly schedule.
[2]Wells located more than 300 feet away from the nearest active recovery well (e.g. S-9 and MW-139-25).
[3]Semiannual and annual LNAPL monitoring will be performed at hydrogeologic minima.

5.2 Sulfolane

The monitoring frequency framework for wells in the sulfolane monitoring network are specified in Table 5-2. The hydraulic capture performance standard of 15 micrograms per liter (µg/L) sulfolane is established as the primary driver for determining sulfolane monitoring frequency for selected onsite monitoring wells. The sulfolane cleanup level for the site is under ADEC review. Once the final sulfolane cleanup level is established by ADEC, the monitoring frequency will be evaluated.

Phase 8 monitoring wells were installed in 2013. Although some of the Phase 8 monitoring wells do not have four quarters of monitoring data as of the submittal date of this LTM Plan, a monitoring frequency has been proposed based on data collected to date.

Table 5-2: Sulfolane Monitoring Criteria

Category[1]	Monitoring Frequency
Selected[2] wells with concentrations greater than 15 µg/L or the final sulfolane cleanup level for the site, whichever is higher	Quarterly
Selected wells with detectable concentrations below 15 µg/L or the final sulfolane cleanup level for the site, whichever is higher[2]	Semiannual
Selected wells with concentrations below the detection limit for two sequential samples	Annual
Groundwater remediation system performance monitoring network	Generally quarterly as assigned in the OMM plan.

Notes:
[1] Data from the last 2 years (since third quarter 2012) were considered for establishing the LTM well network frequency.

[2]Wells which have not historically been included in the groundwater monitoring program were not selected for ongoing long-term monitoring. Generally these wells have either had consistent non-detectable concentrations, or other monitoring wells sampled under the LTM program are located in close proximity.

5.3 Other Constituents of Concern

Other COCs in groundwater are set out in the OCP. Table 5-3 summarizes the monitoring frequency framework for these other COCs. The criteria are based on benzene, which is consistent with past monitoring decisions at the NPR.

Table 5-3: Other Constituents of Concern Monitoring Criteria (based on benzene concentration data)

Category	Monitoring Frequency[1]
North property boundary water table wells	Every five years[2]
VPT wells with screens less than 30 feet below ground surface[3]	Biennial (every 2 years)[2]
Wells with benzene concentrations less than 50 µg/L	Annual
Wells with benzene concentrations greater than 50 µg/L	Semiannual
Groundwater remediation system performance monitoring network	Generally semiannual as assigned in the OMM plan.

Note:

[1] Data from the last 2 years (since third quarter 2012) were considered for establishing the LTM well network frequency.

[2] Wells not previously sampled for Other COCs will be sampled for a minimum of two consecutive events before establishing a frequency less often than annual.

[3]Only intervals within 30 feet of the ground surface will be sampled at the VPT.

Sample locations and frequency based on the above rationale are listed in Tables 2-1, 2-2, 2-3 and 2-4 of this LTM Plan.

5.4 Trend Analysis and Evaluation of the Sampling Program

Statistical concentration trends will continue to be evaluated at the site as appropriate. Historical concentration data along with changes in statistical trends (magnitude and rate of change) will be taken into account while evaluating modifications to sulfolane or other COC monitoring networks and frequency.

Sulfolane concentration trends will be compared to concentrations of 15 µg/L for sulfolane (or the sulfolane cleanup number established for the site) and 50 µg/L benzene for other COCs as discussed above. If sulfolane concentrations in a monitoring well included in the monitoring network increase from less than 15 µg/L to greater than 15 µg/L, the monitoring frequency will increase to quarterly. Similarly, if the benzene concentrations in a monitoring well increase from less than 50 µg/L to greater than 50 µg/L, the monitoring frequency will increase to semiannual. If a well concentration trend is stable or decreasing, the sampling frequency may be reduced as determined on a well by well basis. Prior to any adjustment, a pre-scoping meeting will be held if FHRA deems it necessary. Upon request by FHRA to modify evaluation frequency, ADEC will act upon the request within 30 days provided the submittal is complete.

Monitoring schedule and frequency will be reevaluated on an annual basis and results of the evaluations will be provided annually in the groundwater monitoring reports or more frequently, if appropriate. An updated LTM Plan will be submitted annually. Based on current data, the evaluation of groundwater concentration trends, and groundwater modeling conducted for the site, onsite sulfolane concentrations in groundwater are generally decreasing; these declining trends are expected to continue, and sulfolane concentrations at the alternative points of compliance are currently estimated to reach 15 µg/L within approximately 4 to 6 years. This number is subject to change as the remediation systems continue to operate and new data is generated and evaluated.

6. Soil Management

NPR workers, contractors, and other third parties performing ground-disturbing activities within the site boundary will properly manage soil potentially contaminated with COCs (or “impacted soil”). A SMP has been prepared to provide guidance for potential ground-disturbing activities to protect workers from exposure to impacted soil associated with former site operations and is included as Attachment 1.

7. Documentation of Changes to Long-Term Monitoring Plan

Modifications to the monitoring network and schedule will be documented in the LTM Plan, which will be updated as necessary and submitted as a stand-alone document at least annually. The RSAP will be updated with the Fourth Quarter 2014 Groundwater Monitoring Report. With this update, the RSAP will only describe sampling

methodologies and procedures; groundwater monitoring networks and schedules will be retained and updated in the LTM Plan.

8. Long-Term Monitoring Plan Implementation and Reporting Schedule

FHRA plans to implement the LTM Plan during first quarter 2015. Monitoring results will continue to be reported in quarterly groundwater monitoring reports through fourth quarter 2014. Beginning in 2015 groundwater monitoring reports will be submitted semi-annually on or before July 31st and January 31st of each year.

FHRA has agreed to install two shallow water table monitoring wells, one located in the area of piezometer PZ-2 and the other to the northwest of monitoring well MW-355. The well installation scope of work and proposed location of the two monitoring wells will be provided to ADEC in a brief technical memo. The technical memo will be provided to ADEC in the spring of 2015 for its review and approval. Once approved, the monitoring wells will be installed.

9. References

ARCADIS U.S., Inc. 2014. Revised Sampling and Analysis Plan. January 31, 2014.

Barr Engineering Company. 2014. Operations, Maintenance and Monitoring Plan – Groundwater Remediation System. October 2014.

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Tables

Table 3-1
Groundwater Elevation Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Zone	Comments
MW-101-60	10-55	
MW-101A-25	Water Table	
MW-102-70	55-90	
MW-104-65	10-55	
MW-105-65	10-55	
MW-105A-25	Water Table	
MW-106-25	Water Table	
MW-109-15	Water Table	
MW-110-20	Water Table	
MW-110-65	10-55	added 3/11/14
MW-113-15	Water Table	
MW-125-25	Water Table	
MW-129-40	10-55	
MW-130-25	Water Table	
MW-131-25	Water Table	
MW-133-20	Water Table	
MW-135-20	Water Table	
MW-140-25	Water Table	
MW-141-20	Water Table	
MW-143-20	Water Table	
MW-144A-25	Water Table	
MW-144BR-90	55-90	
MW-145-20	Water Table	
MW-146A-15	Water Table	
MW-146B-30	10-55	
MW-147B-25	10-55	
MW-148A-15	Water Table	
MW-148B-30	10-55	
MW-148C-55	10-55	
MW-148D-150	90-160	
MW-149A-15	Water Table	
MW-149B-20	10-55	added 3/11/14
MW-154A-75	55-90	
MW-173A-15	Water Table	
MW-173B-150	90-160	
MW-174-15	Water Table	added 3/11/14
MW-174A-50	10-55	
MW-174B-90	55-90	
MW-175-90	55-90	
MW-176A-15	Water Table	added 3/11/14
MW-176B-50	10-55	
MW-176C-90	55-90	
MW-178C-90	55-90	
MW-179A-15	Water Table	
MW-179B-50	10-55	
MW-179C-90	55-90	
MW-179D-135	90-160	
MW-180B-50	10-55	
MW-180C-90	55-90	

Table 3-1
Groundwater Elevation Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Zone	Comments
MW-186A-15	Water Table	
MW-186B-60	10-55	
MW-186C-100	90-160	
MW-186D-135	90-160	
MW-186E-75	55-90	
MW-192A-15	Water Table	
MW-192B-55	10-55	
MW-195A-15	Water Table	
MW-195B-150	90-160	
MW-197A-65	10-55	
MW-198-150	90-160	
MW-199-150	90-160	
MW-300-150	90-160	
MW-301-60	10-55	
MW-301-70	55-90	
MW-301-CMT-10	Water Table	
MW-301-CMT-20	10-55	
MW-301-CMT-30	10-55	
MW-301-CMT-40	10-55	
MW-301-CMT-50	10-55	
MW-302-70	55-90	
MW-302-80	55-90	
MW-302-95	55-90	
MW-302-110	90-160	
MW-302-CMT-10	Water Table	
MW-302-CMT-20	10-55	
MW-302-CMT-30	10-55	
MW-302-CMT-40	10-55	
MW-302-CMT-50	10-55	
MW-303-70	55-90	
MW-303-80	55-90	
MW-303-95	55-90	
MW-303-130	90-160	
MW-303-CMT-9	Water Table	
MW-303-CMT-19	10-55	
MW-303-CMT-29	10-55	
MW-303-CMT-39	10-55	
MW-303-CMT-49	10-55	
MW-303-CMT-59	10-55	
MW-304-15	Water Table	
MW-304-70	55-90	
MW-304-80	55-90	
MW-304-96	55-90	
MW-304-125	90-160	
MW-304-150	90-160	
MW-304-CMT-10	Water Table	
MW-304-CMT-20	10-55	
MW-304-CMT-30	10-55	
MW-304-CMT-40	10-55	

Table 3-1
Groundwater Elevation Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Zone	Comments
MW-304-CMT-50	10-55	
MW-304-CMT-60	10-55	
MW-305-70	55-90	
MW-305-80	55-90	
MW-305-100	90-160	
MW-305-CMT-8	Water Table	
MW-305-CMT-18	10-55	
MW-305-CMT-28	10-55	
MW-305-CMT-38	10-55	
MW-305-CMT-48	10-55	
MW-305-CMT-58	10-55	
MW-306-15	Water Table	
MW-306-70	55-90	
MW-306-80	55-90	
MW-306-100	55-90	
MW-306-150	90-160	
MW-306-CMT-10	Water Table	
MW-306-CMT-20	10-55	
MW-306-CMT-30	10-55	
MW-306-CMT-40	10-55	
MW-306-CMT-50	10-55	
MW-306-CMT-60	10-55	
MW-307-150	90-160	
MW-309-15	Water Table	
MW-309-66	10-55	
MW-310-15	Water Table	
MW-310-65	10-55	
MW-310-110	90-160	
MW-321-15	Water Table	
MW-321-65	10-55	
MW-330-20	Water Table	added 3/11/14
MW-330-65	10-55	
MW-334-15	Water Table	added 3/11/14
MW-334-65	10-55	
MW-334-85	55-90	added 3/11/14
MW-336-20	Water Table	added 3/11/14
MW-336-55	10-55	added 3/11/14
MW-355-15	Water Table	
MW-355-55	10-55	
MW-358-15	Water Table	added 3/11/14
MW-358-20	Water Table	added 3/11/14
MW-358-40	10-55	added 3/11/14
MW-358-60	10-55	added 3/11/14
MW-358-150	90-160	added 3/11/14
MW-359-15	Water Table	added 3/11/14
MW-359-35	10-55	added 3/11/14
MW-359-60	10-55	added 3/11/14
MW-359-80	55-90	added 3/11/14
MW-359-150	90-160	added 3/11/14

Table 3-1
Groundwater Elevation Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Zone	Comments
MW-360-15	Water Table	added 3/11/14
MW-360-35	10-55	added 3/11/14
MW-360-50	10-55	added 3/11/14
MW-360-80	55-90	added 3/11/14
MW-360-150	90-160	added 3/11/14
MW-361-15	Water Table	added 3/11/14
MW-362-15	Water Table	added 3/11/14
MW-362-25	10-55	added 3/11/14
MW-362-35	10-55	added 3/11/14
MW-362-50	10-55	added 3/11/14
MW-362-80	55-90	added 3/11/14
MW-362-150	90-160	added 3/11/14
MW-363-15	Water Table	added 3/11/14
MW-364-15	Water Table	added 3/11/14
MW-364-30	10-55	added 3/11/14
MW-364-65	10-55	added 3/11/14
MW-364-90	55-90	added 3/11/14
MW-364-150	90-160	added 3/11/14
MW-365-15	Water Table	added 3/11/14
MW-367-15	Water Table	added 3/11/14
North Gravel Pit	Surface Water	
O-2	Water Table	
O-3	Water Table	
O-4	Water Table	
O-5	Water Table	
O-6	Water Table	
O-8	Water Table	
O-12	Water Table	
O-14	Water Table	
O-15	Water Table	
O-17	Water Table	
O-18	Water Table	
O-22	Water Table	
O-23	Water Table	
O-24	Water Table	
O-26	Water Table	
O-27	Water Table	
O-28	Water Table	
O-30	Water Table	
O-38	Water Table	added 3/11/14
R-14A	Water Table	
R-21	Water Table	
R-35R	Water Table	
R-39	Water Table	
R-40	Water Table	
R-42	Water Table	
S-32	Water Table	
S-39	Water Table	
S-43	Water Table	

Table 3-1
Groundwater Elevation Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Zone	Comments
S-44	Water Table	
S-50	Water Table	
South Gravel Pit	Surface Water	

General Notes:
Wells are gauged quarterly. During inclement weather, wells are prioritized based on accessibility and the assigned priorities summarized in the Revised Sampling and Analysis Plan.

Table 3-2
LNAPL Migration Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Rationale	Notes
MW-139-25	Monthly	Semi-annual	Monitor NW LNAPL boundary	
MW-140-25	Quarterly	Annual	Monitor NE LNAPL boundary	
MW-142-20	Quarterly	Annual	Monitor LNAPL boundary	
MW-144A-25	Quarterly	Annual	Monitor LNAPL boundary	
MW-145-20	Monthly	Quarterly	Monitor LNAPL boundary	
MW-178A-15	Quarterly	Annual	Monitor LNAPL boundary	
MW-179A-15	Quarterly	Annual	Monitor LNAPL boundary	
MW-180A-15	Quarterly	Annual	Monitor LNAPL boundary	
MW-195A-15	Quarterly	Annual	Monitor LNAPL boundary	
MW-196-15	Quarterly	Annual	Monitor LNAPL boundary	
O-1	Monthly	Annual	Monitor LNAPL boundary	
O-12	Monthly	Quarterly	Monitor LNAPL boundary	
O-14	Monthly	Annual	Monitor LNAPL boundary	
O-15	Monthly	Annual	Monitor LNAPL boundary	
O-16	Monthly	Annual	Monitor LNAPL boundary	
O-17	Monthly	Annual	Monitor LNAPL boundary	
O-18	Monthly	Annual	Monitor LNAPL boundary	
O-20	Monthly	Annual	Monitor LNAPL boundary	
O-22	Monthly	Annual	Monitor LNAPL boundary	
O-23	Monthly	Annual	Monitor LNAPL boundary	
O-24	Monthly	Quarterly	Monitor LNAPL boundary	
O-25	Monthly	Quarterly	Monitor LNAPL boundary	
O-26	Monthly	Quarterly	Monitor LNAPL boundary	
O-28	Monthly	Annual	Monitor LNAPL boundary	
O-29	Monthly	Annual	Monitor LNAPL boundary	
O-3	Monthly	Quarterly	Monitor LNAPL boundary	
O-30	Quarterly	Annual	Monitor LNAPL boundary	
O-4	Monthly	Quarterly	Monitor LNAPL boundary	
O-5	Monthly	Semi-annual	Monitor LNAPL boundary	
O-6	Monthly	Semi-annual	Monitor LNAPL boundary	
O-8	Monthly	Annual	Monitor LNAPL boundary	
R-3	Quarterly	Annual	Monitor LNAPL boundary	Well is a 3 foot diameter culvert--typically frozen or dry.
R-42	Monthly	Monthly	Monitor LNAPL boundary	Active recovery well.
R-43	Monthly	Monthly	Monitor LNAPL boundary	Active recovery well.
R-46	Monthly	Monthly	Monitor LNAPL boundary	Active recovery well.
S-9	Monthly	Semi-annual	Monitor LNAPL boundary	

General Notes:

LNAPL appropriate observation wells (O-series) were installed to monitor product boundary and replace MW-113, MW-115, MW-116, MW-132, MW-134, MW-135, MW-136, and MW-137.

LNAPL = light nonaqueous phase liquids

NW = northwest

NE = northeast

Table 3-3
LNAPL Thickness Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Rationale	Notes
MW-135-20	--	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-138-20	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	skimmer pump used when applicable
MW-176A-15	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
MW-186A-15	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-334-15	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	
MW-336-15	--	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-348-15	--	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-354-15	--	Semi-annual	Monitor fluctuation in LNAPL thickness	
MW-366-15	-	Quarterly	Monitor fluctuation in LNAPL thickness	
O-2	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
O-7	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
O-9	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-10	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-11	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-13	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-19	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
O-21	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
O-27	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
O-31	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	installed in 2013
O-32	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	installed in 2013
O-33	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	installed in 2013
O-34	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	installed in 2013
O-35	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	installed in 2013
O-36	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	installed in 2013
O-37	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	installed in 2013
O-38	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	installed in 2013
R-14A	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
R-18	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
R-20R	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
R-21	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	active recovery well
R-32	--	Quarterly	Monitor fluctuation in LNAPL thickness	
R-32R	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	replaced well R-32
R-33	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
R-34	Quarterly	Quarterly	Monitor fluctuation in LNAPL thickness	
R-35R	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	active recovery well
R-39	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
R-40	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
R-44	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	active recovery well
R-45	Monthly	Monthly	Monitor fluctuation in LNAPL thickness	active recovery well
S-21	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
S-22	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
S-32	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
S-39	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
S-43	Monthly	Semi-annual	Monitor fluctuation in LNAPL thickness	
S-44	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	
S-50	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	skimmer pump used when applicable
S-51	Monthly	Quarterly	Monitor fluctuation in LNAPL thickness	

General Notes:

LNAPL appropriate observation wells (O-series) were installed to monitor product boundary and replace MW-113, MW-115, MW-116, MW-132, MW-134, MW-135, MW-136, and MW-137.

LNAPL = light nonaqueous phase liquids

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-101A-25	Annual	Quarterly	Sulfolane >15 µg/L
MW-101-60	Annual	Quarterly	Sulfolane >15 µg/L
MW-104-65	Annual	Annual	ND for two events
MW-105A-25	Annual	Annual	ND for two events
MW-105-65	Annual	Annual	ND for two events
MW-106-25	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-109-15	Annual	Annual	ND for two events
MW-110-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-110-65	Quarterly	Annual	ND for two events
MW-113-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-115-15	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-116-15	Semi-annual	Quarterly	Sulfolane >15 µg/L
MW-125-25	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-127-25	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-129-40	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-130-25	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-131-25	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-132-20	Annual	Annual	ND for two events
MW-133-20	Annual	Annual	ND for two events
MW-134-20	Annual	Annual	ND for two events
MW-135-20	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-138-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-139-25	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-141-20	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-142-20	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-142-65	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-142-150	Quarterly	Annual	ND for two events
MW-143-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-144A-25	Annual	Annual	ND for two events
MW-144BR-90	Annual	Annual	ND for two events
MW-145-20	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-147B-25	Quarterly	Annual	ND for two events
MW-148A-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-148B-30	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-148C-55	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-148-80	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-148-100	Quarterly	Annual	ND for two events
MW-148D-150	Quarterly	Annual	ND for two events
MW-149A-15	Quarterly	Annual	ND for two events
MW-149B-20	Quarterly	Annual	ND for two events
MW-154A-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-154B-95	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-173A-15	Annual	Annual	ND for two events
MW-173B-150	Annual	Annual	ND for two events
MW-174-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-174A-50	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-174B-90	Semi-annual	Annual	ND for two events
MW-175-90	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-176A-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-176B-50	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-176C-90	Semi-annual	Annual	ND for two events
MW-177-90	Annual	Annual	ND for two events

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-178A-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-178B-50	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-178C-90	Semi-annual	Annual	ND for two events
MW-179A-15	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-179B-50	Semi-annual	Semi-annual	Sulfolane <15 µg/L
MW-179C-90	Annual	Annual	ND for two events
MW-179D-135	Semi-annual	Annual	ND for two events
MW-180A-15	Semi-annual	Annual	ND for two events
MW-180B-50	Annual	Annual	ND for two events
MW-180C-90	Annual	Annual	ND for two events
MW-186A-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-186B-60	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-186C-100	Annual	Annual	ND for two events
MW-186D-135	Annual	Annual	ND for two events
MW-186E-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-192A-15	Annual	Annual	ND for two events
MW-192B-55	Annual	Annual	ND for two events
MW-195A-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-195B-150	Annual	Annual	ND for two events
MW-196-15	Annual	Annual	ND for two events
MW-197A-65	Quarterly	Annual	ND for two events
MW-197B-150	Annual	Annual	ND for two events
MW-198-150	Quarterly	Annual	ND for two events
MW-199-150	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-300-150	Annual	Annual	ND for two events
MW-301-CMT-10	Quarterly	Annual	ND for two events
MW-301-CMT-20	Quarterly	Annual	ND for two events
MW-301-CMT-30	Quarterly	Annual	ND for two events
MW-301-CMT-40	Quarterly	Annual	ND for two events
MW-301-CMT-50	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-301-60	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-301-70	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-302-CMT-10	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-302-CMT-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-302-CMT-30	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-302-CMT-40	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-302-CMT-50	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-302-70	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-302-80	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-302-95	Quarterly	Annual	ND for two events
MW-302-110	Semi-annual	Annual	ND for two events
MW-303-CMT-9	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-303-CMT-19	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-303-CMT-29	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-303-CMT-39	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-303-CMT-49	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-303-CMT-59	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-303-70	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-303-80	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-303-95	Quarterly	Annual	ND for two events
MW-303-130	Semi-annual	Annual	ND for two events
MW-304-CMT-10	Quarterly	Quarterly	Sulfolane >15 µg/L

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-304-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-304-CMT-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-304-CMT-30	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-304-CMT-40	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-304-CMT-50	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-304-CMT-60	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-304-70	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-304-80	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-304-96	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-304-125	Semi-annual	Annual	ND for two events
MW-304-150	Annual	Annual	ND for two events
MW-305-CMT-8	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-305-CMT-18	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-305-CMT-28	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-305-CMT-38	Quarterly	Annual	ND for two events
MW-305-CMT-48	Semi-annual	Annual	ND for two events
MW-305-CMT-58	Semi-annual	Annual	ND for two events
MW-305-70	Semi-annual	Annual	ND for two events
MW-305-80	Semi-annual	Annual	ND for two events
MW-305-100	Semi-annual	Annual	ND for two events
MW-306-CMT-10	Annual	Annual	ND for two events
MW-306-15	Annual	Annual	ND for two events
MW-306-CMT-20	Annual	Annual	ND for two events
MW-306-CMT-30	Annual	Annual	ND for two events
MW-306-CMT-40	Annual	Annual	ND for two events
MW-306-CMT-50	Annual	Annual	ND for two events
MW-306-CMT-60	Annual	Annual	ND for two events
MW-306-70	Annual	Annual	ND for two events
MW-306-80	Annual	Annual	ND for two events
MW-306-100	Annual	Annual	ND for two events
MW-306-150	Annual	Annual	ND for two events
MW-307-150	Quarterly	Annual	ND for two events
MW-309-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-309-66	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-309-150	Annual	Annual	ND for two events
MW-310-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-310-65	Quarterly	Annual	ND for two events
MW-310-110	Annual	Annual	ND for two events
MW-321-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-321-65	Quarterly	Annual	ND for two events
MW-321-151	Annual	Annual	ND for two events
MW-330-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-330-65	Semi-annual	Annual	ND for two events
MW-330-150	Annual	Annual	ND for two events
MW-331-150	Annual	Annual	ND for two events
MW-334-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-334-65	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-334-85	Quarterly	Annual	ND for two events
MW-336-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-336-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-336-35	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-336-55	Quarterly	Semi-annual	Sulfolane <15 µg/L

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-337-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-344-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-344-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-344-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-345-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-345-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-345-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-348-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-348-65	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-351-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-351-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-351-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-351-150	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-354-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-354-35	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-354-65	Quarterly	Annual	ND for two events
MW-355-15	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-355-55	Quarterly	Annual	ND for two events
MW-358-15	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-358-20	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-358-40	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-358-60	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-358-150	Quarterly	Annual	ND for two events
MW-359-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-359-35	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-359-60	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-359-80	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-359-150	Quarterly	Annual	ND for two events
MW-360-15	Quarterly	Annual	ND for two events
MW-360-35	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-360-50	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-360-80	Quarterly	Annual	ND for two events
MW-360-150	Quarterly	Annual	ND for two events
MW-361-15	Quarterly	Annual	ND for two events
MW-362-15	Quarterly	Annual	ND for two events
MW-362-25	Quarterly	Annual	ND for two events
MW-362-35	Quarterly	Annual	ND for two events
MW-362-50	Quarterly	Annual	ND for two events
MW-362-80	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-362-150	Quarterly	Annual	ND for two events
MW-363-15	Quarterly	Annual	ND for two events
MW-364-15	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-364-30	Quarterly	Quarterly	Sulfolane >15 µg/L
MW-364-65	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-364-90	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-364-150	Quarterly	Annual	ND for two events
MW-365-15	Quarterly	Annual	ND for two events
MW-366-15	Quarterly	Semi-annual	Sulfolane <15 µg/L
MW-367-15	Quarterly	Annual	ND for two events
MW-368-15	Quarterly	Annual	ND for two events
MW-369-16	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-369-55	Quarterly	Quarterly	Groundwater Remediation System Performance

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-369-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-370-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-370-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-370-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-371-15	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-371-55	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-371-75	Quarterly	Quarterly	Groundwater Remediation System Performance
MW-371-125	Quarterly	Quarterly	Groundwater Remediation System Performance
O-1	Quarterly	Quarterly	Sulfolane >15 µg/L
O-2	Quarterly	Quarterly	Groundwater Remediation System Performance
O-3	Quarterly	Quarterly	Groundwater Remediation System Performance
O-4	Quarterly	Quarterly	Groundwater Remediation System Performance
O-5	Quarterly	Quarterly	Groundwater Remediation System Performance
O-5-65	Quarterly	Quarterly	Groundwater Remediation System Performance
O-6	Quarterly	Quarterly	Groundwater Remediation System Performance
O-12	Quarterly	Quarterly	Groundwater Remediation System Performance
O-12-65	Quarterly	Quarterly	Groundwater Remediation System Performance
O-14	Annual	Annual	ND for two events
O-19	Quarterly	Quarterly	Groundwater Remediation System Performance
O-19-55	Quarterly	Quarterly	Groundwater Remediation System Performance
O-19-90	Quarterly	Quarterly	Groundwater Remediation System Performance
O-20	Quarterly	Quarterly	Sulfolane >15 µg/L
O-24	Quarterly	Quarterly	Groundwater Remediation System Performance
O-24-65	Quarterly	Quarterly	Groundwater Remediation System Performance
O-26	Quarterly	Quarterly	Groundwater Remediation System Performance
O-26-65	Quarterly	Quarterly	Groundwater Remediation System Performance
O-27	Quarterly	Quarterly	Sulfolane >15 µg/L
O-27-65	Quarterly	Semi-annual	Sulfolane <15 µg/L
O-27-150	Quarterly	Annual	ND for two events
O-31	Quarterly	Quarterly	Sulfolane >15 µg/L
O-32	Quarterly	Quarterly	Sulfolane >15 µg/L
O-33	Quarterly	Quarterly	Sulfolane >15 µg/L
O-34	Quarterly	Quarterly	Sulfolane >15 µg/L
O-35	Quarterly	Semi-annual	Sulfolane <15 µg/L
O-36	Quarterly	Annual	ND for two events
O-37	Quarterly	Semi-annual	Sulfolane <15 µg/L
O-38	Quarterly	Quarterly	Sulfolane >15 µg/L
R-21	Monthly	Monthly	Remediation System Well
R-32R	Quarterly	Quarterly	Sulfolane >15 µg/L
R-35R	Monthly	Monthly	Remediation System Well
R-42	Monthly	Monthly	Remediation System Well
R-43	Monthly	Monthly	Remediation System Well
R-44	Monthly	Monthly	Remediation System Well
R-45	Monthly	Monthly	Remediation System Well
R-46	Monthly	Monthly	Remediation System Well
R-47	Monthly	Monthly	Remediation System Well
R-48	Monthly	Monthly	Remediation System Well
S-21	Semi-annual	Semi-annual	Sulfolane <15 µg/L
S-39	Quarterly	Semi-annual	Sulfolane <15 µg/L
S-41R	Quarterly	Quarterly	Sulfolane >15 µg/L
S-43	Quarterly	Quarterly	Groundwater Remediation System Performance
S-50	Semi-annual	Semi-annual	Sulfolane <15 µg/L

Table 3-4
Sulfolane Monitoring Well Network - Onsite

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
S-51	Quarterly	Quarterly	Groundwater Remediation System Performance

General Notes:
Semi-annual wells will be sampled during the first and third quarters of the year.
Annual wells will be sampled during the third quarter of the year.
ND = not detected

Table 3-5
Constituents Of Concern (BTEX, GRO & DRO) Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-101A-25	Annual	Annual	Benzene <50 µg/L
MW-105A-25	Annual	Annual	Benzene <50 µg/L
MW-106-25	Semi-annual	Annual	Benzene <50 µg/L
MW-109-15	Semi-annual	Annual	Benzene <50 µg/L
MW-110-20	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-113-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-115-15	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-116-15	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-124-25	Semi-annual	Annual	Benzene <50 µg/L
MW-125-25	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-126-25	Quarterly	Annual	Benzene <50 µg/L
MW-127-25	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-129-40	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-130-25	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-131-25	Annual	Annual	Benzene <50 µg/L
MW-132-20	Semi-annual	Annual	Benzene <50 µg/L
MW-133-20	Semi-annual	Annual	Benzene <50 µg/L
MW-134-20	Quarterly	Annual	Benzene <50 µg/L
MW-135-20	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-136-20	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-137-20	Quarterly	Semi-annual	Benzene >50 µg/L
MW-138-20	Annual	Semi-annual	Benzene >50 µg/L
MW-139-25	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-140-25	Semi-annual	Annual	Benzene <50 µg/L
MW-141-20	Semi-annual	Annual	Benzene <50 µg/L
MW-142-20	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-143-20	Semi-annual	Annual	Benzene <50 µg/L
MW-144A-25	Semi-annual	Annual	Benzene <50 µg/L
MW-145-20	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-148A-15	Semi-annual	Every 5 years	North Property Boundary
MW-149A-15	Semi-annual	Every 5 years	North Property Boundary
MW-176A-15	Semi-annual	Semi-annual	Benzene >50 µg/L
MW-179A-15	Semi-annual	Annual	Benzene <50 µg/L
MW-180A-15	Semi-annual	Annual	Benzene <50 µg/L
MW-186A-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-192A-15	Annual	Annual	Benzene <50 µg/L
MW-196-15	Annual	Annual	Benzene <50 µg/L
MW-301-CMT-10	--	Biennial	Vertical Profiling Transect
MW-301-CMT-20	--	Biennial	Vertical Profiling Transect
MW-302-CMT-10	--	Biennial	Vertical Profiling Transect
MW-302-CMT-20	--	Biennial	Vertical Profiling Transect
MW-303-CMT-9	--	Biennial	Vertical Profiling Transect
MW-303-CMT-19	--	Biennial	Vertical Profiling Transect
MW-304-CMT-10	--	Biennial	Vertical Profiling Transect
MW-304-15	--	Biennial	Vertical Profiling Transect
MW-304-CMT-20	--	Biennial	Vertical Profiling Transect
MW-305-CMT-8	--	Biennial	Vertical Profiling Transect
MW-309-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-321-15	Semi-annual	Annual	Benzene <50 µg/L
MW-334-15	Quarterly	Semi-annual	Groundwater Remediation System Performance
MW-336-15	Quarterly	Semi-annual	Benzene >50 µg/L
MW-336-20	Quarterly	Semi-annual	Benzene >50 µg/L
MW-336-35	Quarterly	Semi-annual	Benzene >50 µg/L
MW-336-55	Quarterly	Semi-annual	Benzene >50 µg/L
MW-337-20	Quarterly	Semi-annual	Benzene >50 µg/L

Table 3-5
Constituents Of Concern (BTEX, GRO & DRO) Monitoring Well Network

Long-Term Monitoring Plan
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	Previous Frequency	Revised Frequency	Category
MW-344-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-344-55	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-345-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-345-55	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-351-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-351-55	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-358-15	Phase 8	Every 5 years	North Property Boundary
MW-358-20	Phase 8	Every 5 years	North Property Boundary
MW-359-15	Phase 8	Every 5 years	North Property Boundary
MW-360-15	Phase 8	Every 5 years	North Property Boundary
MW-361-15	Phase 8	Every 5 years	North Property Boundary
MW-363-15	Phase 8	Every 5 years	North Property Boundary
MW-364-15	Phase 8	Every 5 years	North Property Boundary
MW-369-16	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-370-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
MW-371-15	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-2	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-3	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-4	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-5	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-6	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-12	Quarterly	Semi-annual	Groundwater Remediation System Performance
O-14	Quarterly	Annual	Benzene <50 µg/L
O-16	Semi-annual	Annual	Benzene <50 µg/L
O-17	Semi-annual	Annual	Benzene <50 µg/L
O-18	Semi-annual	Annual	Benzene <50 µg/L
O-19	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-19-55	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-24	Semi-annual	Semi-annual	Groundwater Remediation System Performance
O-26	Semi-annual	Semi-annual	Groundwater Remediation System Performance
S-9	Quarterly	Annual	Benzene <50 µg/L
S-43	Semi-annual	Semi-annual	Groundwater Remediation System Performance
S-44	Semi-annual	Semi-annual	Benzene >50 µg/L
S-50	Semi-annual	Semi-annual	Benzene >50 µg/L
S-51	Semi-annual	Semi-annual	Groundwater Remediation System Performance

Acronyms and Abbreviations:
BTEX = benzene, toluene, ethylbenzene and total xylenes
GRO = gasoline range organics
DRO = diesel range organics
-- = not currently sampled

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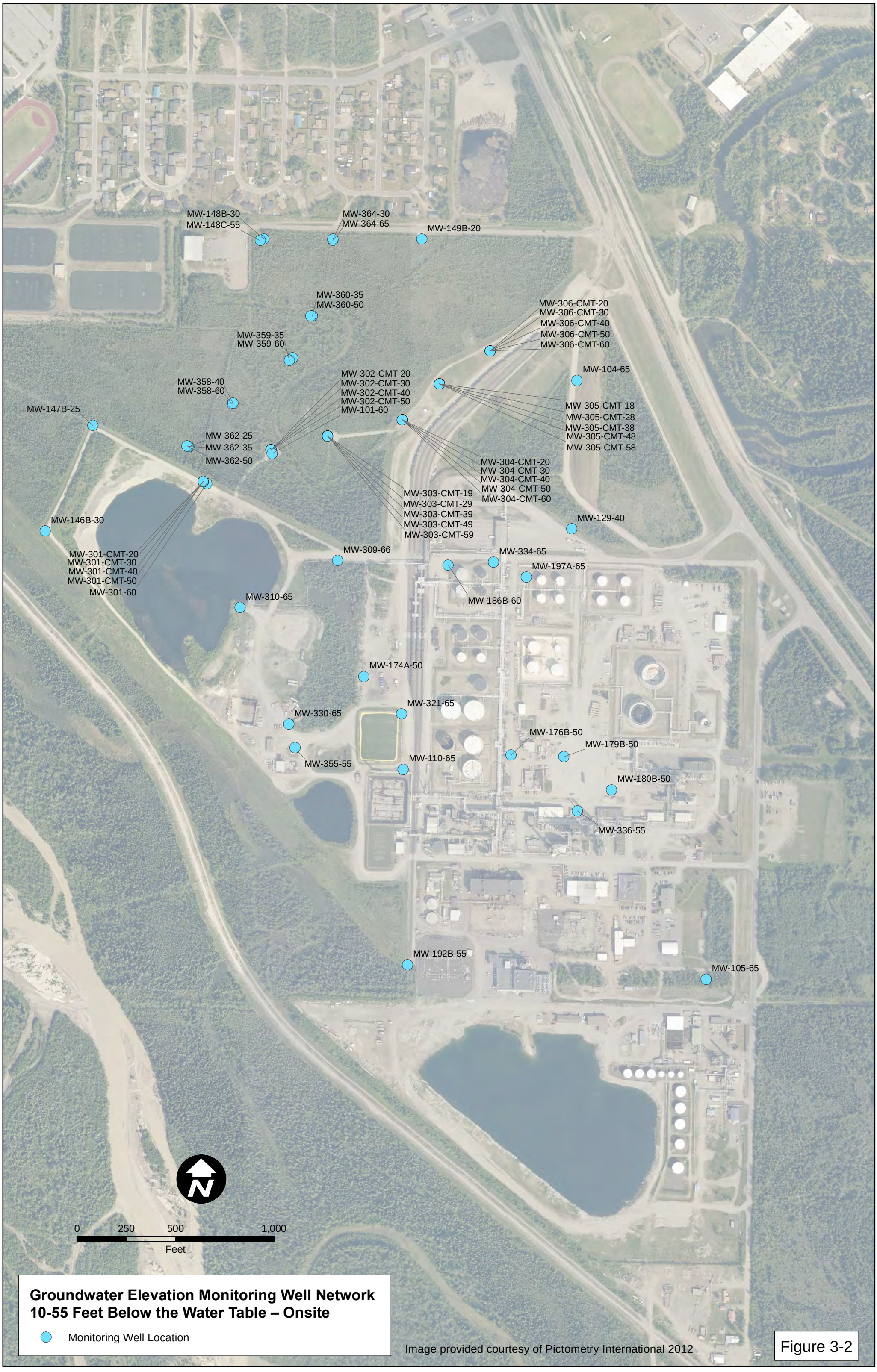
Figures


MW-148A-15
MW-364-15
MW-149A-15
MW-363-15
MW-360-15
MW-306-CMT-10
MW-306-15
MW-359-15
MW-305-CMT-8
MW-131-25
MW-358-15
MW-358-20
MW-303-CMT-9
MW-143-20
MW-304-CMT-10
MW-304-15
MW-140-25
MW-141-20
MW-362-15
MW-101A-25
MW-302-CMT-10
MW-301-CMT-10
MW-144A-25
MW-173A-15
O-26
O-27
O-12
O-24
MW-145-20
MW-146A-15
O-4
MW-334-15
R-14A
O-2
R-40
O-3
R-39
O-23
MW-309-15
MW-186A-15
S-39
MW-135-20
R-42
MW-125-25
S-44
S-32
MW-113-15
R-21
MW-130-25
R-35R
MW-310-15
North Gravel Pit
O-5
O-6
S-50
S-43
O-22
MW-133-20
O-17
MW-174-15
O-38
O-30
O-18
MW-330-20
MW-321-15
O-8
MW-106-25
MW-195A-15
MW-176A-15
MW-355-15
MW-110-20
MW-179A-15
O-14
MW-109-15
MW-336-20
South Gravel Pit
O-28
MW-367-15
MW-361-15
O-15
MW-365-15
MW-192A-15
MW-105A-25
N
0
250
500
1,000
Feet
Groundwater Elevation Monitoring Well Network
Water Table – Onsite
Monitoring Well Location
Image provided courtesy of Pictometry International 2012
Figure 3-1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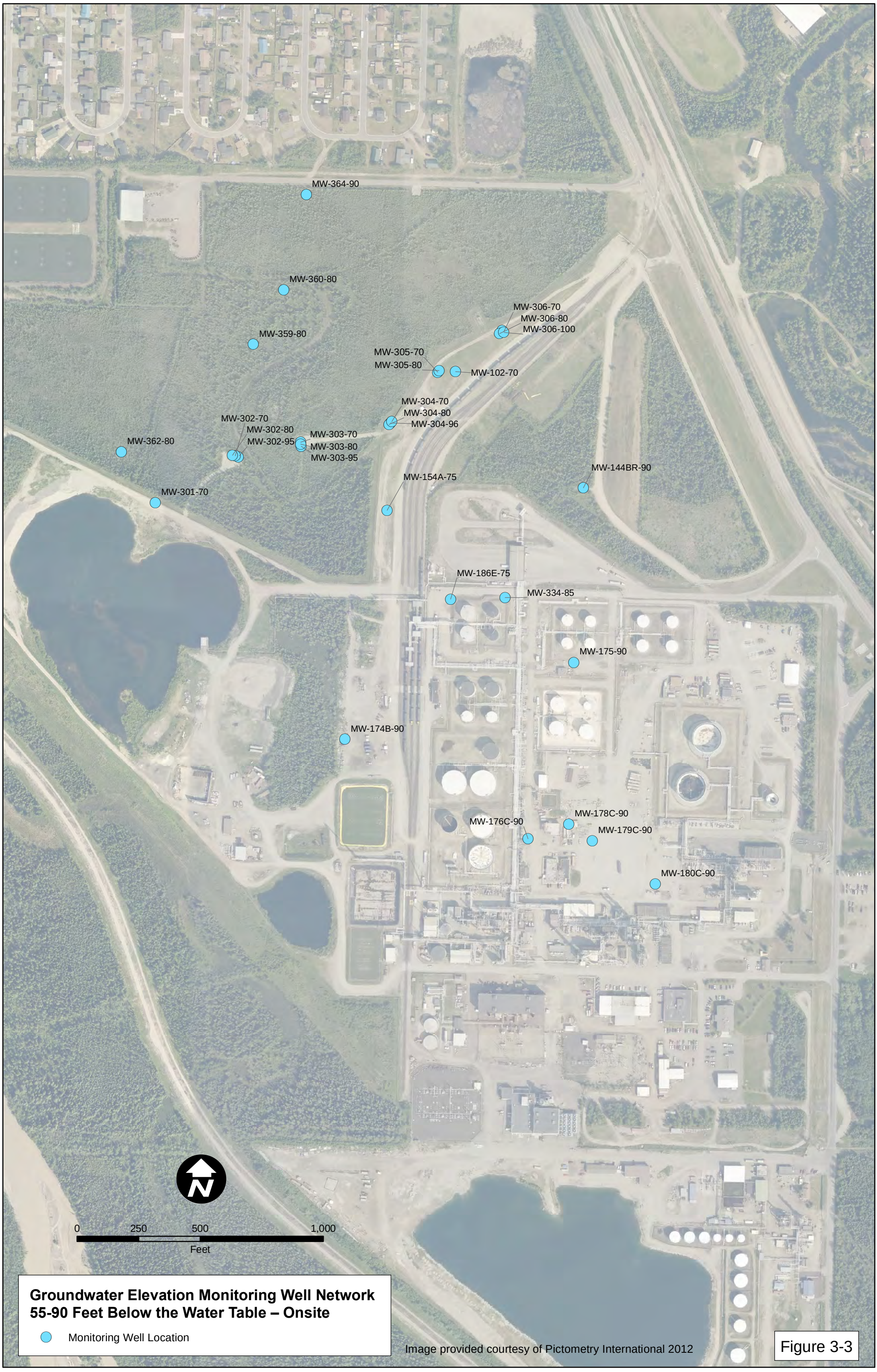
MW-148C-55
MW-364-30
MW-364-65
MW-149B-20
MW-360-35
MW-360-50
MW-306-CMT-20
MW-306-CMT-30
MW-306-CMT-40
MW-306-CMT-50
MW-306-CMT-60
MW-359-35
MW-359-60
MW-104-65
MW-358-40
MW-358-60
MW-302-CMT-20
MW-302-CMT-30
MW-302-CMT-40
MW-302-CMT-50
MW-101-60
MW-147B-25
MW-305-CMT-18
MW-305-CMT-28
MW-305-CMT-38
MW-305-CMT-48
MW-305-CMT-58
MW-362-25
MW-362-35
MW-362-50
MW-304-CMT-20
MW-304-CMT-30
MW-304-CMT-40
MW-304-CMT-50
MW-304-CMT-60
MW-303-CMT-19
MW-303-CMT-29
MW-303-CMT-39
MW-303-CMT-49
MW-303-CMT-59
MW-146B-30
MW-129-40
MW-301-CMT-20
MW-301-CMT-30
MW-301-CMT-40
MW-301-CMT-50
MW-301-60
MW-309-66
MW-334-65
MW-197A-65
MW-186B-60
MW-310-65
MW-174A-50
MW-321-65
MW-330-65
MW-176B-50
MW-179B-50
MW-355-55
MW-110-65
MW-180B-50
MW-336-55
MW-192B-55
MW-105-65
N
0
250
500
1,000
Feet
Groundwater Elevation Monitoring Well Network
10-55 Feet Below the Water Table – Onsite
Monitoring Well Location
Image provided courtesy of Pictometry International 2012
Figure 3-2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MW-305-80
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MW-304-70
MW-304-80
MW-304-96
MW-302-70
MW-302-80
MW-302-95
MW-303-70
MW-303-80
MW-303-95
MW-362-80
MW-301-70
MW-154A-75
MW-144BR-90
MW-186E-75
MW-334-85
MW-175-90
MW-174B-90
MW-176C-90
MW-178C-90
MW-179C-90
MW-180C-90
0
250
500
1,000
Feet
Groundwater Elevation Monitoring Well Network
55-90 Feet Below the Water Table – Onsite
Monitoring Well Location
Image provided courtesy of Pictometry International 2012
Figure 3-3


MW-148D-150
MW-364-150
MW-360-150
MW-359-150
MW-306-150
MW-305-100
MW-358-150
MW-304-150
MW-303-130
MW-304-125
MW-362-150
MW-302-110
MW-173B-150
MW-186C-100
MW-186D-135
MW-199-150
MW-307-150
MW-310-110
MW-195B-150
MW-300-150
MW-179D-135
MW-198-150
0
250
500
1,000
Feet
Groundwater Elevation Monitoring Well Network
90-160 Feet Below the Water Table – Onsite
Monitoring Well Location
Image provided courtesy of Pictometry International 2012

Figure 3-4

MW-140-25
MW-142-20
S-9
MW-144A-25
MW-139-25
O-25
O-26
O-12
O-24
MW-145-20
O-4
O-23
O-3
R-43
R-46
R-42
O-5
O-6
O-22
O-17
O-29
O-30
O-18
MW-195-15
MW-178A-15
O-8
MW-179A-15
O-14
O-1
O-20
MW-180A-15
O-16
O-28
R-3
O-15
MW-196-15

LNAPL Monitoring Well Network - Migration

Proposed Migration Monitoring Frequency

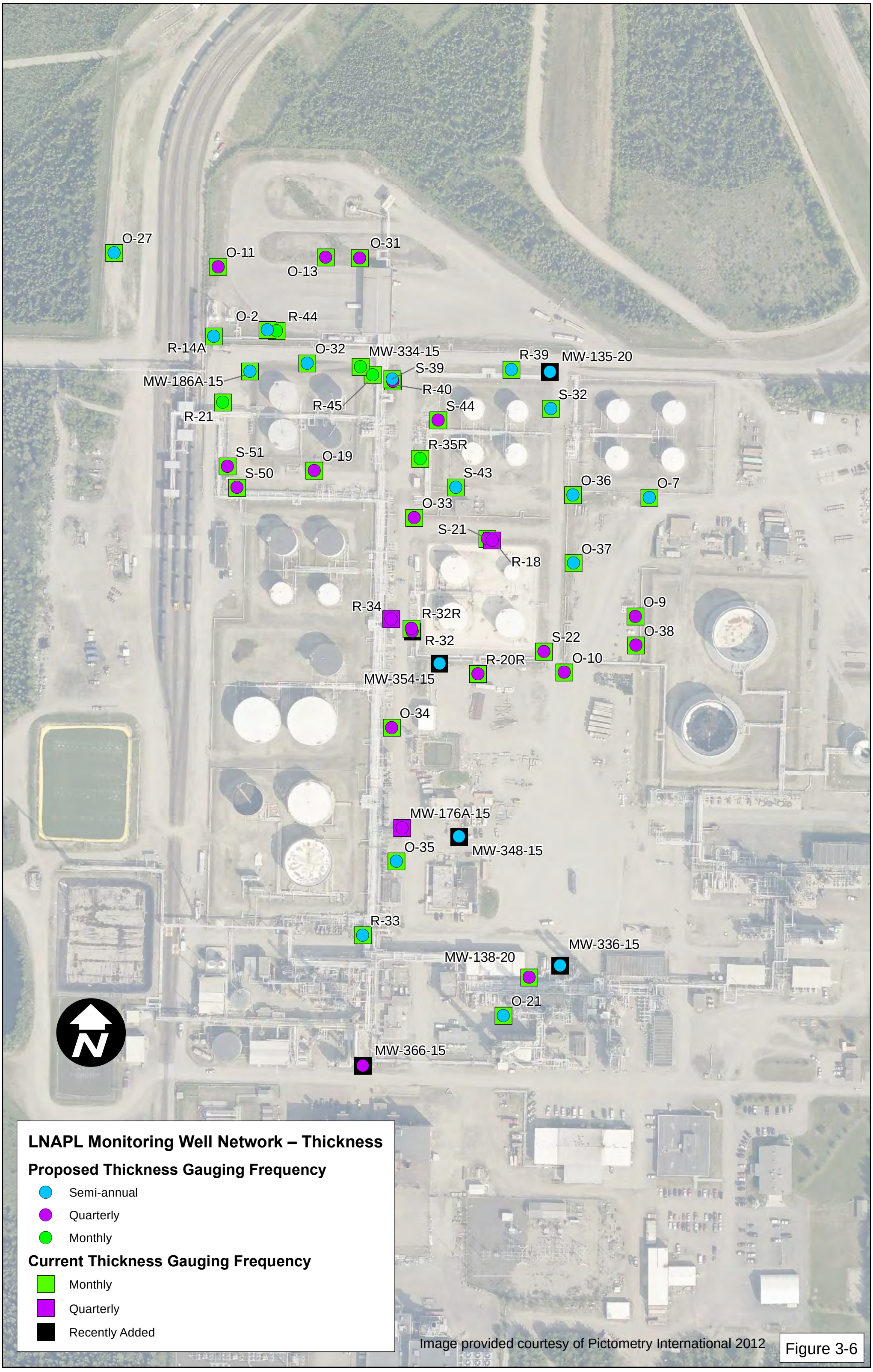
- Annual
- Semi-annual
- Quarterly
- Monthly

Current Migration Monitoring Frequency

- Quarterly
- Monthly

Image provided courtesy of Pictometry International 2012

Figure 3-5


O-27
O-11
O-13
O-31
O-2
R-44
R-14A
O-32
MW-334-15
R-39
MW-135-20
S-39
MW-186A-15
R-40
S-32
R-45
S-44
R-21
R-35R
S-51
O-19
S-50
S-43
O-36
O-7
O-33
S-21
R-18
O-37
R-34
R-32R
O-9
O-38
R-32
S-22
R-20R
O-10
MW-354-15
O-34
MW-176A-15
MW-348-15
O-35
R-33
MW-336-15
MW-138-20
O-21
MW-366-15
N
LNAPL Monitoring Well Network – Thickness
Proposed Thickness Gauging Frequency
Semi-annual
Quarterly
Monthly
Current Thickness Gauging Frequency
Monthly
Quarterly
Recently Added
Image provided courtesy of Pictometry International 2012
Figure 3-6

MW-149A-15
MW-149B-20
MW-148A-15
MW-364-15
MW-363-15
MW-360-15
MW-306-CMT-10
MW-306-15
MW-306-CMT-20
MW-359-15
MW-358-15
MW-305-CMT-8
MW-305-CMT-18
MW-358-20
MW-303-CMT-9
MW-304-CMT-10
MW-303-CMT-19
MW-304-15
MW-302-CMT-10
MW-143-20
MW-304-CMT-20
MW-362-15
MW-302-CMT-20
MW-142-20
MW-173A-15
MW-141-20
MW-301-CMT-10
MW-301-CMT-20
O-26
MW-371-15
O-27
O-12
O-31
O-24
MW-351-15
MW-145-20
O-4
MW-345-15
R-44
MW-334-15
S-39
O-3
MW-370-15
MW-309-15
R-42
O-2
MW-135-20
MW-344-15
O-32
R-46
MW-310-15
MW-113-15
O-5
R-43
R-21
MW-186A-15
R-45
S-51
S-43
R-35R
MW-369-16
O-6
S-50
O-19
O-36
O-33
MW-133-20
S-21
O-37
MW-174-15
MW-132-20
R-32R
O-38
MW-354-15
MW-321-15
MW-330-20
O-34
MW-178A-15
MW-355-15
MW-195A-15
MW-348-15
MW-179A-15
MW-134-20
MW-176A-15
O-14
MW-110-20
S-41R
O-20
MW-109-15
O-35
O-1
MW-180A-15
MW-336-15
MW-336-20
MW-337-20
MW-116-15
MW-115-15
MW-138-20
MW-365-15
MW-366-15
MW-367-15
MW-361-15
MW-368-15
MW-196-15
MW-192A-15

N

0 250 500 1,000
Feet

Sulfolane Monitoring Well Network
Water Table – Onsite

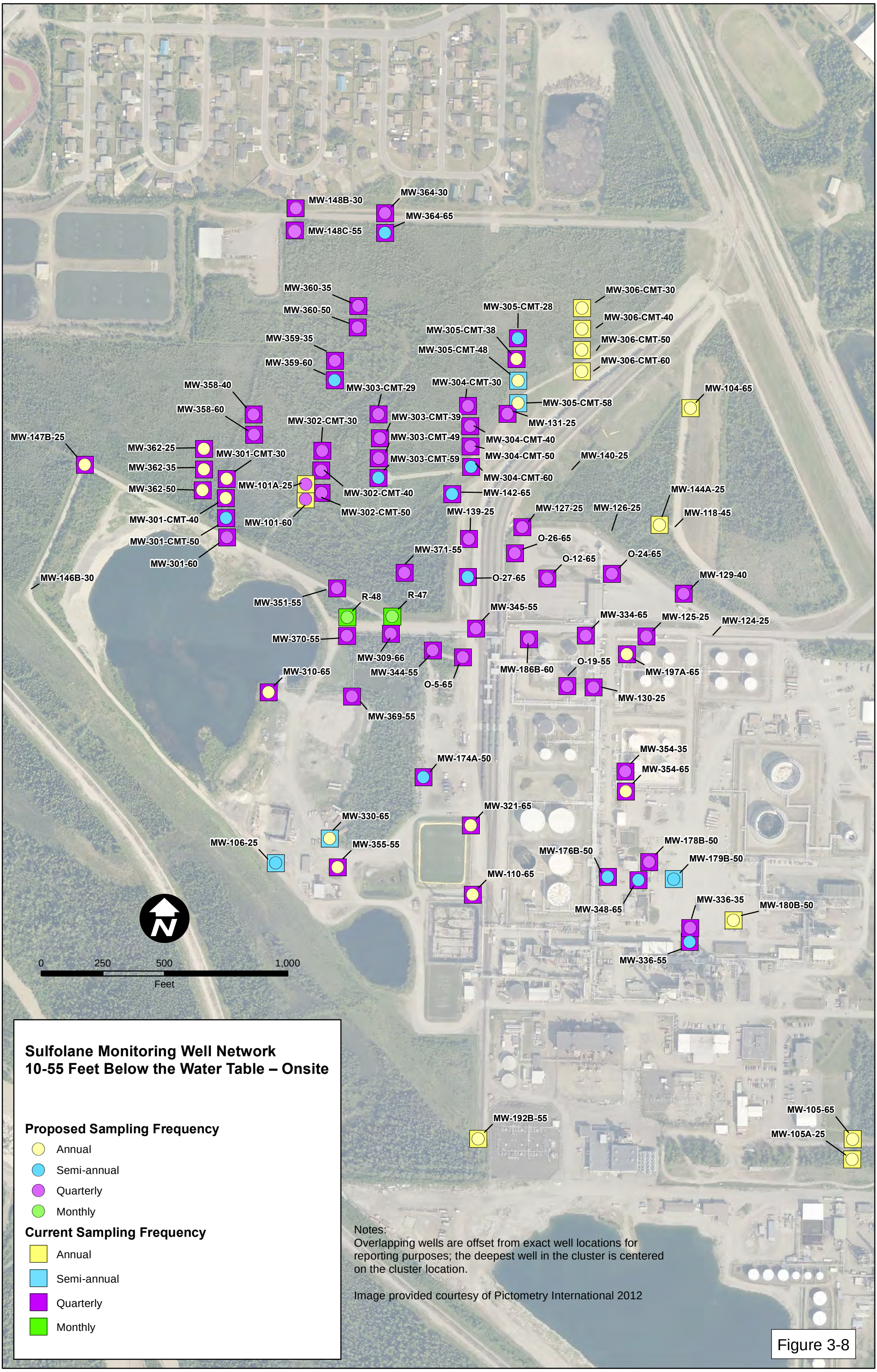
Proposed Sampling Frequency
- Annual
- Semi-annual
- Quarterly
- Monthly

Current Sampling Frequency
- Annual
- Semi-annual
- Quarterly
- Monthly

Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.

Image provided courtesy of Pictometry International 2012

Figure 3-7



Sulfolane Monitoring Well Network
10-55 Feet Below the Water Table – Onsite

Proposed Sampling Frequency

- Annual
- Semi-annual
- Quarterly
- Monthly

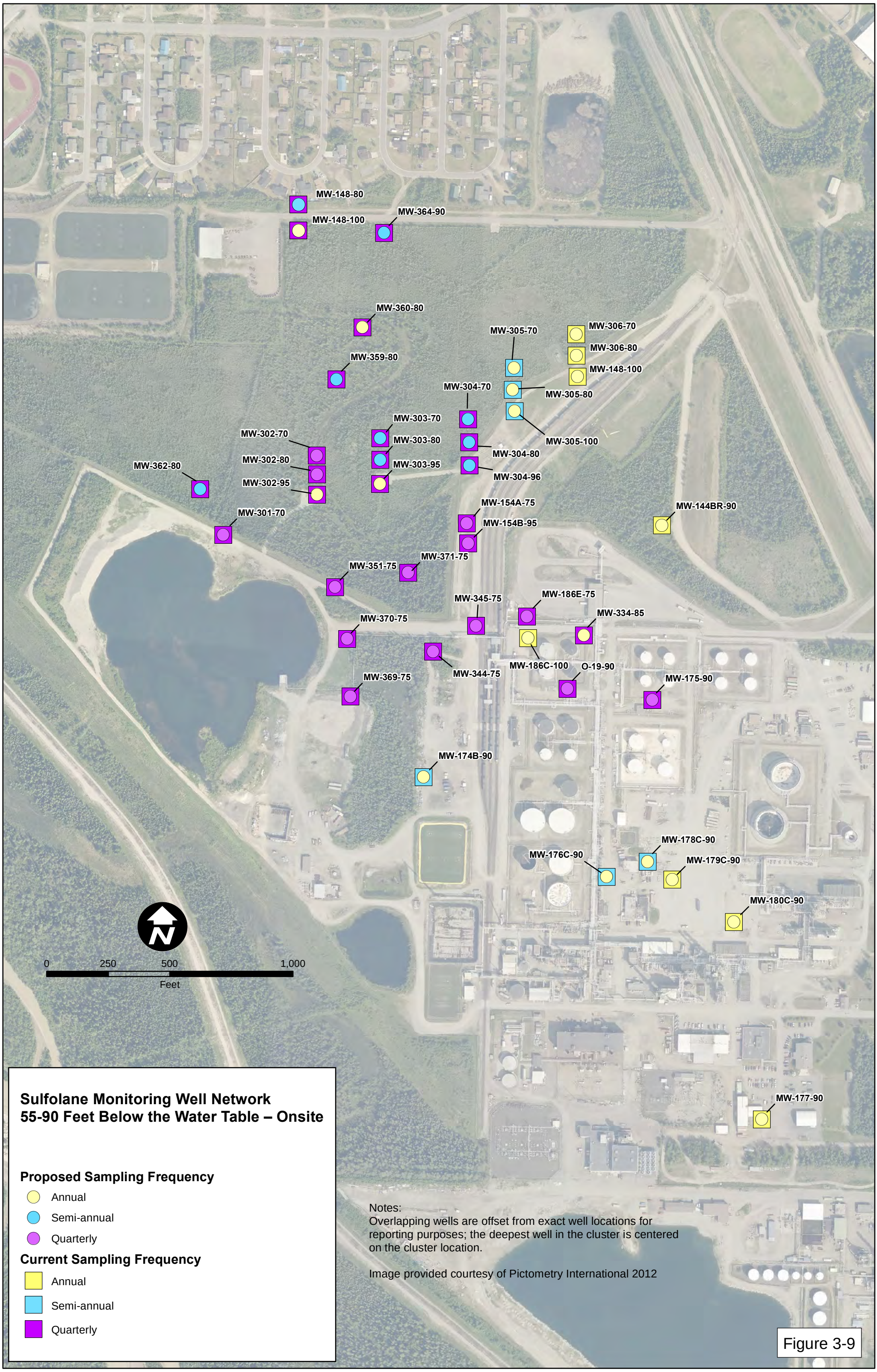
Current Sampling Frequency

- Annual
- Semi-annual
- Quarterly
- Monthly

Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.

Image provided courtesy of Pictometry International 2012

Figure 3-8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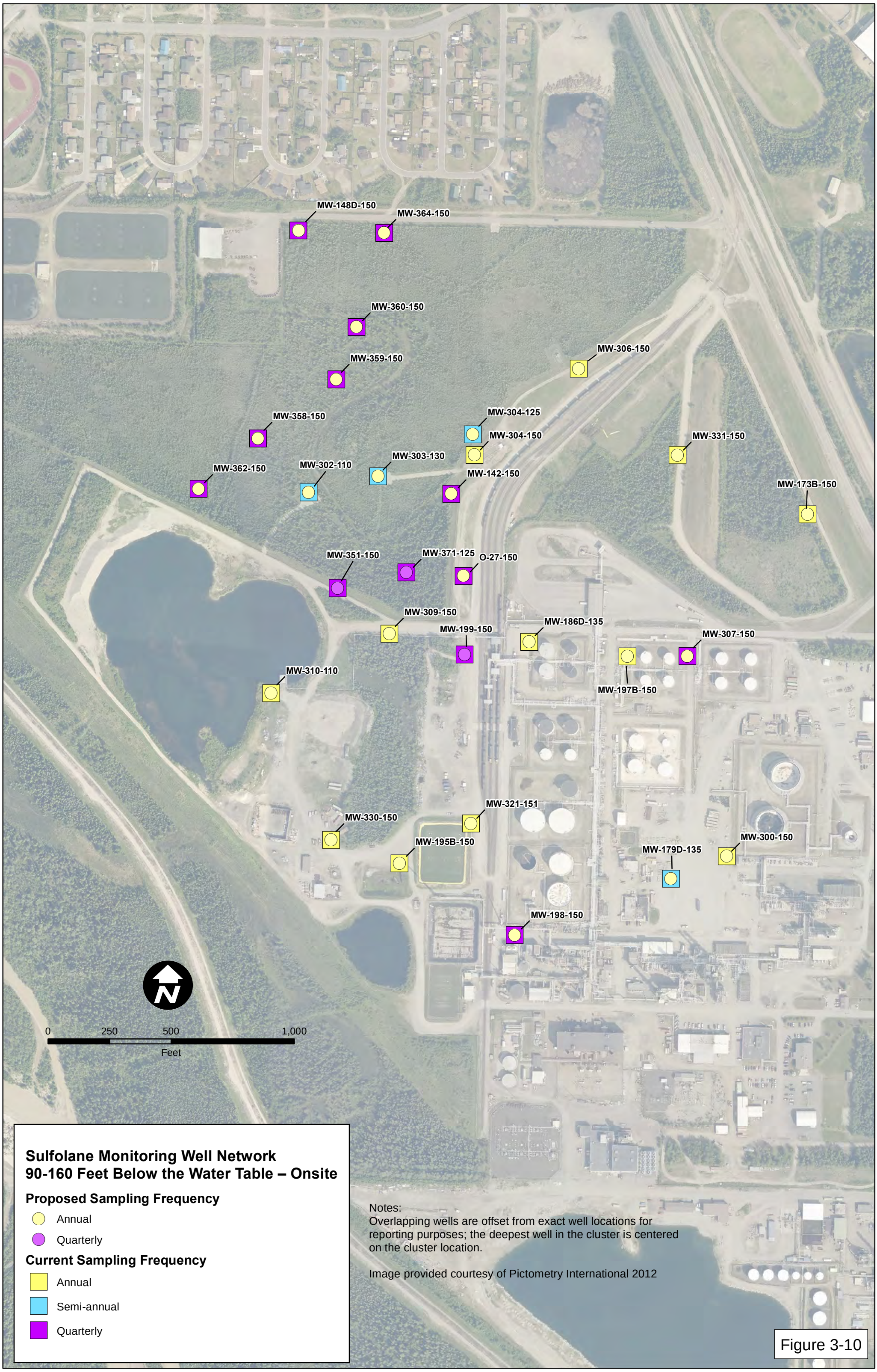
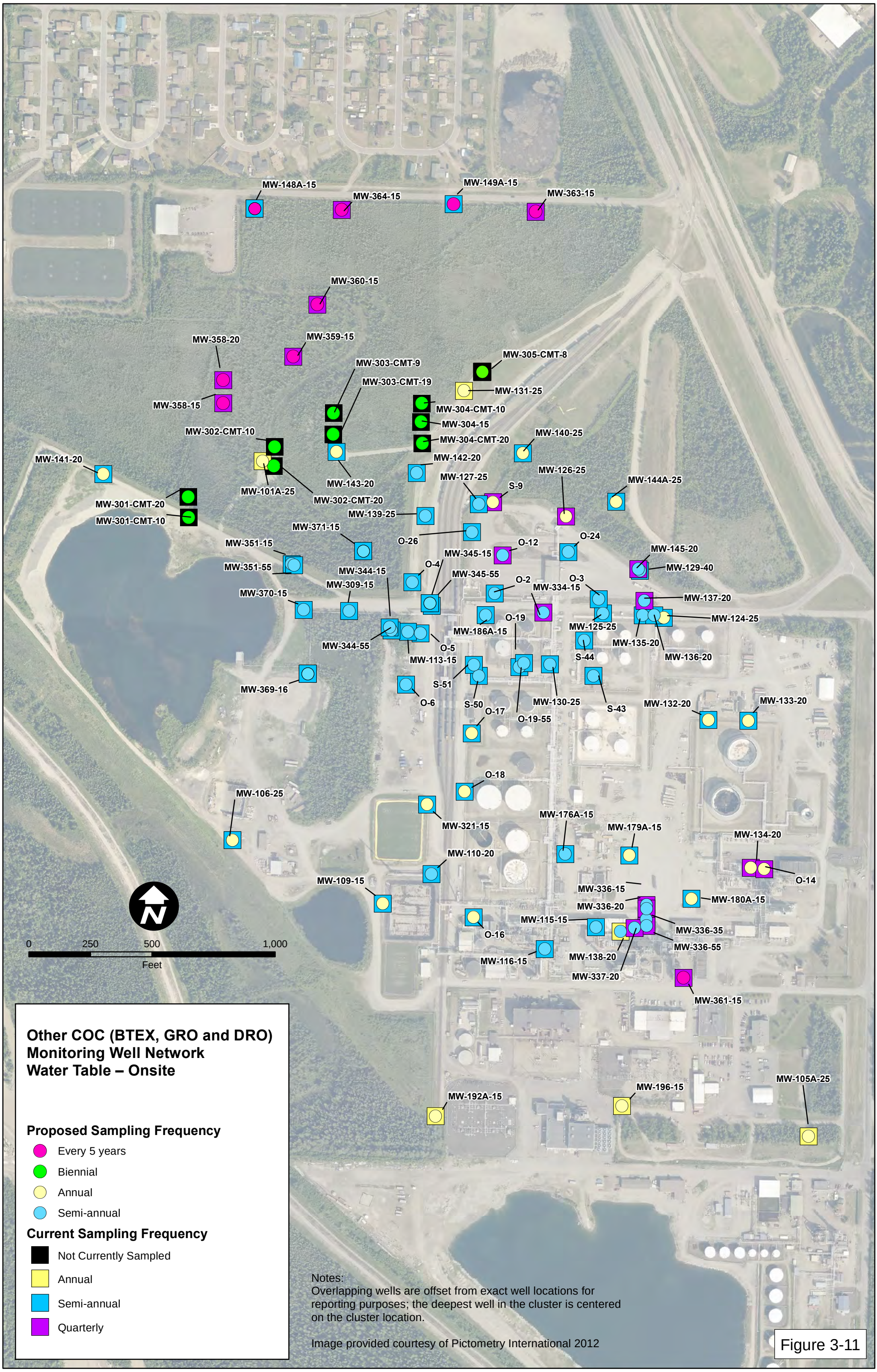
MW-302-70
MW-302-80
MW-303-95
MW-304-96
MW-362-80
MW-302-95
MW-154A-75
MW-144BR-90
MW-301-70
MW-154B-95
MW-371-75
MW-351-75
MW-345-75
MW-186E-75
MW-334-85
MW-370-75
MW-186C-100
O-19-90
MW-344-75
MW-175-90
MW-369-75
MW-174B-90
MW-178C-90
MW-176C-90
MW-179C-90
MW-180C-90
MW-177-90
N
0
250
500
1,000
Feet
Sulfolane Monitoring Well Network
55-90 Feet Below the Water Table – Onsite
Proposed Sampling Frequency
Annual
Semi-annual
Quarterly
Current Sampling Frequency
Annual
Semi-annual
Quarterly
Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.
Image provided courtesy of Pictometry International 2012
Figure 3-9


MW-148D-150
MW-364-150
MW-360-150
MW-359-150
MW-306-150
MW-358-150
MW-304-125
MW-304-150
MW-331-150
MW-362-150
MW-302-110
MW-303-130
MW-142-150
MW-173B-150
MW-351-150
MW-371-125
O-27-150
MW-309-150
MW-199-150
MW-186D-135
MW-307-150
MW-310-110
MW-197B-150
MW-321-151
MW-330-150
MW-195B-150
MW-300-150
MW-179D-135
MW-198-150
0
250
500
1,000
Feet
Sulfolane Monitoring Well Network
90-160 Feet Below the Water Table – Onsite
Proposed Sampling Frequency
Annual
Quarterly
Current Sampling Frequency
Annual
Semi-annual
Quarterly
Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.
Image provided courtesy of Pictometry International 2012
Figure 3-10



Other COC (BTEX, GRO and DRO) Monitoring Well Network Water Table – Onsite

Proposed Sampling Frequency

- Every 5 years
- Biennial
- Annual
- Semi-annual

Current Sampling Frequency

- Not Currently Sampled
- Annual
- Semi-annual
- Quarterly

Notes:
Overlapping wells are offset from exact well locations for reporting purposes; the deepest well in the cluster is centered on the cluster location.

Image provided courtesy of Pictometry International 2012

Figure 3-11

Attachment 1
Soil Management Plan

ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

Flint Hills Resources Alaska, LLC

Onsite Soil Management Plan

North Pole Refinery

North Pole, Alaska

DEC File Number: 100.38.090

October 2014

ARCADIS

Gina France
Project Engineer

Rebecca Andresen
Technical Expert

Onsite Soil Management Plan

North Pole Refinery
North Pole, Alaska

Prepared for:
Flint Hills Resources Alaska, LLC

Prepared by:
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Our Ref.:
B0081981.0072.0001

Date:
October 2014

ARCADIS

Table of Contents

Table (in text)

Attachment

1. Introduction

On behalf of Flint Hills Resources Alaska, LLC (FHRA), ARCADIS U.S., Inc. (ARCADIS) prepared this Onsite Soil Management Plan (Onsite SMP) for the FHRA North Pole Refinery (NPR), an idled petroleum refinery located on H and H Lane in North Pole, Alaska (site). Future land use of the property will remain consistent with an industrial manufacturing setting given its significant infrastructure and capabilities. The purpose of this Onsite SMP is to provide guidance for potential ground-disturbing activities to protect workers from exposure to impacted soil associated with former site operations. This Onsite SMP applies to ground-disturbing activities by the Property Owner and operators, on-site contractors, and future Property Owners and operators, and should be used in conjunction with existing NPR health and safety policies for excavation.

To supplement this Onsite SMP, project-specific soil plans may be developed to identify responsibilities and procedures for onsite soil management based on the scope and extent of a specific project. This Onsite SMP provides general guidance on the roles and responsibilities for emergency, routine maintenance, or short lead-time ground-disturbing activities.

2. Background

The 240-acre site is located inside the city limits of North Pole, Alaska (the city). The city is located approximately 13 miles southeast of Fairbanks, Alaska, within the Fairbanks North Star Borough. The physical setting for the site is described in the Onsite Site Characterization Report – 2013 Addendum (ARCADIS 2013b).

2.1 Site Characterization Background

A series of site characterization reports collectively present an extensive body of information that has been gathered to ascertain the physical characteristics of the site, define the sources of contamination, and determine the nature and extent of contamination present at the site. These reports are listed below:

- Site Characterization Report – Through 2011 (Barr Engineering Company 2012)
- Site Characterization Report – 2012 Addendum (ARCADIS 2013a)
- Onsite Site Characterization Report – 2013 Addendum (ARCADIS 2013b)

For this Onsite SMP, the term “onsite” is the area that is located within the property boundary of the FHRA NPR. This Onsite SMP only applies to excavations that occur more than 12 inches below the soil surface, although all contaminated soil must be

properly managed per Alaska Department of Environmental Conservation (ADEC) regulations.

2.2 Constituents of Concern

Extensive sampling of soil was completed for numerous constituents of potential concern (COPCs) to develop a list of constituents of concern (COCs) for the site. COCs were identified based on a comparison of site maximum concentrations to Method 2 cleanup levels for soil (Table B1 and B2of 18 AAC 75.341(c)) for those constituents listed in Table 2-1.

Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) are considered COPCs for the site, but have not been designated as COCs. Like sulfolane, PFOS and PFOA are not regulated under the above-cited sections of the Alaska regulations; however, they are considered potential contaminants to be considered in future soil excavation plans, as appropriate.

Table 2-1. Constituents of Concern in Soil

Soil COC	Maximum Concentration (mg/kg)	Soil Cleanup Level [1] (mg/kg)
1,2,4-Trimethylbenzene	205	23
1,3,5-Trimethylbenzene	81.1	23
1,2,3 Trichloropropane	0.374	0.00053
Benzene	438	0.025
Ethylbenzene	392	6.9
Methylene chloride	0.188	0.016
n-Butylbenzene	107	15
sec-Butylbenzene	25.3	12
n-Propylbenzene	72.7	15
Toluene	1,330	6.5
Xylenes	2,510	63
1-Methylnaphthalene	88.5	6.2
2-Methylnaphthalene	240	6.1
Naphthalene	125	20
Sulfolane	1,620	TBD
Gasoline range organics	7,730	300
Diesel range organics	32,000	250
Residual range organics	64,700	11,000

[1] Soil cleanup level set at the minimum value of the direct contact, outdoor inhalation and migration to groundwater value in 18 AAC 75 Table B1 and B2 for the under 40-inch zone.

mg/kg = milligrams per kilogram

3. Compliance with Soil Management Requirements

NPR workers, contractors, and other third parties performing ground-disturbing activities within the site boundary will properly manage soil potentially contaminated with COCs (or "impacted soil"). Ground-disturbing activities include any man-made cut, boring, cavity, trench or depression in an earth surface, formed by earth removal. FHRA considers any dig of 12 inches or more an Excavation.

This Onsite SMP will be used in conjunction with existing NPR policies for Excavation activities. Soil management requirements for contaminated soils are defined below. Excavated soil will be properly characterized. Soil will be properly managed, transported, and disposed of in accordance with all state, federal and international laws and regulations.

3.1 Contaminated Soils Management Requirements

The area of the facility where soil may be found that is contaminated is identified in Attachment A. Pursuant to the FHRA Excavation Procedure, any excavation for the purpose of remediation that will take place will be subject to an excavation permit and will be supervised by the qualified person assigned to the excavation project.

For excavation that involves repair and replacement of existing infrastructure, excavated contaminated soil appropriate for use as fill material will be placed back in the excavation where it originated. For new construction or demolition activities, excavated contaminated soil may be used as backfill with prior ADEC approval. Obviously contaminated soils containing saturated levels of hydrocarbons or other COC will not be replaced unless a suitable replacement is not available and an unacceptable safety condition would result.

Basic requirements for handling contaminated soils excavated from the subsurface are as follows:

- Notify FHRA personnel and obtain an Excavation Permit pursuant to FHRA's procedures prior to any excavation.

- Do not transfer, remove, or otherwise move contaminated soils from a contaminated area to a non-contaminated area, or from one contaminated area to another contaminated area without properly emplacing engineering controls to mitigate potentially spreading contamination. Directions will be provided by FHRA

regarding the handling, management, and transport of any excess contaminated soils that will not be returned to the excavation for re-use.

- Avoid mixing contaminated and uncontaminated soils during excavation or repeated handling to minimize potential waste generation.

- Excavation equipment that comes in contact with contaminated soils must be properly decontaminated before transport offsite or to an uncontaminated area of the property.

If new areas of contamination are discovered while excavation is occurring in areas previously believed to be uncontaminated, it will be necessary to halt work in these areas. Under these circumstances, excavation activities will stop to ensure appropriate FHRA personnel and ADEC have been notified that actual or potential contaminated soils have been encountered. This work delay will allow FHRA to ensure that the appropriate health and safety and soil management procedures are in place before continuing.

4. Health and Safety Plan

A site-specific Health and Safety Policy (HSP-06, Alaska Excavation Procedure) has been and will continue to be used to protect the health and safety of subsurface workers when subsurface work is conducted at the site. The HSP conforms to the requirements established under 29 Code of Federal Regulations (CFR) 1910.120, including the use of appropriately trained workers, monitoring and identification of contaminated media, site health and safety officer's authorities and responsibilities, and health and safety meetings for applicable site personnel.

The Excavation Procedure requires anyone involved with subsurface work to use a minimum level of personal protective equipment (PPE) (e.g., protective clothing, work-appropriate gloves and boots, etc.) to protect against the COCs identified at the site. HSP-06 defines appropriate air monitoring protocols, PPE requirements, and worker decontamination.

Hazards associated with the site and the content of the Excavation Procedure are communicated to site workers prior to commencing Excavation work and during daily tailgate safety meetings. Site-specific hazards, changes in site conditions, safe work practices, PPE requirements, emergency procedures, and notification protocols will be discussed with the site workers as part of the Safe Work Permitting process.

The map included in Attachment A is also included in the Excavation Procedure and identifies areas containing COCs. In order to excavate in the areas identified on the map, employees, contractors and other third parties must obtain an Excavation Permit from trained FHRA employee. That employee's training will include identification of areas located within the map so that persons undertaking the excavation can undertake appropriate precautions.

The primary hazard relevant to this Onsite SMP is soil impacted by COCs identified in Table 2-1. The majority of the COCs are related to petroleum hydrocarbons. As the site operations directly involve the handling and storage of petroleum hydrocarbons, the site is very familiar and experienced with the health and safety requirements necessary to ensure workers are properly protected. The primary routes of exposure include inhalation of volatilized constituents in trench air. However, direct contact with soil impacted by other constituents associated with historical operations, including sulfolane, is also considered. Excavation work conducted at the NPR in areas of impacted soil, or areas with soil suspected to be impacted, requires the issuance of a Safe Work Permit prior to commencing work. This includes, but is not limited to, permission by operations personnel to work in an area, a discussion of potential hazards and associated risk mitigation activities, completion of an Excavation checklist, and designation of only authorized workers to be performing work within the work area.

Appropriate worker hygiene is required so that individuals will not inadvertently ingest or inhale impacted soil particles adhering to gloves or clothing, or ingest impacted groundwater. Work within the Excavation areas containing impacted soil is anticipated to require modified Level D PPE for workers who could potentially come into contact with impacted soil and/or groundwater. Modified Level D PPE includes: steel-toed boots, hard hat, and protective eyewear. Chemical-resistant gloves and/or respirators, as well as decontamination requirements, would be required if hazards are identified by the Excavation Competent Person or as part of the Safe Work Permitting Process.

5. Worker Health and Safety Training

The Alaska Occupational Safety and Health Program generally follows federal Occupational Safety and Health Administration (OSHA) requirements. According to OSHA 29 CFR 1910.120(e), workers and field supervisors that are engaged in hazardous substance removal as part of cleanup operations are required to have received either 24- or 40-hour Hazardous Waste Operations and Emergency Response training from a qualified vendor.

6. Soil Management Plan Amendments

This Onsite SMP may be amended and approved by the Property Owner as necessary to address changes in ownership, NPR operations, regulatory changes, or other requirements. A project-specific soil management plan may be prepared based on the proposed scope of future work.

7. References

ARCADIS U.S., Inc. 2012. Revised Draft Final Human Health Risk Assessment. May 24, 2012.

ARCADIS U.S., Inc. 2013a. Site Characterization Report – 2012 Addendum. January 25, 2013.

ARCADIS U.S., Inc. 2013b. Onsite Site Characterization Report – 2013 Addendum. December 20, 2013.

ARCADIS U.S., Inc. 2014. Final Onsite Cleanup Plan. October 2014.

Barr Engineering Company. 2012. Site Characterization Report – Through 2011. December 2012.

ARCADIS

Attachment A

Map of Potential Contamination

Legend

Soil potentially contaminated with BTEX or Sulfolane

FHRA Property Boundary

0 600 1,200

SCALE IN FEET

FLINT HILLS RESOURCES ALASKA, LLC
NORTH POLE REFINERY, NORTH POLE, ALASKA

ONSITE SOIL MANAGEMENT PLAN

MAP OF POTENTIALLY CONTAMINATED SOIL

ARCADIS

Appendix **A**

CITY: SAN FRANCISCO DIV/GROUP: ENV/IM DB: BGRIFFITH LD: PIC: PM: TM: TR:
PROJECT: (PROJECT #)
PATH: W:\ArcGisData\GISPROJECTS_ENV\FHR_AK\NorthPoleRefinery\Misc_Figures\AppendixA PotentiallyContaminatedSoil.mxd 10/14/2014 4:43:11 PM