

Flint Hills Resources Alaska, LLC

FIRST SEMIANNUAL 2016 OFFSITE GROUNDWATER MONITORING REPORT

North Pole Terminal
North Pole, Alaska

DEC File Number 100.38.090

July 29, 2016





Sarah Page, PhD
Management Consultant



Gina Withy
Project Engineer



Rebecca Andresen
Vice President

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North Pole, Alaska
DEC File Number 100.38.090

Prepared for:

Flint Hills Resources Alaska, LLC
1100 H and H Lane
North Pole, Alaska

Prepared by:

Arcadis U.S., Inc.
1100 Olive Way
Suite 800
Seattle, Washington 98101
Tel 206 325 5254
Fax 206 325 8218

Our Ref.:

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Date:

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ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
Arcadis	Arcadis U.S., Inc.
Barr	Barr Engineering Company
bwt	below the water table
CSM	conceptual site model
FHRA	Flint Hills Resources Alaska, LLC
Offsite RSAP	Offsite Revised Sampling and Analysis Plan
Onsite SCR – 2013	Onsite Site Characterization Report – 2013 Addendum
POE	point-of-entry treatment system
QA	quality assurance
QC	quality control
report	First Semiannual 2016 Offsite Groundwater Monitoring Report
reporting period	first and second quarters of 2016
site	Flint Hills Resources Alaska, LLC North Pole Terminal located on H and H Lane in North Pole, Alaska
µg/L	micrograms per liter

1 INTRODUCTION

On behalf of Flint Hills Resources Alaska, LLC (FHRA), Arcadis U.S., Inc. (Arcadis) prepared this First Semiannual 2016 Offsite Groundwater Monitoring Report (report) for groundwater located downgradient of the FHRA North Pole Terminal, located on H and H Lane in North Pole, Alaska (site). This report summarizes offsite field activities completed in areas beyond the site boundary during the first and second quarters of 2016 (reporting period), as described in Section 2. A separate First Semiannual 2016 Onsite Groundwater Monitoring Report is being submitted concurrently with this report.

The data, analyses, and conclusions presented in this report are the product of a collaborative effort among FHRA's consulting team members. The team includes qualified professionals in a variety of technical disciplines from three environmental consulting firms: Arcadis, Shannon & Wilson, Inc., and Barr Engineering Company (Barr). FHRA engaged these consulting firms to perform various tasks for the project. Pursuant to 18 Alaska Administrative Code (AAC) 75.335(c) (1), this report was prepared and submitted by a Qualified Environmental Professional. Samples were collected and analyzed in accordance with 18 AAC 75.355(a). Point-of-entry [POE] system sampling conducted by Arctic Home Living was supervised by FHRA and its consultants, and the resulting sample data were reviewed and used in reports prepared by a Qualified Environmental Professional.

The site, offsite area, and the site's physical setting are described in the conceptual site model (CSM), which was presented as Appendix A of the Onsite Site Characterization Report – 2013 Addendum (Onsite SCR – 2013; Arcadis 2013). The site is shown on Figure 1-1. An offsite site plan is presented on Figure 1-2.

2 CURRENT GROUNDWATER MONITORING PROGRAM AND METHODS

Monitoring conducted during first quarter 2016 was based on the methods and networks included in the Offsite Revised Sampling and Analysis Plan (Offsite RSAP, addendum to the Fourth Quarter 2015 Groundwater Monitoring Report; Arcadis 2015). Second quarter 2016 groundwater monitoring was conducted in accordance with the updated networks presented in correspondence to the Alaska Department of Environmental Conservation (ADEC) regarding the 2016 Offsite Groundwater Monitoring Program dated May 12, 2016 (FHRA 2016). Table 2-1 summarizes the offsite field activities completed during the reporting period. Offsite monitoring well locations are shown on Figure 1-2. Well construction details are summarized in the Offsite RSAP (Arcadis 2015).

Groundwater monitoring data are used to monitor offsite dissolved-phase sulfolane concentrations and groundwater nature and movement. Sulfolane is the only offsite contaminant of concern. As described above, groundwater monitoring during the reporting period was completed according to the procedures summarized in the Offsite RSAP (Arcadis 2015); however, monitoring conducted during the second quarter 2016 was completed according to updated networks provided in the 2016 Offsite Groundwater Monitoring Program that was submitted to ADEC on May 12, 2016 (FHRA 2016). One deviation from the Offsite RSAP (Arcadis 2015) and 2016 Offsite Groundwater Monitoring Program (FHRA 2016) was noted during the reporting period:

- Monitoring well MW-308-30 was frozen during both the first and second quarters of 2016; therefore, no samples were collected from this well during the reporting period. Well MW-308-15 in the same well nest was sampled quarterly during the reporting period.

2.1 Private Well Sampling

Private well locations with well identifiers are shown on the figure included as Appendix A. Background information about private well sampling is documented in the Alternative Water Solutions Program – Management Plan (Barr 2014) and Alternative Water Solutions Program – 2015 Annual Report (Barr 2016).

During first quarter 2016 sampling, FHRA collected samples from private wells, including initial groundwater samples from two private wells (PW-2223 and PW-2224). Private well PW-2223 is located within the previously defined search areas and the home located on the property was recently constructed. Private well PW-2224 is located outside the previously defined search areas and the sample from this private well was collected at the homeowners' request as a "call-in" sample.

During second quarter 2016 sampling, FHRA collected samples from private wells, including an initial sample from one private well (PW-2226). Private well PW-2226 is located outside the previously defined search areas and one sample was collected at the homeowner's request. The wells sampled for the first time during the reporting period are identified on Figure 2-1 with purple halos for samples obtained during the first quarter and with a pink halo for the sample obtained during the second quarter.

2.2 Well Maintenance Activities

During the reporting period, minor repairs were performed on 15 offsite monitoring wells. Other minor maintenance activities were performed as needed for the remaining offsite wells during the reporting period.

3 GROUNDWATER MONITORING RESULTS

Offsite groundwater impacts have been characterized, and continue to be monitored through the analysis of water-level gauging data and groundwater samples collected from offsite monitoring, U.S. Geological Survey, and private wells. Monitoring well field parameters are summarized in Table 3-1, and data are summarized in Tables 3-2 through 3-5.

Historical data for groundwater elevation, sulfolane analyses, private well analyses, and culvert elevations are included as Appendix B. Laboratory reports are provided in Appendix C. A data quality evaluation including ADEC quality assurance (QA)/quality control (QC) checklists is included as Appendix D. Field data sheets are included as Appendix E.

3.1 Groundwater Elevation

Depth to water measurements were collected from monitoring wells on March 22 and 23, 2016 for the first quarter 2016 groundwater elevation monitoring event. Potentiometric maps for the first quarter 2016 monitoring event are included on Figures 3-1 through 3-4 for each monitoring zone: water table, 10 to 55 feet below the water table (bwt), 55 to 90 feet bwt, and 90 to 160 feet bwt. Depth to water measurements and groundwater elevation data for the reporting period are summarized in Table 3-2. During the reporting period, the general direction of the horizontal hydraulic gradient was interpreted to be to the north-northwest, which is consistent with historical groundwater data. Vertical hydraulic gradients were also within the range of historical groundwater data, as discussed in Appendix F. Hydrographs are presented in Appendix G.

3.2 Sulfolane Distribution in Offsite Groundwater

During the first and second quarter 2016 groundwater monitoring events, samples were collected and submitted for sulfolane analysis from the offsite monitoring well network and the private well network. The offsite monitoring well data are presented in Table 3-3. Results from private wells sampled for the first time during the reporting period are presented in Table 3-4 (initial sampling). Results for the buffer zone and resampled private wells are presented in Table 3-5. Offsite sulfolane distribution for the first and second quarters of 2016 are included on Figures 3-5 through 3-10. Historical sulfolane analytical results are included in Appendix B.

3.2.1 Private Well Sampling Results

During first quarter 2016, two private wells were sampled for the first time: one call-in sample was collected from a private well outside the plume area (PW-2224) and one call-in sample was collected from within the sulfolane plume area (PW-2223). The sample from PW-2223, collected from a new structure/well, contained detectable concentrations of sulfolane at 56.4 micrograms per liter ($\mu\text{g/L}$). As a result of the sulfolane detection, FHRA initiated interim bottled water delivery for the home associated with PW-2223. Sulfolane was not detected in the sample from PW-2224.

During the second quarter 2016, one sample was collected for the first time from a private well located outside the sulfolane plume area (PW-2226). Sulfolane was not detected in the sample from PW-2226.

The most recent data within the last 12 months for each private well are shown on Figure 2-1 with color gradation to indicate the concentration. Initial sample results are presented in Table 3-4. Initial samples collected during the reporting period are highlighted on Figures 2-1, 3-5, and 3-8. Private well locations are also shown on the figure presented as Appendix A. Historical private well data, including current and historical POE treatment system data for raw water samples, are presented in Appendix B. Laboratory reports and associated ADEC QA/QC checklists reviewed during the reporting period are presented in Appendices C and D, respectively. Data were evaluated for potential sulfolane concentration trends through first quarter 2016; results are discussed in Section 3.3 and included in Appendix H.

3.2.2 Subpermafrost and Suprapermafrost Aquifers

Figures 3-5 and 3-8 show the combined sulfolane analytical results from offsite monitoring wells and private wells in both the suprapermafrost and subpermafrost aquifers for the first and second quarters of 2016, respectively. These figures include private wells that do not have available or reliable well construction information and, therefore, cannot be designated to either the suprapermafrost or subpermafrost aquifer. If the well was not sampled in the first or second quarter of 2016, then the most recent result within the preceding 12 months is indicated on the map and was used to estimate the extent of sulfolane impacts.

3.2.2.1 Offsite Sulfolane Distribution in the Suprapermafrost Aquifer

Offsite monitoring wells were sampled throughout the reporting period. A subset of these wells may indicate a “mixing zone” between the suprapermafrost and subpermafrost aquifers (Arcadis 2013; hereinafter referred to as “inferred mixing zone”), as shown on Figures 3-6 and 3-7, respectively (and similarly for second quarter 2016 on Figures 3-9 and 3-10). These results are presented in Table 3-3.

The highest sulfolane concentrations in the suprapermafrost aquifer are generally located in the middle of the plume, on the western side.

3.2.2.2 Offsite Sulfolane Distribution in the Subpermafrost Aquifer

Subpermafrost wells sampled during the reporting period included wells from the buffer zone, those identified as part of the resampling program, and POE system sampling. Figures 3-7 and 3-10 present sulfolane data for the first and second quarters, respectively, from samples collected from monitoring well and private wells installed through the permafrost in the deep aquifer system.

Consistent with past monitoring results, the highest sulfolane concentration in wells located within the subpermafrost aquifer to date was detected in PW-1230 (769 µg/L on April 27, 2016), which is located approximately 1 mile northwest of the northern site boundary. Private well PW-1230 has a total depth of approximately 231 feet below ground surface and is not used as a drinking water source. The duplicate sample result was 946J* µg/L, which resulted in an unusually high relative percent difference for the sulfolane field-duplicate pair PW-1230 (769 µg/L) / PW-1230DUP (946 µg/L). A follow-up sample was collected from this well on May 26, 2016, and sulfolane was detected at 733 µg/L. Further discussion of the Level IV analysis can be found in Appendix D.

3.3 Statistical Analysis of Offsite Sulfolane Data

A statistical and graphical evaluation of sulfolane concentration trends using a Mann-Kendall trend analysis is conducted semiannually during the first and third quarters at monitoring and private wells to evaluate plume migration and stability, and to identify relationships between concentrations, groundwater elevations, and flow directions.

The use of the Monitoring and Remediation Optimization System software, developed by the Air Force Center for Engineering and the Environment, for Mann-Kendall trend analysis was applied to offsite groundwater monitoring data collected since 2009 from monitoring wells and private wells.

The analysis trends are expressed as probably increasing, increasing, probably decreasing, decreasing, stable, or no trend. Results of the Mann-Kendall trend analysis for the reporting period are presented in Tables 1 and 2 and Figures 1A through 1D of Appendix H, and are summarized in the table below.

First Quarter 2016			
Parameter/Trend	Monitoring Wells	Suprapermafrost Private Wells	Subpermafrost Private Wells
Number of Wells	156	325	70
All Results Nondetect ^a	50	190	32
Insufficient Data Points ^a	22	60	6
Probably Decreasing	6	1	0
Decreasing	51	13	3
Probably Increasing	1	3	0
Increasing	14	33	23
Stable	6	11	1
No Trend	6	14	5

Notes:

^a Wells with insufficient data points for the statistical analysis (less than four points), but with all results below detection limits, are listed under "All Results Nondetect."

Trends associated with private wells with unknown depth information are included in Appendix H, Table 2.

Wells with increasing and decreasing trends that were screened within the suprapermafrost and the subpermafrost aquifers are discussed below.

3.3.1 Suprapermafrost Aquifer

Offsite monitoring wells in the suprapermafrost aquifer that displayed increasing trends are shown on Figure 1C of Appendix H.

Of these, monitoring well MW-346-65 is located within the inferred mixing zone; therefore, these wells may be influenced by subpermafrost concentrations. A review of the trend plots for this location, provided in Attachment 1 of Appendix H, shows an increasing trend for MW-346-65 since 2013. With the exception

of MW-187-15 and MW-316-15, the remaining monitoring wells with increasing and probably increasing trends are located within the detectable sulfolane plume near the center or leading edges of the plume. MW-187-15 is located near the western edge of the plume and has exhibited low-level estimated concentrations. MW-316-15 is located near the southeastern edge of the plume and has also exhibited low-level estimated concentrations. Concentrations have been stable or decreased to below the detection limit during the reporting period at these two locations.

A visual observation of the concentration trend plots (Attachment 1 of Appendix H) for the remaining wells with increasing Mann-Kendall trends show that concentrations at most locations are either stable or decreasing. The exceptions include MW-166B-30, MW-167B-35, MW-168A-15/B-50, and MW-347-150, which are located near the distal end of the plume. Concentrations at these locations have remained below 100 µg/L since sampling began at these locations.

Thirty-six private wells identified as being screened within the suprapermafrost aquifer displayed increasing or probably increasing trends, which was confirmed through a visual observation of the concentration trend plots (Attachment 1 of Appendix H). These wells are located near the center and along the leading edges of the offsite suprapermafrost sulfolane plume, with the exception of three private wells (PW-620, PW-624, and PW-1374), which are located near the western edge of the sulfolane plume.

Fifty-seven monitoring wells displayed decreasing or probably decreasing trends. A visual observation of the concentration trend plots show that sulfolane concentrations in these wells are continuing to decrease. The monitoring well locations with decreasing or probably decreasing trends are located throughout the plume, with the majority of the wells located in the central and proximal portions of the detectable sulfolane plume.

Fourteen private wells displayed decreasing or probably decreasing trends. A visual observation of the concentration trend plots show that sulfolane concentrations in these wells are continuing to decrease. Private well locations with decreasing or probably decreasing trends are located throughout the detectable sulfolane plume, with the majority of the wells located in the central portion of the plume.

3.3.2 Subpermafrost Aquifer

Trends for wells identified as being screened in the subpermafrost zone are depicted on Figure 1D in Appendix H. The monitoring wells shown on this figure were installed as suprapermafrost wells. However, these wells are located in the inferred mixing zone of the sub- and suprapermafrost aquifers, and appear to be representative of subpermafrost aquifer conditions. Of these wells that are installed in the inferred mixing zone that have increasing trends, a review of the trend plots for MW-332-150, provided in Attachment 1 of Appendix H, shows a stable trend in MW-332-150 since 2013. The locations with increasing or probably increasing trends are primarily located along the leading edge of the offsite sulfolane plume with the exception of PW-1155 and PW-1230, which are located in the central portion and the southernmost extent of the detectable subpermafrost plume, respectively. The available subpermafrost data represent the extended areas of the overall plume, where there are increasing trends both above and below the permafrost

Sulfolane detected at PW-1230 is believed to have reached the subpermafrost through a talik (Arcadis 2013). Vertical head differences across the permafrost at the location of PW-1230 have varied from upward to downward (Appendix F); therefore, migration of sulfolane through the talik is expected to be

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slow and the date of release of the sulfolane detected at PW-1230 cannot necessarily be inferred based on the distance from the site.

Decreasing or probably decreasing trends were observed in three subpermafrost private wells (PW-217, PW-358, and PW-1099).

4 CONCLUSIONS

Quarterly groundwater monitoring events were conducted in the first and second quarters of 2016. The events were conducted in general accordance with the Offsite RSAP (Arcadis 2015) and 2016 Offsite Groundwater Monitoring Program (FHRA 2016). The average magnitude of the horizontal hydraulic gradient in offsite groundwater was calculated at approximately 0.001 foot per foot during the reporting period. This result is consistent with historical data.

Based on the consistency of the monitoring data collected throughout the reporting period, the expected plume behaviour is consistent with previous site characterizations. An evaluation of sulfolane trends in the monitoring wells and private wells show that most of the wells with decreasing trends are located near the site boundary and center of the plume, while wells showing increasing trends are concentrated along the leading edge and distal portions of the plume.

The results from the third and fourth quarter 2016 monitoring activities will be submitted in a semiannual report in January 2017.

5 REFERENCES

Arcadis. 2013. Offsite Site Characterization Report – 2013 Addendum. December 20.

Arcadis. 2015. Fourth Quarter 2014 Groundwater Monitoring Report. January 31.

Barr. 2014. Alternative Water Solutions Program – Management Plan. October.

Barr. 2016. Alternative Water Solutions Program – 2015 Annual Report. February 26.

FHRA. 2016. 2016 Offsite Groundwater Monitoring Program – Flint Hills Resources Alaska North Pole Terminal. May 12.

TABLES



**Table 2-1
Offsite Field Activities**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
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Off-Site Activity	Frequency During Q1 and Q2
Groundwater Elevation Check	Semiannual
Vertical Hydraulic Gradient	Monthly
Culvert Measurements for Flow Rates	Monthly
Data Loggers	Downloaded in Q1 and Q2, measured hourly. UAF data loggers removed in Q1.
Residential Initial Sampling (call-ins)	Two call-ins during Q1, one call-in during Q2
Residential Re-samples	Throughout Q1 and Q2, sampled annually and/or as requested
POE Spent GAC Sampling	0 sampling events in Q1, 1 sampling event in Q2
Sulfolane Network Sampling	Throughout Q1 and Q2
Well Repair and Maintenance	15 monitoring wells repaired, and minor maintenance performed, as necessary

General Notes:

Q1 = Represents field activities associated with the sample results received January 1 through March 31, 2016 for monitoring wells and December 19, 2015 through March 14, 2016 for private wells.

Q2 = Represents field activities associated with the sample results received April 1 through June 30, 2016 for monitoring wells and March 15 through June 13, 2016 for private wells.

Acronyms and Abbreviations:

GAC = granular activated carbon

POE = point-of-entry treatment system

**Table 3-1
Offsite Monitoring Well Field Parameters
First Semiannual 2016 Offsite Groundwater Monitoring Report
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North Pole Terminal, North Pole, Alaska**

Location	Sample	Date	Analysis	Depth to Ice (feet)	Depth to Water (feet)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Sample Collection Notes	Additional Notes
MW-150A-10	MW-150A-10	1/27/2016	S	--	6.04	2.3	0.88	329.8	6.95	-34.9	Clear	Parameters stabilized	--
MW-150B-25	MW-150B-25	1/27/2016	S	--	6.12	2.9	0.86	255.6	7.10	3.0	Clear	>3 well volumes purged	--
MW-150B-25	MW-250B-25	1/27/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-150B-25	--
MW-150C-60	MW-150C-60	1/27/2016	S	--	5.45	1.7	0.86	198.9	7.22	142.2	Clear	Parameters stabilized	--
MW-151A-15	MW-151A-15	1/25/2016	S	--	5.95	1.8	0.83	188.2	7.09	-8.5	Clear	Parameters stabilized	--
MW-151B-25	MW-151B-25	1/25/2016	S	--	5.96	2.0	0.87	217.9	7.28	-27.5	Clear	Parameters stabilized	--
MW-151B-25	MW-251B-25	1/25/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-151B-25	--
MW-151C-60	MW-151C-60	1/25/2016	S	--	9.40	0.6	0.99	180.3	7.35	70.6	Clear	Parameters stabilized	--
MW-151C-60	EB-151C-60	1/25/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-151C-60	--
MW-152A-15	MW-152A-15	1/19/2016	S	--	6.91	2.0	0.72	250.8	7.05	-48.4	Clear	Parameters stabilized	--
MW-152B-25	MW-152B-25	1/19/2016	S	--	6.59	3.7	0.65	242.8	7.23	-33.5	Clear	Parameters stabilized	--
MW-152C-65	MW-152C-65	1/19/2016	S	--	6.57	2.1	0.66	193.2	7.37	36.3	Clear	Parameters stabilized	--
MW-153A-15	MW-153A-15	1/28/2016	S	--	7.83	2.6	0.45	332.4	6.75	73.4	Clear	Parameters stabilized	--
MW-153A-15	--	4/5/2016	--	2.50	7.58	--	--	--	--	--	--	--	Well obstructed by frozen ice, pump could not be deployed, sample not collected.
MW-153A-15	--	4/21/2016	--	2.50	7.72	--	--	--	--	--	--	--	Well obstructed by frozen ice, pump could not be deployed, sample not collected.
MW-153A-15	MW-153A-15	4/22/2016	S	--	7.76	1.7	0.09	259.8	6.96	100.5	Clear	Parameters stabilized	--
MW-153B-55	MW-153B-55	1/28/2016	S	--	7.30	4.3	0.39	257.5	7.35	56.1	Clear	Parameters stabilized	--
MW-153B-55	MW-153B-55	4/5/2016	S	--	7.06	4.3	0.16	105.8	7.04	348.3	Clear	>3 well volumes purged	--
MW-155A-15	MW-155A-15	1/27/2016	S	--	7.86	3.5	0.86	290.9	7.13	-66.0	Clear	Parameters stabilized	--
MW-155B-65	MW-155B-65	1/27/2016	S	--	7.86	2.7	0.96	166.6	7.30	29.4	Clear	Parameters stabilized	--
MW-155B-65	MW-255B-65	1/27/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-155B-65	--
MW-156A-15	MW-156A-15	1/27/2016	S	--	6.76	1.6	0.93	271.4	7.07	-86.1	Clear	Parameters stabilized	--
MW-156B-50	MW-156B-50	1/27/2016	S	--	10.46	0.7	1.07	198.6	7.33	15.8	Clear	Parameters stabilized	--
MW-157A-15	MW-157A-15	1/25/2016	S	--	6.61	2.0	1.24	246.1	7.21	-30.0	Clear	Parameters stabilized	--
MW-157B-30	MW-157B-30	1/25/2016	S	--	6.55	1.6	1.45	220.1	7.33	-51.6	Clear	>3 well volumes purged	--
MW-157B-30	MW-257B-30	1/25/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-157B-30	--
MW-158A-15	MW-158A-15	1/26/2016	S	--	7.33	1.9	0.98	489.2	6.63	60.0	Clear	>3 well volumes purged	--
MW-158B-60	MW-158B-60	1/26/2016	S	--	7.12	0.9	0.85	169.4	7.31	77.0	Clear	>3 well volumes purged	--
MW-159A-15	MW-159A-15	1/28/2016	S	--	7.85	1.9	1.66	425.5	6.44	179.3	Clear	>3 well volumes purged	--
MW-159B-45	MW-159B-45	1/28/2016	S	--	7.67	1.3	0.37	247.0	7.24	167.6	Clear	Parameters stabilized	--
MW-159B-45	EB-159B-45	1/28/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-159B-45	--
MW-159C-70	MW-159C-70	1/28/2016	S	--	8.11	0.7	0.30	231.8	7.32	165.5	Clear	Parameters stabilized	--
MW-160AR-15	MW-160AR-15	1/26/2016	S	--	6.98	2.9	0.95	205.8	7.09	-25.7	Clear	Parameters stabilized	--
MW-160B-90	MW-160B-90	1/26/2016	S	--	6.63	1.2	1.12	184.5	7.39	-75.6	Clear	Parameters stabilized	--
MW-161-30	MW-161-30	1/11/2016	S	--	6.62	0.4	0.92	275.1	7.24	-67.3	Clear	Parameters stabilized	--
MW-161-30	MW-261-30	1/11/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-161-30	--
MW-161A-15	MW-161A-15	1/11/2016	S	--	6.48	1.1	0.84	286.2	7.11	-69.5	Clear	Parameters stabilized	--
MW-161A-15	MW-161A-15	4/4/2016	S	--	6.01	0.7	0.23	386.4	7.15	57.7	Clear	>3 well volumes purged	--
MW-161B-50	MW-161B-50	1/11/2016	S	--	6.50	0.1	0.83	250.2	7.28	-75.3	Clear	Parameters stabilized	--
MW-162A-15	MW-162A-15	1/29/2016	S	--	8.27	1.1	1.50	321.8	7.02	-56.4	Clear	>3 well volumes purged	--
MW-162B-65	MW-162B-65	1/29/2016	S	--	8.23	0.3	1.18	193.3	7.27	-33.2	Clear	Parameters stabilized	--
MW-163A-15	MW-163A-15	1/25/2016	S	--	9.50	1.61	1.22	262	6.62	33.8	Clear	Parameters stabilized	--
MW-163A-15	EB-163A-15	1/25/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-163A-15	--
MW-163B-40	MW-163B-40	1/25/2016	S	--	9.70	0.21	0.79	200	7.06	-44.1	Clear	Parameters stabilized	--
MW-164A-15	MW-164A-15	1/25/2016	S	--	7.51	1.23	0.94	279	6.41	-29.0	Clear	>3 well volumes purged	--
MW-164B-50	MW-164B-50	1/25/2016	S	--	6.91	-0.03	0.81	226	6.58	-10.7	Clear	Parameters stabilized	--
MW-164C-60	MW-164C-60	1/25/2016	S	--	6.35	-0.06	0.72	228	6.74	-23.7	Clear	Parameters stabilized	--
MW-164C-60	MW-264C-60	1/25/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-164C-60	--
MW-165A-15	MW-165A-15	1/11/2016	S	--	6.08	2.2	0.93	223.6	6.57	-86.2	Clear	>3 well volumes purged	--

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Table 3-1
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North Pole Terminal, North Pole, Alaska

Location	Sample	Date	Analysis	Depth to Ice (feet)	Depth to Water (feet)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Sample Collection Notes	Additional Notes
MW-165B-50	MW-165B-50	1/11/2016	S	--	5.86	2.6	0.73	206.8	7.28	-53.7	Clear	Parameters stabilized	--
MW-166A-15	MW-166A-15	1/25/2016	S	--	6.59	-0.1	0.63	324.6	6.82	-58.3	Clear	Parameters stabilized	--
MW-166A-15	MW-166A-15	4/22/2016	S	--	7.13	0.2	0.17	269.5	7.15	209.4	Slightly Turbid	>3 well volumes purged	Observed sediment in purge water.
MW-166B-30	MW-166B-30	1/25/2016	S	--	6.59	-0.3	0.48	263.3	7.13	-56.1	Clear	Parameters stabilized	--
MW-166B-30	MW-166B-30	4/21/2016	S	--	7.09	0.3	0.15	242.8	7.25	272.6	Slightly Turbid	Parameters stabilized	Observed sediment in purge water.
MW-167A-15	MW-167A-15	1/12/2016	S	--	9.28	0.7	0.84	419.6	6.49	59.8	Clear	Parameters stabilized	--
MW-167A-15	MW-167A-15	4/4/2016	S	--	9.06	0.4	0.81	438.8	6.96	89.4	Clear	Parameters stabilized	--
MW-167A-15	EB-167A-15	4/4/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-167A-15.	--
MW-167B-35	MW-167B-35	1/12/2016	S	--	9.15	0.3	0.14	430.5	6.26	33.4	Clear	>3 well volumes purged	--
MW-167B-35	MW-167B-35	4/4/2016	S	--	8.90	0.3	0.30	430.1	7.04	85.1	Clear	>3 well volumes purged	--
MW-168A-15	MW-168A-15	1/27/2016	S	--	6.68	0.76	0.96	210	4.85	63.1	Clear	>3 well volumes purged	--
MW-168A-15	MW-168A-15	4/5/2016	S	--	8.58	0.3	1.14	217.2	6.98	-71.0	Clear	Parameters stabilized	--
MW-168A-15	MW-268A-15	4/5/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-168A-15.	--
MW-168B-50	MW-168B-50	1/27/2016	S	--	6.72	0.15	0.85	202	6.07	-26.5	Clear	>3 well volumes purged	--
MW-168B-50	MW-168B-50	4/5/2016	S	--	8.62	0.2	0.93	206.6	7.20	-85.5	Clear	Parameters stabilized	--
MW-169A-15	MW-169A-15	1/26/2016	S	--	9.40	0.6	0.47	235.6	7.18	-40.1	Clear	Parameters stabilized	--
MW-169C-60	MW-169C-60	1/26/2016	S	--	6.34	-0.3	0.45	221.1	7.31	-1.2	Clear	Parameters stabilized	--
MW-170A-15	MW-170A-15	1/28/2016	S	--	8.99	4.7	0.83	571	6.53	-160.0	Clear	Parameters stabilized	--
MW-170B-75	MW-170B-75	1/28/2016	S	--	8.97	3.7	0.76	193.6	7.27	-123.0	Clear	Parameters stabilized	--
MW-170B-75	MW-270B-75	1/28/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-170B-75	--
MW-170C-130	MW-170C-130	1/28/2016	S	--	8.72	4.0	0.68	126.8	7.29	20.9	Clear	Parameters stabilized	--
MW-170D-50	MW-170D-50	1/28/2016	S	--	8.71	4.1	0.65	250.7	7.31	-139.7	Clear	Parameters stabilized	--
MW-172A-15	MW-172A-15	1/12/2016	S	--	6.09	1.8	0.14	258.1	6.75	-45.3	Clear	Parameters stabilized	--
MW-172B-150	MW-172B-150	1/12/2016	S	--	6.15	3.1	0.15	165.9	6.93	-29.4	Clear	Parameters stabilized	--
MW-181A-15	MW-181A-15	1/27/2016	S	--	8.68	1.93	0.65	190	7.05	-27.1	Clear	Parameters stabilized	--
MW-181A-15	MW-281A-15	1/27/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-181A-15	--
MW-181B-50	MW-181B-50	1/27/2016	S	--	6.56	2.61	0.57	176	7.20	-22.0	Clear	Parameters stabilized	--
MW-181C-150	MW-181C-150	1/27/2016	S	--	8.55	3.32	0.60	177	7.31	-100.0	Clear	Parameters stabilized	--
MW-182A-15	MW-182A-15	1/19/2016	S	--	6.65	0.4	1.02	259.9	6.92	-21.9	Clear	>3 well volumes purged	--
MW-182A-15	MW-182A-15	4/4/2016	S	--	6.72	0.5	0.49	265.5	6.98	201.5	Clear	>3 well volumes purged	--
MW-182A-15	MW-282A-15	4/4/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-182A-15.	--
MW-182B-45	MW-182B-45	1/19/2016	S	--	6.15	0.1	0.87	248.0	7.01	-6.9	Clear	Parameters stabilized	--
MW-182B-45	MW-282B-45	1/19/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-182B-45	--
MW-182B-45	MW-182B-45	4/4/2016	S	--	5.80	0.3	0.18	234.5	7.17	115.8	Clear	>3 well volumes purged	--
MW-183A-15	MW-183A-15	1/11/2016	S	--	6.43	0.6	1.22	242.1	7.09	-32.5	Clear	>3 well volumes purged	--
MW-183B-60	MW-183B-60	1/11/2016	S	--	6.76	0.3	0.81	222.0	7.21	-72.2	Clear	Parameters stabilized	--
MW-184-45	MW-184-45	1/28/2016	S	--	7.48	0.8	0.45	240.9	7.26	104.1	Clear	Parameters stabilized	--
MW-185A-15	MW-185A-15	1/11/2016	S	--	6.77	1.9	6.98	360.4	6.83	-53.8	Clear	>3 well volumes purged	--
MW-185A-15	MW-185A-15	4/21/2016	S	--	6.94	1.0	1.44	457.3	7.03	-104.2	Clear	>3 well volumes purged	--
MW-185A-15	EB-185A-15	4/21/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-185A-15.	--
MW-185B-50	MW-185B-50	1/11/2016	S	--	6.82	3.7	0.09	208.2	7.06	-73.3	Clear	Parameters stabilized	--
MW-185B-50	MW-185B-50	4/21/2016	S	--	7.01	3.8	1.06	209.6	7.40	-106.3	Clear	Parameters stabilized	--
MW-185C-120	MW-185C-120	1/11/2016	S	--	6.79	3.2	0.21	164.0	7.03	-28.4	Clear	Parameters stabilized	--
MW-185C-120	MW-185C-120	4/5/2016	S	--	6.74	3.5	0.16	143.7	7.62	231.0	Clear	>3 well volumes purged	--
MW-187-15	MW-187-15	1/26/2016	S	--	12.27	1.5	0.97	231.6	7.18	206.6	Clear	>3 well volumes purged	--
MW-187-15	MW-187-15	4/21/2016	S	--	11.69	1.4	1.70	181.7	7.09	10.1	Clear	>3 well volumes purged	--
MW-189A-15	MW-189A-15	1/11/2016	S	--	4.24	1.5	0.16	408.1	6.66	-18.4	Clear	>3 well volumes purged	--
MW-189B-60	MW-189B-60	1/11/2016	S	--	4.58	2.0	0.19	213.0	6.83	12.8	Clear	Parameters stabilized	--
MW-190-150	MW-190-150	1/14/2016	S	--	8.37	3.6	0.77	158.3	7.64	-95.4	Clear	Parameters stabilized	--
MW-190A-15	MW-190A-15	1/14/2016	S	--	8.02	2.8	0.88	223.0	6.91	-40.3	Clear	Parameters stabilized	--
MW-190A-15	EB-190A-15	1/14/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-190A-15	--

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North Pole Terminal, North Pole, Alaska

Location	Sample	Date	Analysis	Depth to Ice (feet)	Depth to Water (feet)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Sample Collection Notes	Additional Notes
MW-190BR-60	MW-190BR-60	1/14/2016	S	--	8.32	3.1	0.72	178.4	7.40	-63.5	Clear	Parameters stabilized	--
MW-191A-15	MW-191A-15	1/11/2016	S	--	5.51	2.7	1.29	226.0	7.06	5.0	Clear	Parameters stabilized	--
MW-191B-60	MW-191B-60	1/11/2016	S	--	5.37	3.7	0.64	184.4	7.35	15.0	Clear	Parameters stabilized	--
MW-193A-15	MW-193A-15	1/27/2016	S	--	8.39	1.4	0.43	472.4	6.61	119.4	Clear	Parameters stabilized	--
MW-193B-60	MW-193B-60	1/27/2016	S	--	8.33	-0.1	0.34	233.1	7.22	145.7	Clear	Parameters stabilized	--
MW-194A-15	MW-194A-15	1/27/2016	S	--	5.96	0.1	1.36	267.6	6.97	1.5	Clear	Parameters stabilized	--
MW-194A-15	MW-194A-15	4/22/2016	S	--	6.46	0.4	0.21	217.4	7.10	288.9	Clear	Parameters stabilized	--
MW-194B-40	MW-194B-40	1/27/2016	S	--	5.35	-0.2	0.42	265.4	7.19	3.0	Clear	Parameters stabilized	--
MW-194B-40	MW-194B-40	4/22/2016	S	--	6.29	0.3	0.16	231.1	7.33	294.2	Clear	Parameters stabilized	--
MW-308-15	MW-308-15	1/25/2016	S	--	10.33	1.0	0.52	313.2	6.79	34.0	Clear	>3 well volumes purged	--
MW-308-15	MW-408-15	1/25/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-308-15	--
MW-308-15	MW-308-15	4/21/2016	S	--	9.65	1.1	1.20	282.0	6.81	-31.2	Clear	>3 well volumes purged	--
MW-308-30	--	1/25/2016	--	8.71	--	--	--	--	--	--	--	--	Well frozen, sample not collected.
MW-308-30	--	4/21/2016	--	8.70	--	--	--	--	--	--	--	--	Well frozen, sample not collected.
MW-308-30	--	5/18/2016	--	8.71	--	--	--	--	--	--	--	--	Well frozen, sample not collected.
MW-311-15	MW-311-15	1/11/2016	S	--	5.46	0.9	0.15	211.9	6.64	3.4	Clear	Parameters stabilized	--
MW-311-46	MW-311-46	1/11/2016	S	--	5.32	0.5	0.36	182.4	6.76	22.7	Clear	Parameters stabilized	--
MW-314-15	MW-314-15	1/12/2016	S	--	7.73	1.2	1.78	318.4	6.43	40.7	Clear	Parameters stabilized	--
MW-314-150	MW-314-150	1/12/2016	S	--	7.66	2.5	0.35	187.8	6.97	-47.5	Clear	Parameters stabilized	--
MW-316-15	MW-316-15	1/26/2016	S	--	7.70	1.9	0.87	236.9	7.06	-62.5	Clear	Parameters stabilized	--
MW-316-15	MW-316-15	4/5/2016	S	--	7.55	1.5	0.20	232.3	7.08	225.0	Clear	>3 well volumes purged	--
MW-316-15	EB-316-15	4/5/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-316-15.	--
MW-316-56	MW-316-56	1/26/2016	S	--	7.84	0.8	1.02	184.1	7.34	24.6	Clear	Parameters stabilized	--
MW-317-15	MW-317-15	1/27/2016	S	--	7.29	1.0	1.22	248.5	6.98	26.3	Clear	>3 well volumes purged	--
MW-317-71	MW-317-71	1/27/2016	S	--	7.21	0.7	1.19	191.7	7.40	-26.0	Clear	Parameters stabilized	--
MW-323-15	MW-323-15	1/27/2016	S	--	8.82	0.2	0.32	245.3	7.08	15.2	Clear	Parameters stabilized	--
MW-323-50	MW-323-50	1/27/2016	S	--	8.02	0.4	0.37	255.1	7.17	34.9	Clear	Parameters stabilized	--
MW-325-150	MW-325-150	1/14/2016	S	--	11.94	4.0	0.81	120.1	7.65	-125.8	Clear	Parameters stabilized	--
MW-325-18	MW-325-18	1/14/2016	S	--	11.66	3.1	1.58	219.0	6.79	-49.6	Clear	Parameters stabilized	--
MW-328-15	MW-328-15	1/6/2016	S	--	7.12	2.0	0.48	300.1	7.05	-21.9	Turbid	Parameters stabilized	--
MW-328-151	MW-328-151	1/6/2016	S	--	7.43	1.5	0.26	153.3	7.60	-82.3	Clear	Parameters stabilized	--
MW-329-15	MW-329-15	1/12/2016	S	--	10.49	0.6	1.48	267.9	6.74	22.8	Clear	>3 well volumes purged	--
MW-329-66	MW-329-66	1/12/2016	S	--	6.93	0.0	0.26	214.6	7.00	35.3	Clear	Parameters stabilized	--
MW-332-110	MW-332-110	1/7/2016	S	--	6.92	1.2	9.50	176.7	7.32	-48.8	Clear	Parameters stabilized	Observed higher than normal DO.
MW-332-15	MW-332-15	1/13/2016	S	--	7.36	1.5	0.43	237.5	7.14	-46.7	Clear	Parameters stabilized	--
MW-332-150	MW-332-150	1/13/2016	S	--	7.23	1.2	0.32	181.2	7.34	-94.4	Clear	Parameters stabilized	--
MW-332-150	MW-332-150	5/17/2016	S	--	7.17	1.54	1.11	182	7.11	-77.1	Clear	Parameters stabilized	--
MW-332-41	MW-332-41	1/13/2016	S	--	7.29	1.3	0.33	226.0	7.27	-50.2	Clear	Parameters stabilized	--
MW-332-75	MW-332-75	1/7/2016	S	--	6.93	1.4	2.36	200.8	6.89	-2.6	Clear	Parameters stabilized	--
MW-332-75	MW-432-75	1/7/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-332-75	--
MW-335-41	MW-335-41	1/11/2016	S	--	5.36	0.0	0.24	227.8	6.69	3.7	Clear	Parameters stabilized	--
MW-338-15	MW-338-15	1/26/2016	S	--	6.92	0.7	1.19	286.6	7.25	24.6	Clear	Parameters stabilized	--
MW-338-50	MW-338-50	1/26/2016	S	--	7.16	0.2	1.09	207.6	7.31	-33.5	Clear	Parameters stabilized	--
MW-338-50	EB-338-50	1/26/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-338-50	--
MW-339-15	MW-339-15	1/25/2016	S	--	8.85	0.06	0.75	252	6.74	-69.0	Clear	Parameters stabilized	--
MW-339-50	MW-339-50	1/25/2016	S	--	8.83	-0.09	1.17	238	6.73	-54.8	Clear	Parameters stabilized	--
MW-339-50	MW-439-50	1/25/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-339-50	--
MW-340-150	MW-340-150	1/14/2016	S	--	4.50	3.9	0.87	173.9	7.68	-112.7	Clear	Parameters stabilized	--
MW-340-18	MW-340-18	1/14/2016	S	--	4.81	2.6	0.80	232.9	7.36	-47.9	Clear	Parameters stabilized	--
MW-340-65	MW-340-65	1/14/2016	S	--	4.90	4.0	0.70	159.8	7.42	-70.3	Clear	Parameters stabilized	--
MW-341-15	MW-341-15	1/12/2016	S	--	7.18	0.7	0.55	303.9	6.77	30.1	Clear	Parameters stabilized	--

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Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Location	Sample	Date	Analysis	Depth to Ice (feet)	Depth to Water (feet)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Sample Collection Notes	Additional Notes
MW-341-15	EB-341-15	1/12/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-341-15	--
MW-341-40	MW-341-40	1/12/2016	S	--	6.92	0.2	1.77	226.2	7.19	45.0	Clear	>3 well volumes purged	--
MW-342-15	MW-342-15	1/26/2016	S	--	7.38	2.0	0.71	293.2	6.99	221.9	Clear	Parameters stabilized	--
MW-342-15	EB-342-15	1/26/2016	S	--	--	--	--	--	--	--	--	Equipment Blank of MW-342-15	--
MW-342-65	MW-342-65	1/26/2016	S	--	7.56	0.3	0.72	252.1	7.30	226.3	Clear	Parameters stabilized	--
MW-343-15	MW-343-15	1/25/2016	S	--	9.36	1.1	1.10	234.3	7.07	61.1	Clear	Parameters stabilized	--
MW-343-50	MW-343-50	1/25/2016	S	--	9.13	0.0	1.23	229.2	7.25	50.4	Clear	>3 well volumes purged	--
MW-346-15	MW-346-15	1/27/2016	S	--	5.25	0.85	0.95	254	6.79	-90.7	Clear	Parameters stabilized	--
MW-346-15	MW-446-15	1/27/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-346-15	--
MW-346-150	MW-346-150	1/27/2016	S	--	4.75	2.19	0.73	157	7.34	-101.1	Clear	Parameters stabilized	--
MW-346-65	MW-346-65	1/27/2016	S	--	4.65	0.97	0.72	176	6.96	-52.7	Clear	Parameters stabilized	--
MW-346-65	MW-346-65	4/21/2016	S	--	5.05	1.2	1.49	180.8	7.11	-2.6	Clear	Parameters stabilized	--
MW-347-150	MW-347-150	2/4/2016	S	--	10.23	2.77	0.49	164	7.36	-98.8	Clear	Parameters stabilized	--
MW-347-150	MW-347-150	4/5/2016	S	--	10.45	3.1	0.94	165.0	7.41	-102.4	Clear	Parameters stabilized	--
MW-347-20	MW-347-20	2/4/2016	S	--	10.57	3.08	0.58	205	7.09	-84.1	Clear	>3 well volumes purged	--
MW-347-65	MW-347-65	2/4/2016	S	--	9.42	2.61	0.64	180	7.22	-66.0	Clear	Parameters stabilized	--
MW-347-65	MW-347-65	4/5/2016	S	--	9.53	2.9	0.74	179.0	7.26	-54.0	Clear	Parameters stabilized	--
MW-349-15	MW-349-15	2/5/2016	S	--	7.47	0.1	2.49	221.3	6.60	8.5	Clear	>3 well volumes purged	--
MW-349-45	MW-349-45	2/5/2016	S	--	7.71	0.1	1.22	203.5	7.36	-11.1	Clear	Parameters stabilized	--
MW-350-15	MW-350-15	1/29/2016	S	--	9.22	2.0	1.12	277.3	6.97	49.7	Clear	Parameters stabilized	--
MW-350-50	MW-350-50	1/29/2016	S	--	9.20	0.8	1.04	150.8	7.23	-15.0	Clear	Parameters stabilized	--
MW-350-50	MW-450-50	1/29/2016	S	--	--	--	--	--	--	--	--	Duplicate of MW-350-50	--
MW-352-15	MW-352-15	2/4/2016	S	--	8.35	0.98	1.10	437	7.01	80.3	Clear	>3 well volumes purged	--
MW-352-15	MW-352-15	4/5/2016	S	--	8.35	0.7	1.28	419.8	6.83	-45.9	Clear	>3 well volumes purged	--
MW-352-40	MW-352-40	2/4/2016	S	--	8.47	0.23	0.80	359	6.43	-15.6	Clear	>3 well volumes purged	--
MW-352-40	--	4/5/2016	--	--	8.46	--	--	--	--	--	--	--	Well frozen, sample not collected.
MW-352-40	MW-352-40	4/28/2016	S	--	9.08	0.5	1.70	335.2	7.14	125.0	Clear	>3 well volumes purged	--
MW-353-100	MW-353-100	1/29/2016	S	--	6.76	0.4	1.20	218.1	7.19	1.4	Clear	Parameters stabilized	--
MW-353-15	MW-353-15	1/29/2016	S	--	6.22	1.0	1.23	274.3	6.99	-22.7	Clear	Parameters stabilized	--
MW-353-65	MW-353-65	1/29/2016	S	--	6.68	0.6	1.19	219.9	7.21	-29.3	Clear	Parameters stabilized	--
MW-356-20	MW-356-20	1/7/2016	S	--	7.39	2.8	0.44	292.2	7.00	106.6	Clear	Parameters stabilized	--
MW-356-65	MW-356-65	1/7/2016	S	--	7.46	3.5	0.55	228.9	7.36	90.6	Clear	Parameters stabilized	--
MW-356-90	MW-356-90	1/7/2016	S	--	7.43	3.7	0.27	226.8	7.36	94.8	Clear	Parameters stabilized	--
MW-357-15	MW-357-15	2/1/2016	S	--	12.17	3.2	0.58	209.9	6.87	124.0	Clear	>3 well volumes purged	--
MW-357-150	MW-357-150	1/18/2016	S	--	12.14	3.9	0.65	137.1	7.63	-93.8	Clear	Parameters stabilized	Observed sand in purge water.
MW-357-65	MW-357-65	2/1/2016	S	--	12.14	3.6	0.44	209.7	7.54	-68.1	Clear	Parameters stabilized	--

General Notes:

First Quarter 2016 field activities were completed from January 1, 2016 through March 31, 2016.

Second Quarter 2016 field activities were completed from April 1, 2016 to June 30, 2016.

Acronyms and Abbreviations:

- = not applicable
- °C = degrees Celsius
- DO = dissolved oxygen
- DUP = field duplicate sample
- EB = equipment blank
- mg/L = micrograms per liter
- mV = millivolts
- MW = monitoring well
- ORP = oxidation-reduction potential
- S = sulfolane
- µS/cm = microsiemens per centimeter

**Table 3-2
Offsite Groundwater Elevation Monitoring Results**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Well ID	Zone	Survey Date	Riser Elevation (MSL feet)	Date Measured	Depth to Water (feet)	Probe Correction (feet)	Corrected Groundwater Elevation (MSL feet)
MW-150A-10	Water Table	8/7/2015	487.27	3/22/2016	6.21	0.00	481.06
MW-150B-25	10-55	8/7/2015	487.40	3/22/2016	6.30	0.00	481.10
MW-152A-15	Water Table	8/7/2015	488.53	3/22/2016	7.03	0.00	481.50
MW-152B-25	10-55	8/7/2015	488.28	3/22/2016	6.73	0.00	481.55
MW-152C-65	10-55	8/7/2015	488.22	3/22/2016	6.70	0.00	481.52
MW-153A-15	Water Table	8/11/2015	490.26	3/22/2016	8.00	0.00	482.26
MW-153B-55	10-55	8/11/2015	489.81	3/22/2016	7.47	0.00	482.34
MW-155A-15	Water Table	8/7/2015	488.59	3/22/2016	8.05	0.00	480.54
MW-156A-15	Water Table	6/25/2015	485.84	3/22/2016	6.90	0.00	478.94
MW-156B-50	10-55	8/11/2015	489.58	3/22/2016	10.59	0.00	478.99
MW-158A-15	Water Table	3/24/2016	487.70	3/22/2016	7.41	0.00	480.29
MW-158B-60	10-55	8/11/2015	487.41	3/22/2016	7.30	0.00	480.11
MW-159A-15	Water Table	8/11/2015	487.84	3/22/2016	7.57	0.00	480.27
MW-159B-45	10-55	8/11/2015	487.77	3/22/2016	7.78	0.00	479.99
MW-159C-70	55-90	8/11/2015	488.16	3/22/2016	8.26	0.00	479.90
MW-160B-90	55-90	3/22/2016	485.28	3/22/2016	6.74	0.00	478.54
MW-161A-15	Water Table	3/24/2016	479.61	3/22/2016	6.53	0.00	473.08
MW-161B-50	10-55	8/7/2015	479.70	3/22/2016	6.68	0.00	473.02
MW-162A-15	Water Table	3/22/2016	484.06	3/22/2016	8.32	0.00	475.74
MW-162B-65	10-55	3/22/2016	483.95	3/22/2016	8.27	0.00	475.68
MW-163A-15	Water Table	6/5/2015	485.04	3/22/2016	9.66	0.00	475.38
MW-163B-40	10-55	6/5/2015	485.29	3/22/2016	9.88	0.00	475.41
MW-164A-15	Water Table	10/1/2015	480.25	3/22/2016	7.66	0.00	472.59
MW-164B-50	10-55	6/5/2015	479.83	3/22/2016	7.04	0.00	472.79
MW-164C-60	10-55	3/24/2016	479.59	3/22/2016	6.52	0.00	473.07
MW-165A-15	Water Table	8/10/2015	474.88	3/22/2016	6.41	0.00	468.47
MW-165B-50	10-55	8/10/2015	474.74	3/22/2016	6.21	0.00	468.53
MW-166A-15	Water Table	8/10/2015	474.99	3/22/2016	7.06	0.00	467.93
MW-166B-30	10-55	8/10/2015	475.06	3/22/2016	7.03	0.00	468.03
MW-167A-15	Water Table	3/24/2016	475.68	3/23/2016	9.26	0.00	466.42
MW-167B-35	10-55	8/11/2015	475.57	3/23/2016	9.11	0.00	466.46
MW-168A-15	Water Table	8/10/2015	477.77	3/22/2016	8.58	0.00	469.19
MW-168B-50	10-55	8/10/2015	477.84	3/22/2016	8.91	0.00	468.93
MW-169A-15	Water Table	3/24/2016	486.05	3/22/2016	9.58	0.00	476.47
MW-169B-50	10-55	8/7/2015	485.95	3/22/2016	9.42	0.00	476.53
MW-169C-60	10-55	3/24/2016	483.05	3/22/2016	6.57	0.00	476.48
MW-170A-15	Water Table	8/6/2015	490.69	3/22/2016	9.16	0.00	481.53
MW-170B-75	55-90	8/6/2015	490.70	3/22/2016	9.21	0.00	481.49
MW-170C-130	90-160	12/4/2015	490.46	3/22/2016	8.88	0.00	481.58
MW-170D-50	10-55	8/6/2015	490.43	3/22/2016	8.86	0.00	481.57
MW-172A-15	Water Table	12/4/2015	475.47	3/22/2016	5.90	0.00	469.57

Notes and Abbreviations on Page 3.

**Table 3-2
Offsite Groundwater Elevation Monitoring Results**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Well ID	Zone	Survey Date	Riser Elevation (MSL feet)	Date Measured	Depth to Water (feet)	Probe Correction (feet)	Corrected Groundwater Elevation (MSL feet)
MW-172B-150	90-160	12/4/2015	475.52	3/22/2016	5.95	0.00	469.57
MW-181A-15	Water Table	6/25/2015	475.90	3/22/2016	8.68	0.00	467.22
MW-181B-50	10-55	6/25/2015	475.84	3/22/2016	8.53	0.00	467.31
MW-181C-150	90-160	8/11/2015	475.96	3/22/2016	8.49	0.00	467.47
MW-182A-15	Water Table	10/30/2015	475.45	3/23/2016	6.98	0.00	468.47
MW-182B-45	10-55	10/30/2015	475.26	3/23/2016	6.10	0.00	469.16
MW-183A-15	Water Table	8/10/2015	478.07	3/22/2016	Frozen	—	—
MW-183B-60	10-55	8/10/2015	478.35	3/22/2016	Frozen	—	—
MW-184-45	10-55	10/30/2015	486.31	3/22/2016	7.75	0.00	478.56
MW-185A-15	Water Table	8/10/2015	478.07	3/22/2016	6.50	0.00	471.57
MW-185B-50	10-55	8/10/2015	478.08	3/22/2016	6.57	0.00	471.51
MW-185C-120	90-160	8/10/2015	478.10	3/22/2016	6.54	0.00	471.56
MW-187-15	Water Table	3/24/2016	485.25	3/22/2016	11.93	0.00	473.32
MW-188A-15	Water Table	7/18/2015	461.52	3/22/2016	5.64	0.00	455.88
MW-188B-40	10-55	7/18/2015	461.44	3/22/2016	5.61	0.00	455.83
MW-189A-15	Water Table	8/11/2015	470.23	3/23/2016	4.09	0.00	466.14
MW-189B-60	10-55	8/11/2015	470.56	3/23/2016	4.41	0.00	466.15
MW-190A-15	Water Table	3/24/2016	481.81	3/22/2016	8.03	0.00	473.78
MW-190BR-60	10-55	8/10/2015	481.94	3/22/2016	8.21	0.00	473.73
MW-191A-15	Water Table	8/10/2015	475.67	3/22/2016	4.82	0.00	470.85
MW-191B-60	10-55	8/10/2015	475.50	3/22/2016	4.64	0.00	470.86
MW-193A-15	Water Table	8/6/2015	488.34	3/22/2016	9.01	0.00	479.33
MW-193B-60	10-55	8/7/2015	488.04	3/22/2016	8.77	0.00	479.27
MW-194A-15	Water Table	3/24/2016	475.74	3/22/2016	6.08	0.00	469.66
MW-194B-40	10-55	8/10/2015	475.76	3/22/2016	5.98	0.00	469.78
MW-311-15	Water Table	7/18/2015	467.02	3/22/2016	6.10	0.00	460.92
MW-311-46	10-55	7/18/2015	466.90	3/22/2016	5.98	0.00	460.92
MW-312-15	Water Table	7/18/2015	464.19	3/22/2016	5.58	0.00	458.61
MW-312-50	10-55	7/18/2015	464.18	3/22/2016	5.61	0.00	458.57
MW-313-15	Water Table	7/18/2015	465.80	3/22/2016	Frozen	—	—
MW-315-15	Water Table	7/18/2015	458.17	3/22/2016	5.90	0.00	452.27
MW-315-150	90-160	7/18/2015	458.66	3/22/2016	6.33	0.00	452.33
MW-318-135	90-160	3/22/2016	492.92	3/22/2016	12.31	0.00	480.61
MW-318-20	Water Table	3/22/2016	492.82	3/22/2016	12.10	0.00	480.72
MW-319-15	Water Table	7/18/2015	456.11	3/22/2016	5.30	0.00	450.81
MW-319-45	10-55	7/18/2015	455.94	3/22/2016	5.07	0.00	450.87
MW-322-15	Water Table	6/5/2015	472.09	3/22/2016	10.04	0.00	462.05
MW-322-150	90-160	3/24/2016	472.14	3/22/2016	9.76	0.00	462.38
MW-324-15	Water Table	7/18/2015	463.49	3/23/2016	7.88	0.00	455.61
MW-324-151	90-160	7/18/2015	462.95	3/23/2016	6.90	0.00	456.05
MW-326-150	90-160	3/24/2016	500.51	3/22/2016	9.86	0.00	490.65

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**Table 3-2
Offsite Groundwater Elevation Monitoring Results**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Well ID	Zone	Survey Date	Riser Elevation (MSL feet)	Date Measured	Depth to Water (feet)	Probe Correction (feet)	Corrected Groundwater Elevation (MSL feet)
MW-326-20	Water Table	3/24/2016	500.60	3/22/2016	9.97	0.00	490.63
MW-327-15	Water Table	7/18/2015	467.83	3/22/2016	6.96	0.00	460.87
MW-327-150	90-160	7/18/2015	467.59	3/23/2016	6.56	0.00	461.03
MW-328-15	Water Table	12/4/2015	472.34	3/23/2016	6.90	0.00	465.44
MW-328-151	90-160	12/4/2015	472.66	3/23/2016	7.22	0.00	465.44
MW-332-15	Water Table	8/10/2015	481.57	3/22/2016	7.73	0.00	473.84
MW-332-150	90-160	8/10/2015	481.51	3/22/2016	7.25	0.00	474.26
MW-333-150	90-160	3/24/2016	497.17	3/22/2016	9.20	0.00	487.97
MW-333-16	Water Table	3/24/2016	497.66	3/22/2016	9.75	0.00	487.91
MW-335-41	10-55	7/18/2015	469.88	3/22/2016	5.83	0.00	464.05
MW-339-15	Water Table	8/10/2015	479.53	3/22/2016	8.90	0.00	470.63
MW-339-50	10-55	8/10/2015	479.56	3/22/2016	8.89	0.00	470.67
MW-340-18	Water Table	8/10/2015	478.51	3/22/2016	Frozen	—	—
MW-340-65	10-55	8/10/2015	478.91	3/22/2016	Frozen	—	—
MW-342-15	Water Table	8/7/2015	482.32	3/22/2016	7.40	0.00	474.92
MW-342-65	10-55	8/7/2015	482.49	3/22/2016	7.57	0.00	474.92
MW-346-150	90-160	8/11/2015	472.70	3/22/2016	4.59	0.00	468.11
MW-346-65	10-55	8/11/2015	472.71	3/22/2016	4.67	0.00	468.04
MW-353-100	90-160	8/7/2015	480.71	3/22/2016	6.80	0.00	473.91
MW-353-15	Water Table	8/7/2015	480.27	3/22/2016	6.24	0.00	474.03
MW-353-65	10-55	8/7/2015	480.66	3/22/2016	6.88	0.00	473.78
MW-356-20	10-55	8/11/2015	478.72	3/22/2016	7.08	0.00	471.64
MW-356-65	10-55	8/11/2015	478.79	3/22/2016	7.14	0.00	471.65
MW-356-90	55-90	8/11/2015	478.78	3/22/2016	7.16	0.00	471.62
MW-357-15	Water Table	8/10/2015	487.76	3/22/2016	12.22	0.00	475.54
MW-357-150	90-160	8/10/2015	488.02	3/22/2016	12.21	0.00	475.81
MW-357-65	10-55	8/10/2015	487.92	3/22/2016	12.20	0.00	475.72

General Notes:

Monitoring wells MW-349-15 and MW-349-45 and private well PW-1230 are measured as part of the vertical gradient network. Refer to Appendix F for elevations for remaining vertical gradient network measurements.

Acronyms and Abbreviations:

MSL = mean sea level

— = not applicable

**Table 3-3
Offsite Sulfolane Analytical Results**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Location Name	Zone	Sample Date	Sample Type	Sample Name	Sulfolane (µg/L)	Comments
MW-150A-10	Water Table	01/27/16		MW-150A-10	86.1	
MW-150B-25	10-55	01/27/16		MW-150B-25	29.2	
MW-150B-25	10-55	01/27/16	DUP	MW-250B-25	28.0	
MW-150C-60	10-55	01/27/16		MW-150C-60	6.85J	
MW-151A-15	Water Table	01/25/16		MW-151A-15	34.6	
MW-151B-25	10-55	01/25/16		MW-151B-25	19.6	
MW-151B-25	10-55	01/25/16	DUP	MW-251B-25	19.2	
MW-151C-60	10-55	01/25/16		MW-151C-60	7.97J	
MW-152A-15	Water Table	01/19/16		MW-152A-15	26.4	
MW-152B-25	10-55	01/19/16		MW-152B-25	21.7	
MW-152C-65	10-55	01/19/16		MW-152C-65	4.37J	
MW-153A-15	Water Table	01/28/16		MW-153A-15	19.2	
MW-153A-15	Water Table	04/22/16		MW-153A-15	17.6	
MW-153B-55	10-55	01/28/16		MW-153B-55	4.21J	
MW-153B-55	10-55	04/05/16		MW-153B-55	<5.10	
MW-155A-15	Water Table	01/27/16		MW-155A-15	10.2	
MW-155B-65	10-55	01/27/16		MW-155B-65	<5.10	
MW-155B-65	10-55	01/27/16	DUP	MW-255B-65	<5.00	
MW-156A-15	Water Table	01/27/16		MW-156A-15	16.7	
MW-156B-50	10-55	01/27/16		MW-156B-50	16.4	
MW-157A-15	Water Table	01/25/16		MW-157A-15	24.8	
MW-157B-30	10-55	01/25/16		MW-157B-30	25.3	
MW-157B-30	10-55	01/25/16	DUP	MW-257B-30	23.5	
MW-158A-15	Water Table	01/26/16		MW-158A-15	23.5	
MW-158B-60	10-55	01/26/16		MW-158B-60	30.7	
MW-159A-15	Water Table	01/28/16		MW-159A-15	<5.15	
MW-159B-45	10-55	01/28/16		MW-159B-45	15.2	
MW-159C-70	55-90	01/28/16		MW-159C-70	7.27J	
MW-160AR-15	Water Table	01/26/16		MW-160AR-15	<5.30	
MW-160B-90	55-90	01/26/16		MW-160B-90	14.9	
MW-161-30	10-55	01/11/16		MW-161-30	71.3	
MW-161-30	10-55	01/11/16	DUP	MW-261-30	70.9	
MW-161A-15	Water Table	01/11/16		MW-161A-15	72.9	
MW-161A-15	Water Table	04/04/16		MW-161A-15	63.0	
MW-161B-50	10-55	01/11/16		MW-161B-50	93.4	
MW-162A-15	Water Table	01/29/16		MW-162A-15	22.5	
MW-162B-65	10-55	01/29/16		MW-162B-65	28.5	
MW-163A-15	Water Table	01/25/16		MW-163A-15	13.0	
MW-163B-40	10-55	01/25/16		MW-163B-40	11.5	
MW-164A-15	Water Table	01/25/16		MW-164A-15	50.6	
MW-164B-50	10-55	01/25/16		MW-164B-50	50.4	
MW-164C-60	10-55	01/25/16		MW-164C-60	51.4	
MW-164C-60	10-55	01/25/16	DUP	MW-264C-60	52.7	
MW-165A-15	Water Table	01/11/16		MW-165A-15	<5.15	
MW-165B-50	10-55	01/11/16		MW-165B-50	<5.05	
MW-166A-15	Water Table	01/25/16		MW-166A-15	31.7	
MW-166A-15	Water Table	04/22/16		MW-166A-15	32.5	

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**Table 3-3
Offsite Sulfolane Analytical Results**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Location Name	Zone	Sample Date	Sample Type	Sample Name	Sulfolane (µg/L)	Comments
MW-166B-30	10-55	01/25/16		MW-166B-30	29.4	
MW-166B-30	10-55	04/22/16		MW-166B-30	38.7	
MW-167A-15	Water Table	01/12/16		MW-167A-15	4.35J	
MW-167A-15	Water Table	04/04/16		MW-167A-15	5.58J	
MW-167B-35	10-55	01/12/16		MW-167B-35	16.1	
MW-167B-35	10-55	04/04/16		MW-167B-35	15.2	
MW-168A-15	Water Table	01/27/16		MW-168A-15	24.9	
MW-168A-15	Water Table	04/05/16		MW-168A-15	22.6	
MW-168A-15	Water Table	04/05/16	DUP	MW-268A-15	22.1	
MW-168B-50	10-55	01/27/16		MW-168B-50	38.0	
MW-168B-50	10-55	04/05/16		MW-168B-50	37.6	
MW-169A-15	Water Table	01/26/16		MW-169A-15	<5.10	
MW-169C-60	10-55	01/26/16		MW-169C-60	<5.05	
MW-170A-15	Water Table	01/28/16		MW-170A-15	<5.00	
MW-170B-75	55-90	01/28/16		MW-170B-75	<5.00	
MW-170B-75	55-90	01/28/16	DUP	MW-270B-75	<5.00	
MW-170C-130	90-150	01/28/16		MW-170C-130	<5.00	
MW-170D-50	10-55	01/28/16		MW-170D-50	<5.10	
MW-172A-15	Water Table	01/12/16		MW-172A-15	<5.05	
MW-172B-150	90-150	01/12/16		MW-172B-150	<5.00	
MW-181A-15	Water Table	01/27/16		MW-181A-15	<5.10	
MW-181A-15	Water Table	01/27/16	DUP	MW-281A-15	<5.15	
MW-181B-50	10-55	01/27/16		MW-181B-50	<5.10	
MW-181C-150	90-150	01/27/16		MW-181C-150	<5.10	
MW-182A-15	Water Table	01/19/16		MW-182A-15	27.1	
MW-182A-15	Water Table	04/04/16		MW-182A-15	23.4	
MW-182A-15	Water Table	04/04/16	DUP	MW-282A-15	22.1	
MW-182B-45	10-55	01/19/16		MW-182B-45	30.1	
MW-182B-45	10-55	01/19/16	DUP	MW-282B-45	31.1	
MW-182B-45	10-55	04/04/16		MW-182B-45	26.0	
MW-183A-15	Water Table	01/11/16		MW-183A-15	43.5	
MW-183B-60	10-55	01/11/16		MW-183B-60	63.8	
MW-184-45	10-55	01/28/16		MW-184-45	<5.10	
MW-185A-15	Water Table	01/11/16		MW-185A-15	<5.10	
MW-185A-15	Water Table	04/21/16		MW-185A-15	<5.25	
MW-185B-50	10-55	01/11/16		MW-185B-50	7.03J	
MW-185B-50	10-55	04/21/16		MW-185B-50	6.34J	
MW-185C-120	90-150	01/11/16		MW-185C-120	6.44J	
MW-185C-120	90-150	04/05/16		MW-185C-120	3.87J	
MW-187-15	Water Table	01/26/16		MW-187-15	4.73J	
MW-187-15	Water Table	04/21/16		MW-187-15	3.72J	
MW-189A-15	Water Table	01/11/16		MW-189A-15	<5.05	
MW-189B-60	10-55	01/11/16		MW-189B-60	<5.10	
MW-190-150	90-150	01/14/16		MW-190-150	<5.05	
MW-190A-15	Water Table	01/14/16		MW-190A-15	<5.20	
MW-190BR-60	10-55	01/14/16		MW-190BR-60	<5.15	
MW-191A-15	Water Table	01/11/16		MW-191A-15	<5.05	

Abbreviations on Page 4.

**Table 3-3
Offsite Sulfolane Analytical Results**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Location Name	Zone	Sample Date	Sample Type	Sample Name	Sulfolane (µg/L)	Comments
MW-191B-60	10-55	01/11/16		MW-191B-60	<5.10	
MW-193A-15	Water Table	01/27/16		MW-193A-15	<5.05	
MW-193B-60	10-55	01/27/16		MW-193B-60	<5.05	
MW-194A-15	Water Table	01/27/16		MW-194A-15	5.27J	
MW-194A-15	Water Table	04/22/16		MW-194A-15	7.94J	
MW-194B-40	10-55	01/27/16		MW-194B-40	54.8	
MW-194B-40	10-55	04/22/16		MW-194B-40	67.1	
MW-308-15	Water Table	01/25/16		MW-308-15	8.94J	
MW-308-15	Water Table	01/25/16	DUP	MW-408-15	9.04J	
MW-308-15	Water Table	04/21/16		MW-308-15	10.2	
MW-308-30	10-55	----		----	----	Frozen; no sample collected
MW-308-30	10-55	----		----	----	Frozen; no sample collected
MW-311-15	Water Table	01/11/16		MW-311-15	<5.05	
MW-311-46	10-55	01/11/16		MW-311-46	<5.05	
MW-314-15	Water Table	01/12/16		MW-314-15	<5.10	
MW-314-150	90-150	01/12/16		MW-314-150	<5.10	
MW-316-15	Water Table	01/26/16		MW-316-15	<5.10	
MW-316-15	Water Table	04/05/16		MW-316-15	<5.10	
MW-316-56	10-55	01/26/16		MW-316-56	<5.15	
MW-317-15	Water Table	01/27/16		MW-317-15	<5.00	
MW-317-71	55-90	01/27/16		MW-317-71	<5.05	
MW-323-15	Water Table	01/27/16		MW-323-15	<5.00	
MW-323-50	10-55	01/27/16		MW-323-50	<5.05	
MW-325-150	90-150	01/14/16		MW-325-150	<5.05	
MW-325-18	Water Table	01/14/16		MW-325-18	<5.05	
MW-328-15	Water Table	01/06/16		MW-328-15	<5.10	
MW-328-151	90-150	01/06/16		MW-328-151	<5.05	
MW-329-15	Water Table	01/12/16		MW-329-15	24.8	
MW-329-66	10-55	01/12/16		MW-329-66	33.2	
MW-332-110	90-150	01/07/16		MW-332-110	16.3	
MW-332-15	Water Table	01/13/16		MW-332-15	<5.00	
MW-332-150	90-150	01/13/16		MW-332-150	232	
MW-332-150	90-150	05/17/16		MW-332-150	158	
MW-332-41	10-55	01/13/16		MW-332-41	<5.05	
MW-332-75	55-90	01/07/16		MW-332-75	<5.30	
MW-332-75	55-90	01/07/16	DUP	MW-432-75	<5.15	
MW-335-41	10-55	01/11/16		MW-335-41	<5.05	
MW-338-15	Water Table	01/26/16		MW-338-15	4.31J	
MW-338-50	10-55	01/26/16		MW-338-50	21.6	
MW-339-15	Water Table	01/25/16		MW-339-15	49.1	
MW-339-50	10-55	01/25/16		MW-339-50	9.15J	
MW-339-50	10-55	01/25/16	DUP	MW-439-50	8.53J	
MW-340-150	90-150	01/14/16		MW-340-150	<5.10	
MW-340-18	Water Table	01/14/16		MW-340-18	<5.05	
MW-340-65	10-55	01/14/16		MW-340-65	<5.00	
MW-341-15	Water Table	01/12/16		MW-341-15	25.0	
MW-341-40	10-55	01/12/16		MW-341-40	33.6	

Abbreviations on Page 4.

**Table 3-3
Offsite Sulfolane Analytical Results**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Location Name	Zone	Sample Date	Sample Type	Sample Name	Sulfolane (µg/L)	Comments
MW-342-15	Water Table	01/26/16		MW-342-15	15.7	
MW-342-65	10-55	01/26/16		MW-342-65	23.0	
MW-343-15	Water Table	01/25/16		MW-343-15	<5.05	
MW-343-50	10-55	01/25/16		MW-343-50	<5.15	
MW-346-15	Water Table	01/27/16		MW-346-15	8.84J	
MW-346-15	Water Table	01/27/16	DUP	MW-446-15	9.97J	
MW-346-150	90-150	01/27/16		MW-346-150	<5.10	
MW-346-65	10-55	01/27/16		MW-346-65	34.8	
MW-346-65	10-55	04/21/16		MW-346-65	36.0	
MW-347-150	90-150	02/04/16		MW-347-150	20.5	
MW-347-150	90-150	04/05/16		MW-347-150	21.2	
MW-347-20	Water Table	02/04/16		MW-347-20	10.8	
MW-347-65	10-55	02/04/16		MW-347-65	23.1	
MW-347-65	10-55	04/05/16		MW-347-65	20.7	
MW-349-15	Water Table	02/05/16		MW-349-15-2016 Q1	20.9	
MW-349-45	10-55	02/05/16		MW-349-45-2016 Q1	24.0	
MW-350-15	Water Table	01/29/16		MW-350-15	22.4	
MW-350-50	10-55	01/29/16		MW-350-50	24.4	
MW-350-50	10-55	01/29/16	DUP	MW-450-50	25.0	
MW-352-15	Water Table	02/04/16		MW-352-15	4.70J	
MW-352-15	Water Table	04/05/16		MW-352-15	5.20J	
MW-352-40	10-55	02/04/16		MW-352-40	12.7	
MW-352-40	10-55	04/28/16		MW-352-40	12.5	
MW-353-100	55-90	01/29/16		MW-353-100	157	
MW-353-15	Water Table	01/29/16		MW-353-15	115	
MW-353-65	10-55	01/29/16		MW-353-65	163	
MW-356-20	Water Table	01/07/16		MW-356-20	<5.15	
MW-356-65	10-55	01/07/16		MW-356-65	<5.05	
MW-356-90	55-90	01/07/16		MW-356-90	<5.10	
MW-357-15	Water Table	02/01/16		MW-357-15	<5.05	
MW-357-150	90-150	01/18/16		MW-357-150	<5.00	
MW-357-65	10-55	02/01/16		MW-357-65	<5.50	

Acronyms and Abbreviations:

< = not detected; limit of detection (LOD) listed

DUP = duplicate

J = result is estimated, flag applied by laboratory due to analyte detection below the limit of quantitation.

µg/L = micrograms per liter

Table 3-4
Private Well Sulfolane Results - Initial Sample Event

First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska

Private Well ID	Latitude, Longitude	Sample Date	Sulfolane
			µg/L
PW-2223	64.7754, -147.3805	1/9/2016	56.4
PW-2224	64.8063, -147.4027	1/8/2016	<5.25
PW-2226	64.7923, -147.3988	5/23/2016	<5.20

Acronyms and Abbreviations:

< = not detected; limit of detection (LOD) listed, flag applied by laboratory

µg/L = micrograms per liter

**Table 3-5
Private Well Sulfolane Results - Resampling Event**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Private Well ID	Latitude, Longitude	Well Depth (feet)	Zone	Sample Type	Sample Date	Sulfolane
						µg/L
PW-0266	64.7900, -147.3972	40	10-55	PS	4/11/2016	<5.05
PW-0282	64.7886, -147.3941	41	10-55	PS	5/26/2016	<5.15
PW-0285	64.7885, -147.3982	63	55-90	PS	5/24/2016	<5.10
PW-0286	64.7885, -147.3996	160	>160	PS	5/24/2016	<5.05
PW-0287	64.7885, -147.4010	186	>160	PS	5/6/2016	<5.30
PW-0288	64.7882, -147.4038	200	>160	PS	5/7/2016	<5.25
PW-0289	64.7881, -147.4052	40	10-55	PS	5/31/2016	<5.05
PW-0349	64.7674, -147.3533			PS	5/16/2016	<5.10
PW-0350	64.7678, -147.3535			PS	5/12/2016	<5.25
PW-0353	64.7673, -147.3568	40	10-55	PS	5/16/2016	<5.20
PW-0354	64.7668, -147.3552			DUP	5/26/2016	<5.15
				PS	5/26/2016	<5.20
PW-0355	64.7668, -147.3568	30	10-55	PS	5/3/2016	<5.05
PW-0358	64.7662, -147.3569	105	90-160	PS	4/27/2016	61.8
PW-0358	64.7662, -147.3569	105	90-160	DUP	3/3/2016	55.6
				PS	3/3/2016	58.1
PW-0359	64.7663, -147.3551	40	10-55	PS	5/3/2016	<5.15
PW-0361	64.7664, -147.3520	35	10-55	PS	5/17/2016	<5.20
PW-0370	64.7704, -147.3466			PS	5/6/2016	<5.20
PW-0371	64.7708, -147.3475			PS	5/6/2016	<5.05
PW-0372	64.7714, -147.3498			DUP	5/6/2016	<5.10
				PS	5/6/2016	<5.15
PW-0373	64.7717, -147.3507			PS	5/5/2016	<5.10
PW-0374	64.7720, -147.3514			PS	5/20/2016	<5.10
PW-0379	64.7697, -147.3485			PS	5/16/2016	<5.15
PW-0383	64.7860, -147.3919	300	>160	PS	5/5/2016	<5.20
PW-0384	64.7854, -147.3919	30	10-55	PS	5/6/2016	<5.00J*
PW-0388	64.7836, -147.3910			PS	5/6/2016	<5.15J*
PW-0389	64.7828, -147.3923	223	>160	PS	5/5/2016	<5.10
PW-0437	64.7765, -147.3200	95	90-160	PS	5/23/2016	<5.25
PW-0464	64.7754, -147.3686	98	90-160	PS	3/3/2016	91.6
PW-0464	64.7754, -147.3686	98	90-160	PS	4/27/2016	98.6
PW-0508	64.7764, -147.3553	80	55-90	PS	5/12/2016	<5.20
PW-0531	64.7850, -147.3641			PS	5/10/2016	<5.10
PW-0547	64.7801, -147.3605	40	10-55	PS	5/19/2016	<5.15
PW-0587	64.7890, -147.3881			PS	5/5/2016	<5.10
PW-0589	64.7893, -147.3904			PS	5/24/2016	<5.10J*
PW-0591	64.7874, -147.3925			PS	5/31/2016	<5.15
PW-0627	64.7627, -147.4147			PS	5/18/2016	<5.45
PW-0628	64.7634, -147.4157	30	10-55	PS	5/18/2016	<5.45

Notes and Abbreviations on Page 3.

**Table 3-5
Private Well Sulfolane Results - Resampling Event**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Private Well ID	Latitude, Longitude	Well Depth (feet)	Zone	Sample Type	Sample Date	Sulfolane
						µg/L
PW-0630	64.7638, -147.4173			PS	5/18/2016	<5.05
PW-0749	64.7881, -147.3846	32	10-55	PS	5/10/2016	<5.10
PW-0752	64.7867, -147.3853			PS	5/10/2016	<5.05
PW-0753	64.7862, -147.3856	55	55-90	PS	5/16/2016	<5.20
PW-0761	64.7871, -147.3773	30	10-55	PS	5/19/2016	<5.20
PW-0762	64.7877, -147.3775	40	10-55	PS	6/3/2016	<5.00
PW-0769	64.7880, -147.3822			PS	5/24/2016	<5.10
PW-0770	64.7875, -147.3821			PS	5/10/2016	<5.05
PW-0771	64.7870, -147.3824			DUP	5/10/2016	<5.00
				PS	5/10/2016	<5.20
PW-0772	64.7865, -147.3830			PS	5/10/2016	<5.10
PW-0774	64.7861, -147.3817			PS	5/24/2016	<5.30
PW-0775	64.7865, -147.3808	55	55-90	DUP	5/12/2016	<5.10
				PS	5/12/2016	<5.10
PW-0776	64.7868, -147.3797	40	10-55	PS	5/24/2016	<5.00
PW-0777	64.7875, -147.3801			PS	5/12/2016	<5.20
PW-0859	64.7880, -147.3754			PS	5/10/2016	<5.15
PW-0860	64.7880, -147.3743	40	10-55	PS	5/24/2016	<5.15
PW-0862	64.7880, -147.3721	42	10-55	PS	12/19/2015	<5.30
PW-0863	64.7872, -147.3721	65	55-90	PS	5/16/2016	<5.10
PW-0864	64.7872, -147.3732	42	10-55	PS	5/24/2016	<5.10
PW-0865	64.7872, -147.3743	40	10-55	DUP	5/24/2016	<5.15
				PS	5/24/2016	<5.30
PW-0867	64.7865, -147.3754			PS	5/19/2016	<5.15
PW-0868	64.7865, -147.3743	57	55-90	PS	5/20/2016	<5.05
PW-0869	64.7865, -147.3721	42	10-55	PS	6/1/2016	<5.20
PW-0871	64.7857, -147.3732	50	10-55	PS	5/24/2016	3.82J
PW-0872	64.7858, -147.3749			PS	5/20/2016	<5.25
PW-0906	64.7872, -147.3697	34	10-55	PS	5/24/2016	<5.20
PW-0907	64.7873, -147.3684	45	10-55	PS	5/10/2016	<5.25
PW-0909	64.7865, -147.3697	50	10-55	PS	5/20/2016	<5.15
PW-0910	64.7865, -147.3709	80	55-90	PS	5/24/2016	<5.15
PW-0911	64.7858, -147.3684			PS	5/20/2016	<5.10
PW-0972	64.7696, -147.4319	236	>160	DUP	5/18/2016	<5.10
				PS	5/18/2016	<5.10
PW-0974	64.7692, -147.4293	40	10-55	DUP	5/20/2016	<5.20
				PS	5/20/2016	<5.05
PW-0978	64.7684, -147.4307	218	>160	PS	5/18/2016	<5.30
PW-1052	64.7790, -147.3869	21	10-55	PS	5/16/2016	<5.15
PW-1053	64.7803, -147.3875	353	>160	PS	5/3/2016	<5.20

Notes and Abbreviations on Page 3.

**Table 3-5
Private Well Sulfolane Results - Resampling Event**

**First Semiannual 2016 Offsite Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Terminal, North Pole, Alaska**

Private Well ID	Latitude, Longitude	Well Depth (feet)	Zone	Sample Type	Sample Date	Sulfolane
						µg/L
PW-1087	64.7686, -147.3502			PS	5/19/2016	<5.10
PW-1088	64.7874, -147.3886	60	55-90	PS	5/7/2016	<5.00
PW-1185	64.7617, -147.3566			PS	5/3/2016	<5.05
PW-1230	64.7579, -147.3716	231	>160	PS	2/5/2016	816
PW-1230	64.7579, -147.3716	231	>160	DUP	4/27/2016	946J*
				PS	4/27/2016	769
				PS	5/26/2016	733
PW-1333	64.7831, -147.3648			PS	5/19/2016	<5.05
PW-1403	64.7616, -147.3887	100	90-160	PS	5/12/2016	<5.30
PW-1410	64.7507, -147.3810			PS	5/7/2016	<5.05
PW-1473	64.7865, -147.3732	42	10-55	PS	5/19/2016	<5.10
PW-2205	64.7873, -147.3930			PS	5/31/2016	<5.10

General Notes:

Well depth listed where information is known.

Acronyms and Abbreviations:

< = not detected, limit of detection (LOD) listed; flag applied by laboratory

DUP = duplicate sample

J = estimated concentration detected below the laboratory limit of quantitation (LOQ). Flag applied by laboratory.

J* = estimated concentration due to quality control (QC) failures or lack of field QC samples. Flag applied by Shannon & Wilson, Inc.

PS = primary sample

µg/L = micrograms per liter

FIGURES

