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Flint Hills Resources Alaska, LLC

SECOND SEMIANNUAL 2016 OFFSITE GROUNDWATER MONITORING REPORT

North Pole Terminal
North Pole, Alaska
DEC File Number 100.38.090

January 31, 2017

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SECOND SEMIANNUAL 2016 OFFSITE GROUNDWATER MONITORING REPORT

North Pole Terminal
North Pole, Alaska
DEC File Number 100.38.090

Prepared for:

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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
POE	point-of-entry
QA	quality assurance
QC	quality control
report	Second Semiannual 2016 Offsite Groundwater Monitoring Report
reporting period	third and fourth 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 Second 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 third and fourth quarters of 2016 (reporting period), as described in Section 2.

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 (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

Third and fourth quarter 2016 groundwater monitoring was conducted in accordance with methods and monitoring network included in the following documents:

- Offsite Revised Sampling and Analysis Plan (Offsite RSAP), which was updated and is included as Appendix A
- 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)
- ADEC correspondence dated June 16 and August 17, 2016 (ADEC 2016a and 2016b, respectively)
- Subsequent communications between ADEC and FHRA. The current monitoring networks are shown on Tables 1 and 2 of the Offsite RSAP in Appendix A. Table 2-1 summarizes the offsite field activities completed during the reporting period. Offsite monitoring well locations are shown on Figure 1-2.
- Point-of-Entry Sampling and Analysis Plan (Arcadis 2016)

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 and networks summarized in Appendix A. One deviation from the Offsite RSAP (Appendix A) was noted during the reporting period:

- Monitoring well MW-308-30 was frozen during both the third and fourth 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 in accordance with the Offsite RSAP.

2.1 Private Well Sampling

Private well locations with well identifiers are shown on the figure included as Appendix B. 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 third quarter 2016 sampling, FHRA collected samples from private wells, including initial groundwater samples from two newly installed private wells (PW-1921 and PW-2227). Private well PW-1921 is located within the previously defined search areas; this is the first sample collected from this well. Private well PW-2227 is located within the plume area at a property with a POE system; the system has been connected to the new well. PW-1921 is identified as having been sampled for the first time on Figure 2-1. Because PW-2227 is replacing an existing well, it is not identified as an initial sampling event on Figure 2-1.

During the fourth quarter 2016 sampling, FHRA collected samples only from previously sampled private wells, with no new initial sampling events.

2.2 Well Maintenance Activities

During the reporting period, minor repairs were performed on 29 offsite monitoring wells. Additionally, during the reporting period, well development was performed at 25 offsite monitoring wells in accordance with procedures outlined in the Offsite RSAP (Appendix A). 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 wells, U.S. Geological Survey wells, 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 C. Laboratory reports are provided in Appendix D. A data quality evaluation including ADEC quality assurance (QA)/quality control (QC) checklists is included as Appendix E. Field data sheets are included as Appendix F.

3.1 Groundwater Elevation

Depth to water measurements were collected from monitoring wells on September 12 and 13, 2016 for the third quarter 2016 groundwater elevation monitoring event. Potentiometric maps for the third 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, respectively. 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 G. Hydrographs are presented in Appendix H.

3.2 Sulfolane Distribution in Offsite Groundwater

During the third and fourth 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 third and fourth quarters of 2016 is included on Figures 3-5 through 3-10. Historical and current sulfolane analytical results, including raw water results for private wells with POE systems, are included in Appendix C. Raw water results for private wells with POE systems are included Figures 3-5 through 3-10. POE systems results, including raw water samples, will be presented in the Alternative Water Solutions Program – 2016 Annual Report.

3.2.1 Private Well Sampling Results

During third quarter 2016, one private well outside the plume area (PW-1921) was sampled for the first time. The sample from PW-1921, collected from a newly installed well, did not contain detectable concentrations of sulfolane. Sulfolane was detected in the sample from PW-2227, which is a new well replacing an existing well with a POE system, at a concentration of 64.2 micrograms per liter (µg/L). No other initial samples were collected during the reporting period (including fourth quarter 2016).

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. The initial sample results are presented in Table 3-4. The initial samples collected during the reporting period are highlighted on Figures 2-1 and 3-5. Private well locations are also shown on the figure presented as Appendix B. Historical private well data, including current and historical POE treatment system data for raw water samples, are presented in Appendix C. Laboratory reports and associated ADEC QA/QC checklists reviewed during the reporting period are presented in Appendices D and E, respectively. Data were evaluated for potential sulfolane concentration trends through third quarter 2016; results are discussed in Section 3.3 and included in Appendix I.

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 third and fourth 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 third or fourth 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 fourth 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. Some suprapermafrost monitoring wells, which were installed in the mixing zone, were determined to have concentrations representative of the subpermafrost aquifer and are included as part of the subpermafrost dataset. Figures 3-7 and 3-10 present sulfolane data for the third and fourth quarters of 2016, respectively, for samples collected from monitoring wells in the mixing zone 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 (795 µg/L with a duplicate sample result of 915 µg/L on November 18, 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.

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 on Figures 1A through 1D of Appendix I, and are summarized in the table below.

Third Quarter 2016			
Parameter/Trend	**Monitoring Wells**	**Suprapermafrost Private Wells**	**Subpermafrost Private Wells**
Number of Wells	156	325	70
All Results Nondetect [a]	50	187	32
Insufficient Data Points [a]	22	59	6
Probably Decreasing	6	0	0
Decreasing	54	14	3
Probably Increasing	1	3	1
Increasing	13	35	23
Stable	5	14	0
No Trend	5	13	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 I, 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 I. Of these, monitoring well MW-346-65 is located within the inferred mixing zone; therefore, this well 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 during the reporting period at these two locations.

A visual observation of the concentration trend plots (Attachment 1 of Appendix I) 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, and MW-168A-15/B-50, 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-eight 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 I). 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.

Sixty monitoring wells displayed decreasing or probably decreasing trends. A visual observation of the concentration trend plots confirms 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. The decreasing sulfolane concentration trends in wells in the central and proximal portions of the plume likely represent the effects of source controls at the North Pole Terminal.

Fourteen private wells displayed decreasing or probably decreasing trends. A visual observation of the concentration trend plots confirms 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 I. The monitoring wells shown on this figure were installed as suprapermafrost wells. However, these monitoring wells are located in the inferred mixing zone of the subpermafrost and suprapermafrost aquifers, and appear to be representative of subpermafrost aquifer conditions. 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 southern 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.

Decreasing or probably decreasing trends were observed in three subpermafrost private wells (PW-217, PW-358, and PW-1099), which are located near the southern extent of the detectable sulfolane plume.

4 CONCLUSIONS

Quarterly groundwater monitoring events were conducted in the third and fourth quarters of 2016. The events were conducted in general accordance with the Offsite RSAP (Appendix A). 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 monitoring data collected throughout the reporting period, the plume behavior is consistent with previous site characterizations and the CSM presented in 2013 (Arcadis 2013). 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 first and second quarter 2017 monitoring activities will be submitted in a semiannual report in July 2017.

5 REFERENCES

ADEC. 2016a. Comments on Proposed Changes to Offsite Long Term Monitoring Plans, FHR North Pole Terminal. June 16.

ADEC. 2016b. Comment Resolution Meeting, Thursday July 7. August 17.

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

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

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

Off-Site Activity	Frequency During Q3 and Q4
Groundwater Elevation Check	Semiannual
Vertical Hydraulic Gradient	Monthly
Data Loggers	Downloaded in Q3 and Q4, measured hourly
Residential Initial Sampling (includes call-ins)	1 sampled in Q3
Resample Residential Locations	Throughout Q3 and Q4, sampled annually and/or as requested
POE Spent GAC Sampling	0 sampling events in Q3 and Q4
Sulfolane Network Sampling	Throughout Q3 and Q4
Well Repair and Maintenance	29 monitoring wells repaired and maintenance performed as necessary
Wells Installed	0 monitoring or observation wells installed
Wells Developed	25 wells developed
Initial Sulfolane Monitoring Well Sampling	No initial sampling

General Notes:
Q3 = Represents field activities associated with the sample results received July 1 through September 30, 2016 for monitoring wells and June 14 through September 13, 2016 for private wells.
Q4 = Represents field activities associated with the sample results received October 1 through December 31, 2016 for monitoring wells and September 14 through November 30, 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

Second Semiannual 2016 Offsite Groundwater Monitoring Report
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-150A-10	MW-150A-10	7/11/2016	S	--	4.61	4.3	0.53	318	6.90	-51.9	Clear	Parameters Stablized	
MW-150B-25	MW-150B-25	7/11/2016	S	--	4.70	2.1	0.90	247	7.14	-22.8	Clear	>3 Well Volumes	
MW-150C-60	MW-150C-60	7/11/2016	S	--	4.00	2.2	1.00	206	7.19	119.8	Clear	>3 Well Volumes	
MW-151A-15	MW-151A-15	7/11/2016	S	--	3.98	3.0	0.49	261	6.94	-7.3	Clear	Parameters Stablized	
MW-151B-25	MW-151B-25	7/11/2016	S	--	4.56	1.9	1.84	216	7.01	-38.0	Clear	>3 Well Volumes	
MW-151C-60	MW-151C-60	7/11/2016	S	--	7.91	1.4	0.30	186	7.08	33.4	Clear	Parameters Stablized	
MW-152A-15	MW-152A-15	7/11/2016	S	--	5.51	4.5	1.46	272	6.89	-38.3	Clear	>3 Well Volumes	
MW-152B-25	MW-152B-25	7/11/2016	S	--	9.21	3.6	0.39	237	7.18	-38.9	Clear	Parameters Stablized	
MW-152C-65	MW-152C-65	7/11/2016	S	--	5.17	2.6	0.22	191	7.30	9.2	Clear	Parameters Stablized	
MW-153A-15	MW-153A-15	7/13/2016	S	--	6.14	1.9	0.21	262	7.05	112.4	Clear	Parameters Stablized	
MW-153A-15	MW-153A-15	10/11/2016	S	--	7.29	6.3	0.38	342	6.64	-1.9	Clear	>3 Well Volumes	
MW-153B-55	MW-153B-55	7/13/2016	S	--	5.63	4.4	0.13	199	7.42	80.1	Clear	Parameters Stablized	
MW-153B-55	MW-153B-55	10/11/2016	S	--	6.91	4.5	0.48	206	7.26	-105.7	Clear	Parameters Stablized	
MW-155A-15	MW-155A-15	7/11/2016	S	--	6.59	2.9	0.47	295	7.16	-75.6	Clear	>3 Well Volumes	
MW-155B-65	MW-155B-65	7/11/2016	S	--	6.58	2.9	0.83	177	7.27	135.6	Clear	Parameters Stablized	
MW-156A-15	MW-156A-15	7/11/2016	S	--	5.55	4.0	1.30	298	6.91	55.1	Clear	>3 Well Volumes	
MW-156B-50	MW-156B-50	7/11/2016	S	--	8.90	0.8	0.23	202	7.39	-15.8	Clear	Parameters Stablized	
MW-157A-15	MW-157A-15	7/11/2016	S	--	5.54	4.5	0.77	254	7.14	-45.7	Clear	>3 Well Volumes	
MW-157B-30	MW-157B-30	7/11/2016	S	--	5.39	1.5	0.50	220	7.41	-76.7	Clear	Parameters Stablized	
MW-158A-15	MW-158A-15	7/12/2016	S	--	6.01	3.8	0.42	465	6.71	351.0	Clear	Parameters Stablized	
MW-158B-60	MW-158B-60	7/12/2016	S	--	5.85	1.2	0.25	200	7.42	366.2	Clear	Parameters Stablized	
MW-159A-15	MW-159A-15	7/11/2016	S	--	6.63	2.6	3.88	363	6.58	42.2	Clear	>3 Well Volumes	
MW-159B-45	MW-159B-45	7/11/2016	S	--	6.41	1.7	1.58	201	7.22	57.5	Clear	Parameters Stablized	
MW-159C-70	MW-159C-70	7/11/2016	S	--	6.89	1.3	0.46 J	187	7.33	13.9	Clear	>3 Well Volumes	DO meter suspected to not be working properly
MW-160AR-15	MW-160AR-15	7/12/2016	S	--	5.89	9.4	2.62	297	6.70	205.4	Clear	>3 Well Volumes	
MW-160B-90	MW-160B-90	7/12/2016	S	--	5.50	1.7	0.10	194	7.47	193.1	Clear	Parameters Stablized	
MW-161-30	MW-161-30	7/9/2016	S	--	5.30	0.6	0.14	257	7.34	224.3	Clear	Parameters Stablized	
MW-161A-15	MW-161A-15	7/9/2016	S	--	5.29	0.8	0.20	357	7.01	195.5	Clear	>3 Well Volumes	
MW-161A-15	MW-161A-15	10/11/2016	S	--	5.87	3.6	0.75	445	6.77	-37.1	Clear	>3 Well Volumes	
MW-161B-50	MW-161B-50	7/9/2016	S	--	5.45	0.6	0.08	262	7.35	241.2	Clear	Parameters Stablized	
MW-162A-15	MW-162A-15	7/13/2016	S	--	7.07	2.4	0.91	303	6.93	-66.9	Clear	>3 Well Volumes	
MW-162B-65	MW-162B-65	7/13/2016	S	--	7.00	0.5	0.19	208	7.31	-22.5	Clear	Parameters Stablized	
MW-163A-15	MW-163A-15	7/13/2016	S	--	8.02	2.5	1.37	203	6.66	53.6	Clear	>3 Well Volumes	
MW-163B-40	MW-163B-40	7/13/2016	S	--	8.34	1.0	0.27	207	7.43	-83.5	Clear	Parameters Stablized	
MW-164A-15	MW-164A-15	7/13/2016	S	--	6.11	2.0	1.05	411	6.86	-73.2	Clear	>3 Well Volumes	
MW-164B-50	MW-164B-50	7/13/2016	S	--	5.53	2.7	0.64	245	7.14	-33.8	Clear	Parameters Stablized	
MW-164C-60	MW-164C-60	7/13/2016	S	--	5.45	0.6	1.39	232	7.23	-21.4	Clear	Parameters Stablized	
MW-165A-15	MW-165A-15	7/9/2016	S	--	4.35	2.5	0.30	209	6.77	197.6	Clear	>3 Well Volumes	
MW-165B-50	MW-165B-50	7/9/2016	S	--	4.17	3.1	0.18	206	7.37	169.2	Clear	Parameters Stablized	
MW-166A-15	MW-166A-15	7/12/2016	S	--	7.80	1.1	1.77	394	6.64	-107.3	Clear	Parameters Stablized	
MW-166A-15	MW-166A-15	10/12/2016	S	--	8.31	2.9	0.48	405	6.60	-72.8	Clear	Parameters Stablized	
MW-166B-30	MW-166B-30	7/12/2016	S	--	8.18	0.5	1.63	249	7.23	-61.4	Clear	>3 Well Volumes	
MW-166B-30	MW-166B-30	10/12/2016	S	--	8.57	0.8	0.50	278	6.68	-66.1	Clear	>3 Well Volumes	
MW-167A-15	MW-167A-15	7/7/2016	S	--	8.63	0.5	2.69	472	6.88	46.9	Clear	Parameters Stablized	
MW-167A-15	MW-167A-15	10/10/2016	S	--	8.69	3.0	3.07	562	6.46	86.5	Clear	>3 Well Volumes	
MW-167B-35	MW-167B-35	7/7/2016	S	--	8.49	0.3	1.95	430	6.94	12.5	Clear	>3 Well Volumes	
MW-167B-35	MW-167B-35	10/10/2016	S	--	8.58	0.5	0.98	436	6.79	31.7	Clear	>3 Well Volumes	
MW-168A-15	MW-168A-15	7/13/2016	S	--	8.20	2.3	3.39	251	6.98	-50.8	Clear	>3 Well Volumes	
MW-168A-15	MW-168A-15	10/12/2016	S	--	8.51	4.2	0.47	298	6.72	-53.0	Clear	Parameters Stablized	

Notes and Abbreviations on Page 4.

Table 3-1
Offsite Monitoring Well Field Parameters

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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-168B-50	MW-168B-50	7/13/2016	S	--	8.26	0.6	0.71	213	7.50	-91.7	Clear	Parameters Stablized	
MW-168B-50	MW-168B-50	10/12/2016	S	--	8.57	0.5	0.74	212	7.14	-68.5	Clear	Parameters Stablized	
MW-169A-15	MW-169A-15	7/13/2016	S	--	8.68	1.0	1.85	208	7.14	-106.9	Clear	Parameters Stablized	
MW-169C-60	MW-169C-60	7/13/2016	S	--	5.09	0.5	1.61	182	7.32	-95.5	Clear	Parameters Stablized	
MW-170A-15	MW-170A-15	7/11/2016	S	--	7.81	4.8	1.48	648	6.54	-87.5	Clear	>3 Well Volumes	
MW-170B-75	MW-170B-75	7/11/2016	S	--	7.75	4.6	0.20	204	7.38	-42.9	Clear	Parameters Stablized	
MW-170C-130	MW-170C-130	7/11/2016	S	--	7.49	4.8	0.40	194	7.33	15.8	Clear	Parameters Stablized	
MW-170D-50	MW-170D-50	7/11/2016	S	--	7.50	4.5	1.02	287	7.29	-64.5	Clear	Parameters Stablized	
MW-172A-15	MW-172A-15	7/7/2016	S	--	5.99	1.7	0.78	267	6.92	-78.9	Clear	>3 Well Volumes	
MW-172A-15	MW-172A-15	10/27/2016	S	--	6.23	3.0	0.34	258	7.12	-86.8	Clear	Parameters Stablized	
MW-172B-150	MW-172B-150	7/7/2016	S	--	6.06	3.6	0.41	166	7.55	-99.3	Clear	Parameters Stablized	
MW-181A-15	MW-181A-15	7/12/2016	S	--	8.60	2.4	1.17	208	7.22	69.2	Clear	Parameters Stablized	
MW-181B-50	MW-181B-50	7/12/2016	S	--	8.49	3.3	0.20	180	7.45	-39.2	Clear	Parameters Stablized	
MW-181B-50	MW-181B-50	10/27/2016	S	--	8.72	2.7	0.32	173	7.36	-35.3	Clear	Parameters Stablized	
MW-181C-150	MW-181C-150	7/12/2016	S	--	8.44	3.4	0.30	180	7.60	-94.1	Clear	Parameters Stablized	
MW-181C-150	MW-181C-150	10/27/2016	S	--	8.67	2.9	0.40	172	7.35	-95.5	Clear	Parameters Stablized	
MW-182A-15	MW-182A-15	7/7/2016	S	--	5.29	1.2	1.23	274	6.88	7.1	Clear	>3 Well Volumes	
MW-182A-15	MW-182A-15	10/11/2016	S	--	5.53	3.9	0.48	310	6.79	-20.4	Clear	Parameters Stablized	
MW-182B-45	MW-182B-45	7/7/2016	S	--	1.76	0.3	0.79	239	7.50	-52.3	Clear	Parameters Stablized	
MW-182B-45	MW-182B-45	10/11/2016	S	--	5.49	0.3	0.92	251	6.90	-12.7	Clear	Parameters Stablized	
MW-183A-15	MW-183A-15	7/9/2016	S	--	5.21	1.1	6.23	200	6.66	63.0	Clear	>3 Well Volumes	
MW-183B-60	MW-183B-60	7/9/2016	S	--	5.54	0.7	0.71	224	7.33	-9.5	Clear	Parameters Stablized	
MW-184-45	MW-184-45	7/13/2016	S	--	6.79	1.4	0.20	195	7.45	91.7	Clear	Parameters Stablized	
MW-185A-15	MW-185A-15	7/7/2016	S	--	6.58	3.8	1.70	520	7.02	-84.1	Clear	Parameters Stablized	
MW-185A-15	MW-185A-15	10/10/2016	S	--	6.69	5.6	0.44	384	7.08	-111.0	Clear	Parameters Stablized	
MW-185B-50	MW-185B-50	7/7/2016	S	--	6.97	4.0	1.50	211	7.45	-91.2	Clear	>3 Well Volumes	
MW-185B-50	MW-185B-50	10/10/2016	S	--	6.75	3.8	0.50	208	7.32	-90.5	Clear	Parameters Stablized	
MW-185C-120	MW-185C-120	7/7/2016	S	--	6.65	3.5	0.44	164	7.58	-86.9	Clear	Parameters Stablized	
MW-185C-120	MW-185C-120	10/10/2016	S	--	6.72	3.5	0.54	167	7.42	-35.3	Clear	Parameters Stablized	
MW-187-15	MW-187-15	7/13/2016	S	--	11.56	3.1	3.28	204	7.16	47.9	Clear	>3 Well Volumes	
MW-187-15	MW-187-15	10/12/2016	S	--	12.48	5.3	1.16	213	7.03	10.6	Clear	>3 Well Volumes	
MW-189A-15	MW-189A-15	7/6/2016	S	--	4.15	1.0	0.68	404	7.07	-86.5	Clear	Parameters Stablized	
MW-189B-60	MW-189B-60	7/6/2016	S	--	4.48	2.8	0.47	214	7.22	10.7	Slightly Turbid	Parameters Stablized	
MW-190-150	MW-190-150	7/9/2016	S	--	7.91	4.0	0.47	158	7.40	-100.1	Clear	Parameters Stablized	
MW-190A-15	MW-190A-15	7/9/2016	S	--	7.74	2.3	1.51	216	6.70	-12.3	Clear	>3 Well Volumes	
MW-190BR-60	MW-190BR-60	7/9/2016	S	--	7.88	3.5	1.12	183	7.22	-60.8	Clear	Parameters Stablized	
MW-191A-15	MW-191A-15	7/9/2016	S	--	4.17	3.8	0.67	216	7.11	153.6	Clear	Parameters Stablized	
MW-191B-60	MW-191B-60	7/9/2016	S	--	3.97	3.7	0.33	203	7.45	149.7	Clear	Parameters Stablized	
MW-193A-15	MW-193A-15	7/13/2016	S	--	8.10	1.8	1.51	470	6.69	-53.7	Clear	Parameters Stablized	
MW-193B-60	MW-193B-60	7/13/2016	S	--	7.51	0.8	1.56	201	7.18	-55.9	Clear	Parameters Stablized	
MW-194A-15	MW-194A-15	7/12/2016	S	--	7.28	1.9	1.42	248	7.08	-45.9	Clear	Parameters Stablized	
MW-194A-15	MW-194A-15	10/12/2016	S	--	7.95	2.7	0.74	242	6.97	-44.5	Clear	>3 Well Volumes	
MW-194B-40	MW-194B-40	7/12/2016	S	--	7.57	0.4	1.21	218	7.24	-41.0	Clear	Parameters Stablized	
MW-194B-40	MW-194B-40	10/12/2016	S	--	8.25	0.5	0.59	216	7.19	-25.3	Clear	Parameters Stablized	
MW-308-15	MW-308-15	7/12/2016	S	--	10.34	2.6	1.68	306	6.58	32.0	Clear	>3 Well Volumes	
MW-308-15	MW-308-15	10/12/2016	S	--	10.86	4.6	0.53	326	6.72	-8.3	Clear	>3 Well Volumes	
MW-308-30	--	7/12/2016		8.82	--	--	--	--	--	--	--	--	No Sample, frozen well.

Notes and Abbreviations on Page 4.

Table 3-1
Offsite Monitoring Well Field Parameters

Second Semiannual 2016 Offsite Groundwater Monitoring Report
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-308-30	--	8/19/2016		8.70	--	--	--	--	--	--	--	--	No sample, well frozen.
MW-308-30	--	10/12/2016		9.01	--	--	--	--	--	--	--	--	Well frozen, no sample collected.
MW-311-15	MW-311-15	7/6/2016	S	--	1.94	4.0	1.47	216	7.02	-32.4	Clear	>3 Well Volumes	
MW-311-46	MW-311-46	7/6/2016	S	--	1.91	0.9	0.47	183	7.85	3.2	Clear	>3 Well Volumes	
MW-314-15	MW-314-15	7/7/2016	S	--	7.68	2.4	5.97	363	6.65	7.4	Clear	>3 Well Volumes	
MW-314-15	MW-314-15	10/27/2016	S	--	7.85	3.2	0.60	369	6.73	3.7	Clear	>3 Well Volumes	
MW-314-150	MW-314-150	7/7/2016	S	--	7.58	3.3	0.65	193	7.51	-83.8	Clear	Parameters Stablized	
MW-314-150	MW-314-150	10/27/2016	S	--	7.75	2.8	0.43	188	7.38	-82.6	Clear	Parameters Stablized	
MW-316-15	MW-316-15	7/12/2016	S	--	6.56	2.6	0.07	261	7.03	134.1	Clear	>3 Well Volumes	
MW-316-15	MW-316-15	10/11/2016	S	--	7.27	4.4	0.46	273	6.82	-104.4	Clear	Parameters Stablized	
MW-316-56	MW-316-56	7/12/2016	S	--	6.89	1.1	0.08	184	7.44	243.2	Clear	Parameters Stablized	
MW-317-15	MW-317-15	7/12/2016	S	--	6.04	5.0	1.14	293	6.96	205.0	Clear	>3 Well Volumes	
MW-317-71	MW-317-71	7/12/2016	S	--	5.95	1.1	0.08	192	7.49	216.1	Clear	Parameters Stablized	
MW-318-20	MW-318-20	7/13/2016	S	--	9.70	1.6	3.12	215	6.87	-44.2	Clear	>3 Well Volumes	
MW-318-135	MW-318-135	7/13/2016	S	--	9.90	4.8	1.39	202	7.31	-50.9	Clear	Parameters Stablized	
MW-322-15	MW-322-15	8/19/2016	S	--	6.96	6.1	0.25	310	6.90	147.4	Clear	>3 Well Volumes	
MW-322-150	MW-322-150	8/19/2016	S	--	6.73	4.9	0.13	178	7.55	66.5	Clear	Parameters Stablized	
MW-323-15	MW-323-15	8/19/2016	S	--	7.15	2.1	0.21	213	7.17	55.1	Clear	Parameters Stablized	
MW-323-50	MW-323-50	8/19/2016	S	--	6.40	0.9	0.33	226	7.29	87.1	Clear	>3 Well Volumes	
MW-325-150	MW-325-150	7/7/2016	S	--	11.42	4.4	0.29	164	7.86	-114.3	Clear	Parameters Stablized	
MW-325-18	MW-325-18	7/7/2016	S	--	11.15	3.6	0.37	242	7.15	-38.8	Slightly Turbid	>3 Well Volumes	
MW-328-15	MW-328-15	7/6/2016	S	--	6.83	2.3	1.21	242	7.17	44.8	Slightly Turbid	>3 Well Volumes	
MW-328-151	MW-328-151	7/6/2016	S	--	7.15	2.5	0.37	155	7.60	-112.2	Clear	Parameters Stablized	
MW-328-151	MW-328-151	10/27/2016	S	--	7.56	1.8	0.63	153	7.28	-101.3	Clear	Parameters Stablized	
MW-329-15	MW-329-15	7/9/2016	S	--	8.96	2.5	0.48	290	7.03	13.5	Clear	Parameters Stablized	
MW-329-66	MW-329-66	7/9/2016	S	--	5.42	0.8	0.58	216	7.37	13.1	Clear	Parameters Stablized	
MW-332-15	MW-332-15	7/8/2016	S	--	6.89	2.5	2.51	255	6.89	-1.1	Clear	>3 Well Volumes	
MW-332-41	MW-332-41	7/8/2016	S	--	6.86	2.2	1.11	237	7.14	-62.4	Clear	Parameters Stablized	
MW-332-75	MW-332-75	7/8/2016	S	--	6.38	1.9	0.24	213	7.27	-79.8	Clear	Parameters Stablized	
MW-332-110	MW-332-110	7/8/2016	S	--	6.31	1.6	0.28	181	7.36	-49.3	Clear	Parameters Stablized	
MW-332-150	MW-332-150	7/8/2016	S	--	6.62	1.8	0.35	179	7.48	-98.8	Clear	Parameters Stablized	
MW-332-150	MW-332-150	10/12/2016	S	--	6.87	1.5	0.59	181	7.28	-90.6	Clear	Parameters Stablized	
MW-335-41	MW-335-41	7/7/2016	S	--	3.73	0.3	0.72	238	7.24	-70.6	Clear	Parameters Stablized	
MW-338-15	MW-338-15	7/12/2016	S	--	5.87	2.7	2.17	320	7.21	204.1	Clear	>3 Well Volumes	
MW-338-50	MW-338-50	7/12/2016	S	--	6.07	0.4	0.08	215	7.45	198.9	Clear	Parameters Stablized	
MW-339-15	MW-339-15	7/13/2016	S	--	8.15	0.5	0.77	272	6.81	-32.1	Clear	>3 Well Volumes	
MW-339-50	MW-339-50	7/13/2016	S	--	8.20	0.5	0.46	239	7.46	-84.5	Clear	Parameters Stablized	
MW-340-18	MW-340-18	7/8/2016	S	--	4.24	4.8	1.55	278	7.21	-9.1	Clear	>3 Well Volumes	
MW-340-65	MW-340-65	7/8/2016	S	--	4.48	4.6	0.41	192	7.52	-25.5	Clear	Parameters Stablized	
MW-340-150	MW-340-150	7/8/2016	S	--	4.07	4.6	0.53	171	7.77	-121.3	Clear	Parameters Stablized	
MW-341-15	MW-341-15	7/9/2016	S	--	5.77	1.0	0.48	312	7.17	202.9	Clear	Parameters Stablized	
MW-341-40	MW-341-40	7/9/2016	S	--	5.51	0.4	0.44	222	7.42	208.4	Clear	Parameters Stablized	
MW-342-15	MW-342-15	7/13/2016	S	--	6.40	3.3	1.30	227	7.00	-37.3	Clear	Parameters Stablized	
MW-342-65	MW-342-65	7/13/2016	S	--	6.59	0.8	1.24	216	7.37	-40.4	Clear	Parameters Stablized	
MW-343-15	MW-343-15	7/12/2016	S	--	7.71	4.7	1.52	259	6.78	-34.3	Clear	Parameters Stablized	
MW-343-50	MW-343-50	7/12/2016	S	--	7.71	1.2	1.77	203	7.27	-114.9	Clear	>3 Well Volumes	
MW-346-15	MW-346-15	7/12/2016	S	--	5.17	0.8	0.87	245	7.39	-134.5	Clear	>3 Well Volumes	
MW-346-65	MW-346-65	7/12/2016	S	--	4.61	1.3	0.06	184	7.40	-56.0	Clear	Parameters Stablized	
MW-346-65	MW-346-65	10/13/2016	S	--	8.83	1.1	0.66	176	7.21	17.8	Clear	Parameters Stablized	
MW-346-150	MW-346-150	7/12/2016	S	--	4.52	2.5	0.14	162	7.63	-89.0	Clear	Parameters Stablized	

Notes and Abbreviations on Page 4.

Table 3-1
Offsite Monitoring Well Field Parameters

Second Semiannual 2016 Offsite Groundwater Monitoring Report
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-347-20	MW-347-20	7/12/2016	S	--	10.41	3.87	0.77	212	7.32	-72.0	Clear	>3 Well Volumes	
MW-347-65	MW-347-65	7/12/2016	S	--	9.23	3.2	0.22 J	188	7.28	-61.7	Clear	Parameters Stablized	DO meter suspected to not be working properly
MW-347-65	MW-347-65	10/13/2016	S	--	9.41	2.9	0.42	184	7.25	-58.3	Clear	Parameters Stablized	
MW-347-150	MW-347-150	7/12/2016	S	--	10.06	3.4	1.05	168	7.26	-88.1	Clear	Parameters Stablized	
MW-347-150	MW-347-150	10/13/2016	S	--	10.27	3.1	0.40	166	7.34	-105.0	Clear	Parameters Stablized	
MW-349-15	MW-349-15	8/18/2016	S	--	5.83	3.3	5.03 JH	256	6.98	-36.0	Clear	>3 Well Volumes	DO probe malfunction, DO readings high
MW-349-45	MW-349-45	8/18/2016	S	--	6.04	1.6	6.42 JH	210	7.10	43.5	Clear	>3 Well Volumes	DO probe malfunction, DO readings high
MW-350-15	MW-350-15	7/13/2016	S	--	8.05	3.7	0.65	317	6.94	249.2	Clear	Parameters Stablized	
MW-350-50	MW-350-50	7/13/2016	S	--	8.70	0.7	0.11	201	7.37	245.3	Clear	Parameters Stablized	
MW-352-15	MW-352-15	7/13/2016	S	--	8.19	2.5	0.53	427	6.96	117.0	Clear	Parameters Stablized	
MW-352-15	MW-352-15	10/13/2016	S	--	8.36	4.7	0.40	458	6.79	-55.2	Clear	Parameters Stablized	
MW-352-40	MW-352-40	7/13/2016	S	--	8.51	0.6	0.20	365	7.31	126.4	Clear	Parameters Stablized	
MW-352-40	MW-352-40	10/13/2016	S	--	8.70	0.7	0.59	380	6.97	-72.0	Clear	Parameters Stablized	
MW-353-15	MW-353-15	7/13/2016	S	--	4.92	2.2	0.21	272	7.12	302.9	Clear	>3 Well Volumes	
MW-353-65	MW-353-65	7/13/2016	S	--	5.33	1.0	0.17	219	7.33	278.0	Clear	Parameters Stablized	
MW-353-100	MW-353-100	7/13/2016	S	--	5.40	0.9	0.31	221	7.33	336.5	Clear	Parameters Stablized	
MW-356-20	MW-356-20	7/6/2016	S	--	7.32	2.3	1.59	296	7.11	55.4	Clear	>3 Well Volumes	
MW-356-65	MW-356-65	7/6/2016	S	--	7.34	4.1	0.70	217	7.40	7.2	Clear	Parameters Stablized	
MW-356-90	MW-356-90	7/6/2016	S	3.65	7.30	4.3	0.46	217	7.43	-28.1	Clear	Parameters Stablized	
MW-357-15	MW-357-15	7/9/2016	S	--	11.66	3.0	2.23	170	7.16	-43.6	Clear	>3 Well Volumes	
MW-357-65	MW-357-65	7/9/2016	S	--	11.65	3.8	0.38	173	7.61	-95.1	Clear	Parameters Stablized	
MW-357-150	MW-357-150	7/9/2016	S	--	11.66	3.9	0.59	164	7.66	-116.5	Slightly Turbid	Parameters Stablized	

General Notes:
Q3 = Quarter 3: represents July 1 through September 30, 2016.
Q4 = Quarter 4: represents October 1 through December 31, 2016.
Acronyms and Abbreviations:
S = sulfolane
-- = not applicable
> = greater than
µS/cm = microsiemens per centimeter
°C = degrees Celsius
DO = dissolved oxygen
Fe = iron
ft. = feet
J = value is estimated
JH = value is estimated to be biased high
mg/L = milligrams per liter
mV = millivolts
MW = monitoring well
ORP = oxidation-reduction potential

Table 3-2
Offsite Groundwater Elevation Monitoring Results

Second 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)	Corrected Groundwater Elevation (MSL feet)
MW-150A-10	Water Table	8/7/2015	487.33	9/13/2016	4.99	482.34
MW-150B-25	10-55	8/7/2015	487.42	9/13/2016	5.09	482.33
MW-153A-15	Water Table	8/11/2015	490.34	9/13/2016	6.64	483.70
MW-153B-55	10-55	8/11/2015	489.86	9/13/2016	6.16	483.70
MW-156A-15	Water Table	6/25/2015	485.88	9/13/2016	5.51	480.37
MW-156B-50	10-55	8/11/2015	489.26	9/13/2016	8.88	480.38
MW-159A-15	Water Table	8/11/2015	488.42	9/13/2016	6.66	481.76
MW-159B-45	10-55	8/11/2015	488.28	9/13/2016	6.46	481.82
MW-159C-70	55-90	8/11/2015	488.71	9/13/2016	6.92	481.79
MW-160B-90	55-90	3/22/2016	485.28	9/13/2016	5.43	479.85
MW-163A-15	Water Table	6/5/2015	484.89	9/12/2016	7.79	477.10
MW-163B-40	10-55	6/5/2015	485.25	9/12/2016	8.13	477.12
MW-166A-15	Water Table	8/10/2015	474.84	9/13/2016	8.36	466.48
MW-166B-30	10-55	8/10/2015	475.09	9/13/2016	8.43	466.66
MW-169A-15	Water Table	3/24/2016	486.49	9/13/2016	9.13	477.04
MW-169B-50	10-55	8/7/2015	486.32	9/13/2016	8.86	477.46
MW-169C-60	10-55	3/24/2016	483.05	9/13/2016	5.59	477.46
MW-170A-15	Water Table	8/6/2015	490.70	9/13/2016	7.91	482.79
MW-170B-75	55-90	8/6/2015	490.71	9/13/2016	7.87	482.84
MW-170C-130	90-150	12/4/2015	490.48	9/13/2016	7.62	482.86
MW-170D-50	10-55	8/6/2015	490.44	9/13/2016	7.61	482.83
MW-181A-15	Water Table	6/25/2015	475.92	9/12/2016	8.38	467.54
MW-181B-50	10-55	6/25/2015	475.85	9/12/2016	8.38	467.47
MW-181C-150	90-150	8/11/2015	475.98	9/12/2016	8.20	467.78
MW-182A-15	Water Table	10/30/2015	475.30	9/12/2016	4.73	470.57
MW-182B-45	10-55	10/30/2015	475.24	9/12/2016	4.67	470.57
MW-183B-60	10-55	8/10/2015	478.42	9/13/2016	5.96	472.46
MW-184-45	10-55	10/30/2015	486.52	9/13/2016	6.67	479.85
MW-185C-120	90-150	8/10/2015	478.11	9/12/2016	6.35	471.76
MW-187-15	Water Table	3/24/2016	485.38	9/13/2016	11.89	473.49
MW-190A-15	Water Table	3/24/2016	481.81	9/12/2016	7.45	474.36
MW-190BR-60	10-55	8/10/2015	481.97	9/12/2016	7.63	474.34
MW-191A-15	Water Table	8/10/2015	475.82	9/13/2016	4.78	471.04
MW-191B-60	10-55	8/10/2015	475.64	9/13/2016	4.64	471.00
MW-193A-15	Water Table	8/6/2015	488.36	9/13/2016	8.42	479.94
MW-193B-60	10-55	8/7/2015	488.04	9/13/2016	7.95	480.09
MW-194B-40	10-55	8/10/2015	475.98	9/13/2016	7.86	468.12
MW-311-15	Water Table	7/18/2015	466.87	9/12/2016	1.85	465.02
MW-311-46	10-55	7/18/2015	466.85	9/12/2016	1.82	465.03
MW-312-15	Water Table	7/18/2015	464.17	9/12/2016	3.90	460.27
MW-312-50	10-55	7/18/2015	464.19	9/12/2016	3.50	460.69

Notes and Abbreviations on Page 2.

Table 3-2
Offsite Groundwater Elevation Monitoring Results

Second 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)	Corrected Groundwater Elevation (MSL feet)
MW-318-135	90-150	3/22/2016	492.92	9/13/2016	11.26	481.66
MW-319-15	Water Table	7/18/2015	456.12	9/12/2016	3.17	452.95
MW-319-45	10-55	7/18/2015	455.94	9/12/2016	2.95	452.99
MW-322-150	90-150	3/24/2016	471.68	9/13/2016	7.87	463.81
MW-324-15	Water Table	7/18/2015	463.68	9/12/2016	5.93	457.75
MW-324-151	90-150	7/18/2015	462.84	9/12/2016	5.17	457.67
MW-326-20	Water Table	3/24/2016	500.63	9/13/2016	7.87	492.76
MW-326-150	90-150	3/24/2016	500.51	9/13/2016	7.77	492.74
MW-328-15	Water Table	12/4/2015	472.26	9/12/2016	6.73	465.53
MW-328-151	90-150	12/4/2015	472.57	9/12/2016	7.02	465.55
MW-332-15	Water Table	8/10/2015	481.93	9/12/2016	6.67	475.26
MW-332-41	10-55	8/10/2015	481.85	9/13/2016	6.62	475.23
MW-332-75	55-90	8/10/2015	481.34	9/13/2016	6.13	475.21
MW-332-110	90-150	8/10/2015	481.26	9/13/2016	6.10	475.16
MW-332-150	90-150	8/10/2015	481.57	9/12/2016	6.38	475.19
MW-333-150	90-150	3/24/2016	497.17	9/13/2016	7.24	489.93
MW-333-16	Water Table	3/24/2016	497.66	9/13/2016	7.78	489.88
MW-335-41	10-55	7/18/2015	469.62	9/12/2016	3.69	465.93
MW-339-15	Water Table	8/10/2015	479.53	9/12/2016	7.83	471.70
MW-339-50	10-55	8/10/2015	479.38	9/12/2016	7.64	471.74
MW-342-15	Water Table	8/7/2015	482.35	9/13/2016	6.26	476.09
MW-342-65	10-55	8/7/2015	482.50	9/13/2016	6.46	476.04
MW-353-15	Water Table	8/7/2015	480.26	9/13/2016	4.86	475.40
MW-353-65	10-55	8/7/2015	480.62	9/13/2016	5.30	475.32
MW-353-100	55-90	8/7/2015	480.61	9/13/2016	5.37	475.24
MW-356-20	Water Table	8/11/2015	478.72	9/12/2016	6.99	471.73
MW-357-15	Water Table	8/10/2015	487.76	9/12/2016	11.36	476.40
MW-357-65	10-55	8/10/2015	487.89	9/12/2016	11.31	476.58
MW-357-150	90-150	8/10/2015	487.99	9/12/2016	11.33	476.66

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 G for elevations for remaining vertical gradient network measurements.

Acronyms and Abbreviations:

MSL = mean sea level

Table 3-3
Offsite Sulfolane Analytical Results

Second 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	07/11/16		MW-150A-10	87.7	
MW-150B-25	10-55	07/11/16		MW-150B-25	22.9	
MW-150C-60	10-55	07/11/16		MW-150C-60	5.51J	
MW-150C-60	10-55	07/11/16	DUP	MW-250C-60	5.81J	
MW-151A-15	Water Table	07/11/16		MW-151A-15	23.9	
MW-151B-25	10-55	07/11/16		MW-151B-25	14.8	
MW-151C-60	10-55	07/11/16		MW-151C-60	5.89J	
MW-152A-15	Water Table	07/11/16		MW-152A-15	17.2	
MW-152B-25	10-55	07/11/16		MW-152B-25	13.8	
MW-152C-65	10-55	07/11/16		MW-152C-65	3.36J	
MW-153A-15	Water Table	07/13/16		MW-153A-15	8.26J	
MW-153A-15	Water Table	10/11/16		MW-153A-15	14.9	
MW-153A-15	Water Table	10/11/16	DUP	MW-253A-15	14.4	
MW-153B-55	10-55	07/13/16		MW-153B-55	3.69J	
MW-153B-55	10-55	10/11/16		MW-153B-55	<5.15	
MW-155A-15	Water Table	07/11/16		MW-155A-15	11.9	
MW-155B-65	10-55	07/11/16		MW-155B-65	<5.10	
MW-156A-15	Water Table	07/11/16		MW-156A-15	15.0	
MW-156B-50	10-55	07/11/16		MW-156B-50	13.8	
MW-157A-15	Water Table	07/11/16		MW-157A-15	12.9	
MW-157B-30	10-55	07/11/16		MW-157B-30	19.7	
MW-158A-15	Water Table	07/12/16		MW-158A-15	22.1	
MW-158B-60	10-55	07/12/16		MW-158B-60	24.5	
MW-158B-60	10-55	07/12/16	DUP	MW-258B-60	24.8	
MW-159A-15	Water Table	07/11/16		MW-159A-15	<5.15	
MW-159B-45	10-55	07/11/16		MW-159B-45	9.43J	
MW-159C-70	55-90	07/11/16		MW-159C-70	5.73J	
MW-160AR-15	Water Table	07/12/16		MW-160AR-15	<5.05	
MW-160B-90	55-90	07/12/16		MW-160B-90	8.67J	
MW-161-30	10-55	07/08/16		MW-161-30	60.1	
MW-161A-15	Water Table	07/08/16		MW-161A-15	40.8	
MW-161A-15	Water Table	10/11/16		MW-161A-15	23.9	
MW-161B-50	10-55	07/08/16		MW-161B-50	71.8	
MW-162A-15	Water Table	07/13/16		MW-162A-15	15.8	
MW-162B-65	10-55	07/13/16		MW-162B-65	22.7	
MW-163A-15	Water Table	07/13/16		MW-163A-15	<5.05	
MW-163B-40	10-55	07/13/16		MW-163B-40	8.47J	
MW-164A-15	Water Table	07/13/16		MW-164A-15	23.0	
MW-164B-50	10-55	07/13/16		MW-164B-50	41.3	
MW-164C-60	10-55	07/13/16		MW-164C-60	41.9	
MW-165A-15	Water Table	07/08/16		MW-165A-15	<5.10	
MW-165B-50	10-55	07/08/16		MW-165B-50	<5.10	
MW-166A-15	Water Table	07/12/16		MW-166A-15	12.4	

Notes and Abbreviations on Page 5.

Table 3-3
Offsite Sulfolane Analytical Results

Second 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-166A-15	Water Table	10/12/16		MW-166A-15	4.44J	
MW-166A-15	Water Table	07/12/16	DUP	MW-266A-15	12.6	
MW-166B-30	10-55	07/12/16		MW-166B-30	51.8	
MW-166B-30	10-55	10/12/16		MW-166B-30	75.5	
MW-167A-15	Water Table	07/07/16		MW-167A-15	3.32J	
MW-167A-15	Water Table	10/10/16		MW-167A-15	<5.10	
MW-167B-35	10-55	07/07/16		MW-167B-35	15.5	
MW-167B-35	10-55	10/10/16		MW-167B-35	14.9	
MW-168A-15	Water Table	07/13/16		MW-168A-15	16.7	
MW-168A-15	Water Table	10/12/16		MW-168A-15	18.7	
MW-168B-50	10-55	07/13/16		MW-168B-50	42.5	
MW-168B-50	10-55	10/12/16		MW-168B-50	41.4	
MW-169A-15	Water Table	07/13/16		MW-169A-15	<4.76	
MW-169C-60	10-55	07/13/16		MW-169C-60	<5.10	
MW-170A-15	Water Table	07/11/16		MW-170A-15	<5.10	
MW-170B-75	55-90	07/11/16		MW-170B-75	<5.00	
MW-170C-130	90-150	07/11/16		MW-170C-130	<5.20	
MW-170D-50	10-55	07/11/16		MW-170D-50	<5.10	
MW-172A-15	Water Table	07/07/16		MW-172A-15	<5.00	
MW-172A-15	Water Table	10/27/16		MW-172A-15	<5.10	
MW-172B-150	90-150	07/07/16		MW-172B-150	<5.10	
MW-181A-15	Water Table	07/12/16		MW-181A-15	<5.10	
MW-181B-50	10-55	07/12/16		MW-181B-50	<5.00	
MW-181B-50	10-55	10/27/16		MW-181B-50	<5.00	
MW-181B-50	10-55	10/27/16	DUP	MW-281B-50	<5.00	
MW-181C-150	90-150	07/12/16		MW-181C-150	<5.05	
MW-181C-150	90-150	10/27/16		MW-181C-150	<5.05	
MW-182A-15	Water Table	07/07/16		MW-182A-15	4.74J	
MW-182A-15	Water Table	10/11/16		MW-182A-15	19.8	
MW-182A-15	Water Table	07/07/16	DUP	MW-282A-15	<5.40	
MW-182B-45	10-55	07/07/16		MW-182B-45	29.5	
MW-182B-45	10-55	10/11/16		MW-182B-45	32.2	
MW-183A-15	Water Table	07/09/16		MW-183A-15	4.63J	
MW-183B-60	10-55	07/09/16		MW-183B-60	56.2	
MW-184-45	10-55	07/13/16		MW-184-45	<5.05	
MW-185A-15	Water Table	07/07/16		MW-185A-15	<5.15	
MW-185A-15	Water Table	10/10/16		MW-185A-15	<5.05	
MW-185B-50	10-55	07/07/16		MW-185B-50	6.55J	
MW-185B-50	10-55	10/10/16		MW-185B-50	6.73J	
MW-185B-50	10-55	10/10/16	DUP	MW-285B-50	5.99J	
MW-185C-120	90-150	07/07/16		MW-185C-120	5.09J	
MW-185C-120	90-150	10/10/16		MW-185C-120	6.91J	
MW-187-15	Water Table	07/13/16		MW-187-15	5.83J	

Notes and Abbreviations on Page 5.

Table 3-3
Offsite Sulfolane Analytical Results

Second 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-187-15	Water Table	10/12/16		MW-187-15	3.93J	
MW-189A-15	Water Table	07/06/16		MW-189A-15	<5.10	
MW-189B-60	10-55	07/06/16		MW-189B-60	<5.10	
MW-190A-15	Water Table	07/08/16		MW-190A-15	<5.05	
MW-190BR-60	10-55	07/08/16		MW-190BR-60	<5.20	
MW-190-150	90-150	07/08/16		MW-190-150	<5.15	
MW-190-150	90-150	07/08/16	DUP	MW-290-150	<5.05	
MW-191A-15	Water Table	07/08/16		MW-191A-15	<5.10	
MW-191B-60	10-55	07/08/16		MW-191B-60	<4.95	
MW-193A-15	Water Table	07/13/16		MW-193A-15	<5.10	
MW-193B-60	10-55	07/13/16		MW-193B-60	<5.05	
MW-194A-15	Water Table	07/12/16		MW-194A-15	14.9	
MW-194A-15	Water Table	10/12/16		MW-194A-15	9.84J	
MW-194B-40	10-55	07/12/16		MW-194B-40	35.1	
MW-194B-40	10-55	10/12/16		MW-194B-40	16.0	
MW-308-15	Water Table	07/12/16		MW-308-15	4.02J	
MW-308-15	Water Table	10/12/16		MW-308-15	6.91J	
MW-308-30	Water Table	--		--	--	Frozen; no sample collected
MW-308-30	Water Table	--		--	--	Frozen; no sample collected
MW-311-15	Water Table	07/06/16		MW-311-15	<5.10	
MW-311-46	10-55	07/06/16		MW-311-46	<5.05	
MW-314-15	Water Table	07/07/16		MW-314-15	<5.00	
MW-314-15	Water Table	10/27/16		MW-314-15	<5.05	
MW-314-150	90-150	07/07/16		MW-314-150	<5.05	
MW-314-150	90-150	10/27/16		MW-314-150	<5.00	
MW-316-15	Water Table	07/12/16		MW-316-15	<5.05	
MW-316-15	Water Table	10/11/16		MW-316-15	<5.05	
MW-316-56	10-55	07/12/16		MW-316-56	<5.05	
MW-317-15	Water Table	07/12/16		MW-317-15	<4.94	
MW-317-71	55-90	07/12/16		MW-317-71	<5.10	
MW-318-20	Water Table	07/13/16		MW-318-20	<5.10	
MW-318-135	90-150	07/13/16		MW-318-135	<5.05	
MW-322-15	Water Table	08/19/16		MW-322-15	<5.05	
MW-322-150	90-150	08/19/16		MW-322-150	<5.10J*	
MW-323-15	Water Table	08/19/16		MW-323-15	<5.20	
MW-323-50	10-55	08/19/16		MW-323-50	<5.10	
MW-325-18	Water Table	07/07/16		MW-325-18	<5.00	
MW-325-150	90-150	07/07/16		MW-325-150	<5.10	
MW-328-15	Water Table	07/06/16		MW-328-15	<5.05	
MW-328-15	Water Table	07/06/16	DUP	MW-428-15	<5.10	
MW-328-151	90-150	07/06/16		MW-328-151	<5.05	
MW-328-151	90-150	10/27/16		MW-328-151	<5.05	
MW-329-15	Water Table	07/09/16		MW-329-15	33.6	

Notes and Abbreviations on Page 5.

Table 3-3
Offsite Sulfolane Analytical Results

Second 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-329-66	10-55	07/09/16		MW-329-66	37.6	
MW-332-15	Water Table	07/08/16		MW-332-15	<5.10	
MW-332-41	10-55	07/08/16		MW-332-41	<5.10	
MW-332-75	55-90	07/08/16		MW-332-75	<5.15	
MW-332-110	90-150	07/08/16		MW-332-110	13.5	
MW-332-150	90-150	07/08/16		MW-332-150	128	
MW-332-150	90-150	10/12/16		MW-332-150	159	
MW-335-41	10-55	07/07/16		MW-335-41	<5.10	
MW-338-15	Water Table	07/12/16		MW-338-15	<5.05	
MW-338-50	10-55	07/12/16		MW-338-50	19.3	
MW-339-15	Water Table	07/13/16		MW-339-15	23.6	
MW-339-50	10-55	07/13/16		MW-339-50	26.6	
MW-340-18	Water Table	07/08/16		MW-340-18	<5.10	
MW-340-65	10-55	07/08/16		MW-340-65	<5.10	
MW-340-150	90-150	07/08/16		MW-340-150	<5.10	
MW-341-15	Water Table	07/08/16		MW-341-15	23.6	
MW-341-40	10-55	07/08/16		MW-341-40	28.0	
MW-342-15	Water Table	07/13/16		MW-342-15	12.1	
MW-342-15	Water Table	07/13/16	DUP	MW-442-15	12.7	
MW-342-65	10-55	07/13/16		MW-342-65	18.0	
MW-343-15	Water Table	07/12/16		MW-343-15	<4.73	
MW-343-50	10-55	07/12/16		MW-343-50	<4.70	
MW-346-15	Water Table	07/12/16		MW-346-15	14.0	
MW-346-65	10-55	07/12/16		MW-346-65	36.9	
MW-346-65	10-55	10/13/16		MW-346-65	40.4	
MW-346-150	90-150	07/12/16		MW-346-150	3.22J	
MW-347-150	90-150	07/12/16		MW-347-150	20.6	
MW-347-150	90-150	10/13/16		MW-347-150	21.1	
MW-347-20	Water Table	07/12/16		MW-347-20	9.33J	
MW-347-65	10-55	07/12/16		MW-347-65	18.8	
MW-347-65	10-55	10/13/16		MW-347-65	18.0	
MW-347-65	10-55	10/13/16	DUP	MW-447-65	19.5	
MW-349-15	Water Table	08/18/16		MW-349-15	21.5	
MW-349-45	10-55	08/18/16		MW-349-45	16.0	
MW-349-45	10-55	08/18/16	DUP	MW-449-45	17.1	
MW-350-15	Water Table	07/13/16		MW-350-15	<5.00	
MW-350-50	10-55	07/13/16		MW-350-50	17.8	
MW-352-15	Water Table	07/13/16		MW-352-15	<5.15	
MW-352-15	Water Table	10/13/16		MW-352-15	3.44J	
MW-352-40	10-55	07/13/16		MW-352-40	13.9	
MW-352-40	10-55	10/13/16		MW-352-40	14.3	
MW-353-15	Water Table	07/13/16		MW-353-15	104	

Notes and Abbreviations on Page 5.

Table 3-3
Offsite Sulfolane Analytical Results

Second 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-353-15	Water Table	07/13/16	DUP	MW-453-15	103	
MW-353-65	10-55	07/13/16		MW-353-65	136	
MW-353-100	55-90	07/13/16		MW-353-100	139	
MW-356-20	Water Table	07/06/16		MW-356-20	<5.00	
MW-356-65	10-55	07/06/16		MW-356-65	<5.10	
MW-356-90	55-90	07/06/16		MW-356-90	<5.05	
MW-357-15	Water Table	07/09/16		MW-357-15	<5.05	
MW-357-65	10-55	07/09/16		MW-357-65	<5.15	
MW-357-150	90-150	07/09/16		MW-357-150	<5.10	
MW-357-150	90-150	07/09/16	DUP	MW-457-150	<5.10	

Acronyms and Abbreviations:
-- = information not provided, a sample was not collected. Refer to the comments for details
< = not detected; limit of detection (LOD) listed
DUP = field 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.
µg/L = micrograms per liter

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

Second 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-1921	64.7814, -147.3603	7/14/2016	<5.20

General Notes:
Well depth listed where information is known.
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

Second 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-0265	64.7900, -147.3958	35	10-55	PS	7/1/2016	<5.10
PW-0267	64.7900, -147.4000	60	55-90	PS	7/1/2016	<5.20
PW-0268	64.7900, -147.4015	--	--	PS	8/26/2016	<5.00
PW-0270	64.7889, -147.4074	--	--	PS	7/1/2016	<5.10J*
PW-0271	64.7889, -147.4054	48	10-55	PS	7/1/2016	<5.20
PW-0273	64.7893, -147.4029	170	>160	PS	7/8/2016	<5.05
PW-0274	64.7893, -147.4015	158	90-160	PS	8/26/2016	<5.10
PW-0275	64.7893, -147.3986	57	55-90	PS	7/14/2016	<5.10
PW-0276	64.7893, -147.3972	49	10-55	PS	7/15/2016	<5.05
PW-0277	64.7893, -147.3958	45	10-55	PS	7/1/2016	<5.20
PW-0280	64.7899, -147.3940	40	10-55	PS	7/21/2016	<5.05
PW-0281	64.7893, -147.3939	40	10-55	PS	7/21/2016	<5.20
PW-0284	64.7885, -147.3968	63	55-90	DUP	7/7/2016	3.25J
				PS	7/7/2016	3.49J
PW-0351	64.7678, -147.3551	30	10-55	PS	8/25/2016	<5.05
PW-0352	64.7678, -147.3568	40	10-55	PS	8/25/2016	<5.00
PW-0356	64.7668, -147.3586	30	10-55	PS	8/25/2016	<5.00
PW-0358	64.7662, -147.3569	105	90-160	PS	8/18/2016	49.9
PW-0358	64.7662, -147.3569	105	90-160	PS	11/11/2016	50.9
PW-0366	64.7672, -147.3428	--	--	PS	7/21/2016	<5.25
PW-0367	64.7684, -147.3435	--	--	PS	10/11/2016	<5.25
PW-0368	64.7682, -147.3431	--	--	PS	10/11/2016	<5.40
PW-0369	64.7690, -147.3445	--	--	DUP	7/15/2016	<5.00
				PS	7/15/2016	<5.05
PW-0460	64.7764, -147.3718	45	10-55	DUP	8/25/2016	<5.05
				PS	8/25/2016	<5.30
PW-0464	64.7754, -147.3686	98	90-160	PS	8/18/2016	103
PW-0464	64.7754, -147.3686	98	90-160	PS	11/18/2016	104
PW-0510	64.7756, -147.3552	34	10-55	PS	6/27/2016	<5.15
PW-0512	64.7744, -147.3534	300	>160	PS	8/26/2016	<5.00
PW-0513	64.7738, -147.3530	45.6	10-55	PS	7/15/2016	<5.15
PW-0548	64.7793, -147.3595	40	10-55	DUP	10/11/2016	<5.30
				PS	10/11/2016	<5.10
PW-0594	64.7896, -147.3905	--	--	PS	7/21/2016	<5.25
PW-0750	64.7876, -147.3847	--	--	PS	8/26/2016	<4.95
PW-0766	64.7907, -147.3824	40	10-55	PS	7/11/2016	<5.15
PW-0866	64.7872, -147.3754	42	10-55	PS	7/8/2016	<5.00
PW-0870	64.7856, -147.3721	42	10-55	PS	7/6/2016	<5.15
PW-0905	64.7872, -147.3709	40	10-55	PS	7/15/2016	<5.15

Notes and Abbreviations on Page 2.

Table 3-5
Private Well Sulfolane Results - Resampling Event

Second 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-0912	64.7851, -147.3710	42	10-55	DUP	6/23/2016	4.25J
				PS	6/23/2016	4.79J
PW-0973	64.7695, -147.4305	70	55-90	PS	7/8/2016	<5.25
PW-0976	64.7698, -147.4291	38	10-55	PS	6/30/2016	<5.25
PW-0977	64.7702, -147.4319	--	--	PS	7/8/2016	<5.30
PW-0979	64.7683, -147.4294	--	--	PS	8/27/2016	<4.95
PW-0998	64.7710, -147.3517	--	--	PS	6/17/2016	<5.10
PW-1093	64.7889, -147.4064	220	>160	PS	7/15/2016	<5.00
PW-1230	64.7579, -147.3716	231	>160	DUP	8/18/2016	768
				PS	8/18/2016	742
PW-1230	64.7579, -147.3716	231	>160	DUP	11/18/2016	915
				PS	11/18/2016	795
PW-1409	64.7501, -147.3822	--	--	PS	9/13/2016	<5.30
PW-1450	64.7678, -147.3484	--	--	PS	6/8/2016	<5.60
PW-1454	64.7787, -147.3588	--	--	PS	6/17/2016	<5.20
PW-1461	64.7650, -147.3494	--	--	PS	7/15/2016	<5.00
PW-1483	64.7664, -147.3510	37	10-55	PS	7/1/2016	<5.10
PW-1608	64.7900, -147.3986	60	55-90	PS	6/23/2016	<5.00
PW-1930	64.7735, -147.3528	--	--	PS	7/22/2016	<5.10

General Notes:
Well depth listed where information is known.
Acronyms and Abbreviations:
-- = not available
< = 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