

**Table 1.1
Field Activities**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Standard Activities	Frequency during Fourth Quarter 2013
Groundwater elevation check	Quarterly
Vertical Hydraulic Gradient	Monthly
Data logger download	Downloaded quarterly, measuring hourly
New data loggers added	0
LNAPL migration network check	Monthly
LNAPL thickness network check	Monthly
Hydraulic capture performance monitoring	Monthly
Private well sulfolane initial sampling (call-ins)	Throughout quarter
Private well sulfolane resampling (near plume edge)	Throughout quarter
Deep (sub-permafrost) private well sampling	End of Q4
Sulfolane network sampling	Throughout Q4
BTEX network sampling	Throughout Q4
Sampling select wells for UAF stable-isotope analysis	Throughout Q4
Sampling select wells for UAF microbial analysis	Throughout Q4
Contaminant capture performance monitoring - sulfolane sampling	Throughout Q4
Groundwater treatment system (including GAC filters) and recovery well sampling	Monthly
Well repair and maintenance	Flag installation continued in Q4 Several offsite wells repaired
Wells installed	62 monitoring and observation wells installed (on- & off-site)
Wells developed	55 wells developed and sampled
Initial Sulfolane/BTEX Sampling	
Air-sparge system pilot study sampling	Seven post-shutdown sampling events in Q4
LNAPL recovery activities	Throughout quarter
Non-Standard Activities	Frequency during Fourth Quarter 2013
LNAPL Composition Sampling	Beginning of Q4
Tracer injection and data collection	Throughout quarter
Onsite hydropunch and grab sampling for sulfolane and BTEX	Beginning of Q4
Onsite soil boring advancement and sample collection for sulfolane, BTEX, PAHs, 1,3,5-TMB and TOC	October and November, 2013
North Gravel Pit surface water and sediment sampling	Beginning of Q4
Ground-based FDEM and ERI data collection and down-hole geophysical evaluation	October and November, 2013

Acronyms and Abbreviations:

BTEX = benzene, toluene, ethylbenzene, and total xylenes
 ERI = electrical resistivity imaging
 FDEM = frequency domain electromagnetic induction
 GAC = granular activated carbon
 GWE = groundwater elevation
 LNAPL = light non-aqueous phase liquid
 PAHs = polycyclic aromatic hydrocarbons
 Q4 = Represents activities completed from October 1 through December 17
 TMB = trimethylbenzene
 TOC = total organic carbon

Table 3-1
Well Construction Parameters
Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen							Riser Material	Filter Pack		WATER TABLE			ALASKA STATE PLANE	
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)	Screen Slot Size (inches)	Material		Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NAD83, ZONE 3	
																									NORTHING	EASTING
MW-101	MW-101-60	On-site	3/19/1987	Nov-2012	494.59	3.45	491.1	61.00	430.14	—	2.00	56.00	435.14	61.00	430.14	5.00	0.02	ss	ss?	—	—	8.0	N	48.0	3927588.78	1428199.67
MW-101A	MW-101A-25	On-site	3/28/1987	Nov-2012	495.01	4.00	491.0	23.00	468.01	—	2.00	17.80	473.21	22.80	468.21	5.00	0.02	ss	ss?	—	—	8.0	N	9.8	3927590.29	1428209.63
MW-102	MW-102-70	On-site	4/4/1987	Nov-2012	496.02	3.46	492.6	71.50	421.06	—	2.50	61.50	431.06	71.50	421.06	10.00	0.01	PVC	PVC?	—	—	9.0	N	52.5	3927955.12	1429113.91
MW-104	MW-104-65	On-site	4/2/1987	Nov-2012	496.02	2.99	493.0	67.00	426.03	—	2.50	63.00	430.03	67.00	426.03	4.00	0.02	PVC	PVC?	—	—	7.0	N	56.0	3927958.82	1429747.75
MW-105	MW-105-65	On-site	3/21/1987	Nov-2012	497.66	2.46	495.2	63.00	432.20	—	2.00	58.00	437.20	63.00	432.20	5.00	0.02	ss	ss?	—	—	8.0	N	50.0	3924919.0	1430402.38
MW-105A	MW-105A-25	On-site	3/21/1987	Nov-2012	499.21	3.58	495.6	23.00	472.63	—	2.00	18.00	477.63	23.00	472.63	5.00	0.02	ss	ss?	—	—	8.0	N	10.0	3924910.02	1430404.24
MW-106	MW-106-25	On-site	9/14/1987	Nov-2012	499.28	1.51	497.8	23.00	474.77	—	2.00	18.50	479.27	23.00	474.77	4.50	0.02	PVC	PVC?	—	—	12.4	N	6.1	3926112.10	1428065.05
MW-109	MW-109-15	On-site	8/9/1988	Aug-2013	495.16	0.32	494.8	14.00	480.84	—	2.00	9.50	485.34	14.00	480.84	4.50	0.02	PVC	PVC?	—	—	4.5	N	5.0	3925855.20	1428674.99
MW-110	MW-110-20	On-site	8/10/1988	Nov-2012	496.73	3.26	493.5	18.00	475.47	—	2.00	13.50	479.97	18.00	475.47	4.50	0.02	PVC	PVC?	—	—	5.0	N	8.5	3925975.36	1428873.06
MW-110-65	MW-110-65	On-site	8/23/2013	Nov-2013	496.38	2.70	493.9	65.87	428.05	—	2.00	60.78	—	65.34	—	4.56	0.01	PVC	PVC	Natural pack	—	6.6	N	54.23	3925984.07	1428864.82
MW-113	MW-113-15	On-site	9/19/1988	Sept-2013	494.50	3.11	491.4	16.00	475.39	—	2.00	11.50	479.89	16.00	475.39	4.50	0.02	PVC	PVC?	—	—	8.3	N	3.2	3926957.71	1428777.98
MW-115	MW-115-15	On-site	9/20/1988	Nov-2012	495.84	2.55	493.3	17.00	476.29	—	2.00	12.50	480.79	17.00	476.29	4.50	0.02	ss	ss?	—	—	9.0	N	3.5	3925758.76	1429540.81
MW-116	MW-116-15	On-site	9/22/1988	Nov-2012	496.17	2.91	493.3	17.00	476.26	—	2.00	12.00	481.26	17.00	476.26	5.00	0.02	ss	ss?	—	—	9.0	N	3.0	3925670.10	1429332.64
MW-118	MW-118-45	On-site	3/9/1990	Nov-2012	496.90	4.26	492.6	43.00	449.64	—	2.00	38.50	454.14	43.00	449.64	4.50	0.02	ss	PVC	—	—	7.0	N	31.5	3927467.01	1429638.43
MW-124	MW-124-25	On-site	6/6/1990	Nov-2012	497.39	3.36	494.0	24.50	469.53	—	2.00	20.00	474.03	24.50	469.53	4.50	0.02	PVC	PVC?	—	—	8.0	N	12.0	3927015.09	1429816.83
MW-125	MW-125-25	On-site	6/6/1990	Sept-2013	496.19	3.16	493.0	24.00	469.03	—	2.00	19.50	473.53	24.00	469.03	4.50	0.02	PVC	PVC	—	—	8.0	N	11.5	3927032.49	1429569.75
MW-126	MW-126-25	On-site	6/4/1991	Nov-2012	495.53	3.72	491.8	24.50	467.31	—	2.00	20.00	471.81	24.50	467.31	4.50	0.02	PVC	PVC	—	—	7.0	N	13.0	3927426.37	1429419.17
MW-127	MW-127-25	On-site	6/4/1991	Nov-2012	496.53	3.68	492.9	24.50	468.35	—	2.00	20.00	472.85	24.50	468.35	4.50	0.02	PVC	PVC	—	—	8.5	N	11.5	3927476.29	1429065.47
MW-129	MW-129-40	On-site	10/21/1996	Nov-2012	496.05	3.12	492.9	41.50	451.43	—	2.00	37.00	455.93	41.50	451.43	4.50	0.02	PVC	PVC	—	—	8.2	N	28.8	3927205.45	1429720.22
MW-130	MW-130-25	On-site	4/22/1997	Sept-2013	496.92	3.09	493.8	23.00	470.83	—	2.00	19.00	474.83	23.00	470.83	4.00	0.02	PVC	PVC	—	—	9.0	N	10.0	3926825.66	1429354.64
MW-131	MW-131-25	On-site	8/5/1988	Nov-2012	495.75	2.00	493.8	24.50	469.25	—	2.00	20.00	473.75	24.50	469.25	4.50	0.02	PVC	PVC	—	—	9.0	N	11.0	3927936.24	1429024.82
MW-132	MW-132-20	On-site	9/1/1999	Nov-2012	499.41	2.69	496.7	22.00	474.72	—	2.00	17.50	479.22	22.00	474.72	4.50	0.02	PVC	PVC	—	—	9.0	N	8.5	3926600.34	1429997.01
MW-133	MW-133-20	On-site	9/1/1999	Nov-2012	498.34	2.59	495.8	22.00	473.75	—	2.00	17.50	478.25	22.00	473.75	4.50	0.02	PVC	PVC	—	—	9.0	N	8.5	3926597.42	1430160.18
MW-134	MW-134-20	On-site	9/2/1999	Nov-2012	497.76	2.56	495.2	21.50	473.70	—	2.00	17.00	478.20	21.50	473.70	4.50	0.02	PVC	PVC	—	—	8.6	N	8.4	3926000.91	1430170.26
MW-135	MW-135-20	On-site	3/8/2001	Sept-2013	496.93	3.74	493.2	19.50	473.69	—	2.00	10.60	482.59	19.50	473.69	8.90	0.02	PVC	PVC	—	—	9.0	N	1.6	3927024.53	1429730.91
MW-136	MW-136-20	On-site	3/8/2001	Sept-2013	496.90	3.46	493.4	19.10	474.34	—	2.00	10.10	483.34	19.10	474.34	9.00	0.02	PVC	PVC	—	—	9.0	N	1.1	3927024.41	1429778.02
MW-137	MW-137-20	On-site	3/8/2001	Sept-2013	497.41	3.17	494.2	19.30	474.94	—	2.00	10.40	483.84	19.30	474.94	8.90	0.02	PVC	PVC	—	—	9.0	N	1.4	3927083.81	1429737.46
MW-138	MW-138-20	On-site	4/12/2001	Nov-2012	496.34	3.14	493.2	18.10	475.10	—	2.00	3.90	489.30	18.10	475.10	14.20	0.02	PVC	PVC	—	—	9.0	Y	-5.1	3925738.32	1429686.77
MW-139	MW-139-25	On-site	5/29/2001	Nov-2012	497.25	1.96	495.3	25.00	470.29	—	2.00	5.70	489.59	25.00	470.29	19.30	0.02	PVC	PVC	—	—	9.0	Y	-3.3	3927427.97	1428848.56
MW-140	MW-140-25	On-site	5/30/2001	Nov-2012	494.90	2.83	492.1	23.50	468.57	—	2.00	4.20	487.87	23.50	468.57	19.30	0.02	PVC	PVC	—	—	8.0	Y	-3.8	3927683.10	1429244.57
MW-141	MW-141-20	On-site	10/5/2001	Nov-2012	492.38	2.17	490.2	22.40	467.81	—	2.00	7.90	482.31	22.40	467.81	14.50	0.02	PVC	PVC	—	—	5.4	N	2.5	3927598.03	1427540.67
MW-142	MW-142-20	On-site	8/10/2001	Nov-2012	495.73	2.73	493.0	19.40	473.60	—	2.00	5.40	487.60	19.40	473.60	14.00	0.02	PVC	PVC	—	—	9.1	Y	-3.7	3927602.87	1428813.48
MW-143	MW-143-20	On-site	8/15/2005	Nov-2012	495.37	3.36	492.0	19.50	472.51	—	2.00	4.70	487.31	19.50	472.51	14.80	0.02	PVC	PVC	—	—	7.5	Y	-2.8	3927688.65	1428487.50
MW-144A	MW-144A-25	On-site	9/15/2005	Nov-2012	495.35	2.95	492.4	24.70	467.70	—	2.00	5.70	486.70	24.70	467.70	19.00	0.02	PVC	PVC	—	—	6.8	Y	-1.1	3927485.68	1429623.04
MW-144BR	MW-144BR-90	On-site	9/21/2011	Nov-2012	494.98	2.88	492.1	90.52	401.58	—	2.00	85.44	406.66	89.91	402.19	4.47	0.01	PVC	PVC	80.0	92.0	6.5	N	78.9	3927483.2	1429632.06
MW-145	MW-145-20	On-site	8/15/2005	Nov-2012	495.61	2.76	492.9	19.00	473.85	—	2.00	4.70	488.15	19.00	473.85	14.30	0.02	PVC	PVC	—	—	8.0	Y	-3.3	3927212.61	1429712.57
MW-146A	MW-146A-15	On-site	9/29/2008	Nov-2012	495.09	2.52	492.6	16.00	476.57	—	2.00	6.00	486.57	16.00	476.57	10.00	0.02	PVC	PVC	4.5	16.0	7.0	Y	-1.0	3927201.05	1427049.42
MW-146B	MW-146B-30	On-site	9/29/2008	Nov-2012	494.98	2.39	492.6	28.00	464.59	—	2.00	22.00	470.59	27.00	465.59	5.00	0.02	PVC	PVC	16.0	27.0	7.0	N	15.0	3927193.28	1427048.17
MW-147A	MW-147A-15	On-site	10/1/2008	Nov-2012	491.93	2.26	489.7	13.00	476.67	—	2.00	3.00	486.67	13.00	476.67	10.00	0.02	PVC	PVC	2.4	13.0	5.5	Y	-2.5	3927723.21	1427288.46
MW-147B	MW-147B-25	On-site	9/30/2008	Nov-2012	492.59	2.90	489.7	26.00	463.69	—	2.00	20.50	469.19	25.50	464.19	5.00	0.02	PVC	PVC	17.5	25.0	5.5	N	15.0	3927729.22	1427290.37
MW-148A	MW-148A-15	Off-site	10/2/2008	Sept-2013	493.07	2.17	490.9	15.00	475.90	—	2.00	5.00	485.90	15.00	475.90	10.00	0.02	PVC	PVC	4.0	15.0	6.9	Y	-1.9	3928675.03	1428153.49
MW-148B	MW-148B-30	Off-site	10/2/2008	Sept-2013	492.86	2.60	490.3	29.00	461.26	—	2.00	22.00	468.26	27.00	463.26	5.00	0.02	PVC	PVC	17.0	27.0	6.9	N	15.1	3928677.21	1428158.65
MW-148C	MW-148C-55	Off-site	9/27/2011	Sept-2013	493.33	2.74	490.6	55.74	434.85	—	2.00	50.72	439.87	55.15	435.44	4.43	0.01	PVC	PVC	45.0	56.0	9	N	41.7	3928670.73	1428140.18
MW-148D	MW-148D-150	Off-site	9/26/2011	Sept-2013	493.36	3.01	490.4	150.96	339.39	151.5	2.00	145.92	344.43	150.36	339.99	4.44	0.01	PVC	PVC	140.0	152.0	9	N	136.9	3928673.10	1428146.93
MW-148-100	MW-148-100	Off-site	10/3/2013	Oct-2013	493.04	2.72	490.1	100.40	389.74	100.0	2	95.38	3													

Table 3-1
Well Construction Parameters

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North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen							Riser Material	Filter Pack		WATER TABLE			ALASKA STATE PLANE NAD83, ZONE 3	
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)	Screen Slot Size (inches)	Material		Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NORTHING	EASTING
																				Natural pack						
MW-161-30	MW-161-30	Off-site	4/23/2013	Sept-2013	479.62	-0.51	479.8	30.19	449.64	—	2.00	25.18	454.65	29.73	450.10	4.55	0.01	PVC	PVC	3.8	16.5	7.5	Y	-2.0	3935553.69	1421673.97
MW-162A	MW-162A-15	Off-site	11/25/2009	Sept-2013	484.02	-0.47	484.5	15.60	468.89	—	2.00	5.50	478.99	15.20	469.29	9.70	0.02	PVC	PVC	3.8	16.5	7.5	Y	-2.0	3934831.10	1425571.90
MW-162B	MW-162B-65	Off-site	11/25/2009	Sept-2013	484.20	-0.22	484.4	65.38	419.04	67.5	2.00	60.18	424.24	64.73	419.69	4.55	0.01	PVC	PVC	50.0	66.5	7.5	Y	52.7	3934825.07	1425574.08
MW-163A	MW-163A-15	Off-site	12/9/2009	Nov-2012	485.02	-0.78	485.8	15.60	470.20	—	2.00	5.50	480.30	15.20	470.60	9.70	0.02	PVC	PVC	3.6	16.5	9.0	Y	-3.5	3935430.75	1426901.11
MW-163B	MW-163B-40	Off-site	9/13/2010	Nov-2012	484.80	-0.93	485.7	39.55	446.18	40.0	2.00	34.53	451.20	38.96	446.77	4.43	0.02	PVC	PVC	30.0	41.5	9.5	N	25.0	3935430.72	1426906.78
MW-164A	MW-164A-15	Off-site	12/10/2009	Sept-2013	480.09	-0.59	480.7	15.60	465.08	—	2.00	5.50	475.18	15.20	465.48	9.70	0.02	PVC	PVC	3.8	16.5	9.0	Y	-3.5	3938026.16	1425651.07
MW-164B	MW-164B-50	Off-site	9/9/2010	June-2013	479.85	-0.33	480.2	50.67	429.51	—	2.00	45.62	434.56	50.06	430.12	4.44	0.02	PVC	PVC	35.0	51.5	9.0	N	36.6	3938027.01	1425654.08
MW-164C	MW-164C-60	Off-site	8/17/2011	June-2013	479.90	-0.44	480.3	62.44	417.90	63.0	2.00	57.34	423.00	61.99	418.35	4.65	0.01	PVC	PVC	52.0	63.5	8.0	N	49.3	3938023.06	1425652.19
MW-165A	MW-165A-15	Off-site	1/18/2010	Nov-2012	474.79	-0.46	475.3	15.40	459.85	—	2.00	5.19	470.06	14.90	460.35	9.71	0.01	PVC	PVC	4.0	15.5	7.5	Y	-2.3	3938692.18	1416849.70
MW-165B	MW-165B-50	Off-site	9/28/2010	Nov-2012	474.64	-0.62	475.3	50.88	424.38	—	2.00	45.87	429.39	50.35	424.91	4.48	0.02	PVC	PVC	35.0	51.5	8.0	N	37.9	3938690.33	1416854.17
MW-166A	MW-166A-15	Off-site	1/8/2010	Sept-2013	475.08	2.38	472.7	15.60	457.10	—	2.00	5.44	467.26	15.15	457.55	9.71	0.01	PVC	PVC	4.0	16.0	7.5	Y	-2.1	3940972.27	1419512.27
MW-166B	MW-166B-30	Off-site	3/15/2010	July-2013	475.51	3.24	472.3	32.10	440.17	33.0	2.00	27.15	445.12	31.35	440.92	4.20	0.01	PVC	PVC	21.0	33.5	7.0	N	20.2	3940967.37	1419509.53
MW-167A	MW-167A-15	Off-site	1/7/2010	July-2013	475.70	-0.32	476.0	15.80	460.22	—	2.00	5.65	470.37	15.35	460.67	9.70	0.01	PVC	PVC	4.0	16.0	9.0	Y	-3.4	3942809.92	1423092.52
MW-167B	MW-167B-35	Off-site	3/23/2010	Nov-2012	475.57	-0.52	476.1	33.27	442.82	33.5	2.00	28.17	447.92	33.15	442.94	4.98	0.01	PVC	PVC	25.0	34.0	6.5	N	21.7	3942813.73	1423092.51
MW-168A	MW-168A-15	Off-site	1/8/2010	Mar-2013	478.25	-0.41	478.7	15.50	463.16	—	2.00	5.36	473.30	15.06	463.60	9.70	0.01	PVC	PVC	4.0	16.0	9.0	Y	-3.6	3941284.64	1425723.88
MW-168B	MW-168B-50	Off-site	10/1/2011	Nov-2012	478.34	-0.28	478.6	51.45	427.17	55.0	2.00	46.29	432.33	51.00	427.62	4.71	0.01	PVC	PVC	40.0	52.0	10.9	N	35.4	3941289.40	1425724.13
MW-169A	MW-169A-15	Off-site	2/25/2010	Sept-2013	486.12	2.94	483.2	15.15	468.03	—	2.00	5.27	477.91	15.06	468.12	9.79	0.01	PVC	PVC	4.0	15.5	8.0	Y	-2.7	3931955.69	1423035.08
MW-169B	MW-169B-50	Off-site	10/21/2010	Nov-2012	485.95	3.05	482.9	49.20	433.70	—	2.00	44.09	438.81	48.72	434.18	4.63	0.02	PVC	PVC	35.0	51.5	10.0	N	34.1	3931960.39	1423037.49
MW-169C	MW-169C-60	Off-site	9/1/2011	June-2013	482.52	-0.47	483.0	59.94	423.05	69.0	2.00	54.82	428.17	59.47	423.52	4.65	0.02	PVC	PVC	50.0	60.0	8.0	N	46.8	3931966.50	1423042.84
MW-170A	MW-170A-15	Off-site	2/24/2010	June-2013	490.69	-0.42	491.1	14.90	476.21	—	2.00	4.60	486.51	14.40	476.71	9.80	0.01	PVC	PVC	4.6	16.0	8.0	Y	-3.4	3930005.65	1429184.98
MW-170B	MW-170B-75	Off-site	3/6/2010	Nov-2012	490.74	-0.27	491.0	74.79	416.22	—	4.00	69.70	421.31	74.06	416.95	4.36	0.01	PVC	PVC	65.0	75.6	8.0	N	61.7	3930000.43	1429187.53
MW-170C	MW-170C-130	Off-site	3/4/2010	Sept-2013	490.84	-0.46	491.3	130.90	360.40	135.0	2.00	125.90	365.40	130.20	361.10	4.30	0.01	PVC	PVC	120.0	135.0	8.0	N	117.9	3929995.96	1429188.84
MW-170D	MW-170D-50	Off-site	10/13/2010	Nov-2012	490.41	-0.55	491.0	50.62	440.34	—	2.00	45.52	445.44	50.14	440.82	4.62	0.02	PVC	PVC	35.0	51.5	8.0	N	37.5	3929991.96	1429189.27
MW-171A	MW-171A-15	Off-site	2/25/2010	Sept-2013	484.89	-0.70	485.6	15.20	470.39	—	2.00	4.96	480.63	14.77	470.82	9.81	0.01	PVC	PVC	4.0	16.0	9.0	Y	-4.0	3935401.97	1428945.84
MW-171B	MW-171B-40	Off-site	3/16/2010	Nov-2012	484.83	-0.40	485.2	40.28	444.95	42.0	2.00	35.26	449.97	39.70	445.53	4.44	0.01	PVC	PVC	30.0	44.5	10.0	N	25.3	3935402.47	1428941.37
MW-172A	MW-172A-15	Off-site	3/24/2010	June-2013	475.67	-0.15	475.8	15.47	460.35	—	2.00	5.33	470.49	15.04	460.78	9.71	0.01	PVC	PVC	3.5	16.0	8.0	Y	-2.7	3942632.06	1427431.58
MW-172B	MW-172B-150	Off-site	3/27/2010	Sept-2013	475.78	-0.31	476.1	150.37	325.72	150.5	2.00	145.35	330.74	149.78	326.31	4.43	0.01	PVC	PVC	135.0	151.5	8.0	N	137.4	3942631.33	1427425.63
MW-173A	MW-173A-15	On-site	3/3/2010	Aug-2013	496.10	3.12	493.0	14.60	478.38	—	2.00	4.54	488.44	14.24	478.74	9.70	0.01	PVC	PVC	4.0	16.0	8.0	Y	-3.5	3927534.58	1430223.98
MW-173B	MW-173B-150	On-site	3/30/2010	Aug-2013	496.41	3.34	493.1	150.82	342.25	—	2.00	145.80	347.27	150.20	342.87	4.40	0.01	PVC	PVC	135.0	151.5	8.0	N	137.8	3927527.38	1430222.41
MW-174A	MW-174A-50	On-site	9/16/2010	Aug-2013	494.40	3.06	491.3	50.17	441.17	—	2.00	44.96	446.38	49.68	441.66	4.72	0.02	PVC	PVC	30.0	51.5	7.5	N	37.5	3926454.50	1428665.44
MW-174B	MW-174B-90	On-site	9/15/2010	Aug-2013	493.53	2.11	491.4	90.37	401.05	—	2.00	85.16	406.26	89.88	401.54	4.72	0.02	PVC	PVC	70.0	91.5	7.5	N	77.7	3926461.30	1428664.22
MW-174-15	MW-174-15	On-site	3/16/2013	Aug-2013	494.66	3.33	491.3	13.62	477.71	—	2.00	3.22	488.11	13.02	478.31	9.80	0.01	PVC	PVC	3.2	13.6	8.5	Y	-5.3	3926469.65	1428666.66
MW-175	MW-175-90	On-site	9/30/2010	Sept-2013	497.09	3.31	493.8	90.82	402.96	—	2.00	85.81	407.97	90.30	403.48	4.49	0.02	PVC	PVC	75.0	91.5	8.0	N	77.8	3926774.40	1429593.36
MW-176A	MW-176A-15	On-site	10/4/2010	Nov-2012	497.02	3.20	493.8	14.83	478.99	—	2.00	4.67	489.15	14.42	479.40	9.75	0.02	PVC	PVC	4.0	16.5	9.5	Y	-4.8	3926055.80	1429416.30
MW-176B	MW-176B-50	On-site	10/4/2010	Nov-2012	496.93	3.21	493.7	50.61	443.11	—	2.00	45.56	448.16	50.06	443.66	4.50	0.02	PVC	PVC	35.0	51.5	9.5	N	36.1	3926056.30	1429412.03
MW-176C	MW-176C-90	On-site	10/1/2010	Nov-2012	496.86	3.15	493.7	90.49	403.22	—	2.00	85.43	408.28	89.93	403.78	4.50	0.02	PVC	PVC	75.0	91.5	9.5	N	75.9	3926056.80	1429407.76
MW-177	MW-177-90	On-site	9/22/2010	Nov-2012	497.92	3.01	494.9	89.71	405.20	—	2.00	84.71	410.20	89.19	405.72	4.48	0.02	PVC	PVC	70.0	91.5	7.5	N	77.2	3925072.46	1430037.88
MW-178A	MW-178A-15	On-site	9/18/2010	Nov-2012	496.48	2.32	494.2	16.06	478.10	—	2.00	5.90	488.26	15.64	478.52	9.74	0.02	PVC	PVC	3.0	16.5	7.0	Y	-1.1	3926117.29	1429586.63
MW-178B	MW-178B-50	On-site	9/18/2010	Nov-2012	496.10	2.19	493.9	51.17	442.74	—	2.00	46.01	447.90	50.73	443.18	4.72	0.02	PVC	PVC	40.0	51.5	7.5	N	38.5	3926117.08	1429579.97
MW-178C	MW-178C-90	On-site	9/17/2010	Nov-2012	497.27	3.03	494.2	90.15	404.09	—	2.00	85.16	409.08	89.93	404.31	4.77	0.02	PVC	PVC	75.0	91.5	7.5	N	77.7	3926117.30	1429575.58
MW-179A	MW-179A-15	On-site	9/21/2010	Aug-2013	496.96	3.05	493.9	15.61	478.30	—	2.00	5.56	488.35	15.20	478.71	9.64	0.02	PVC	PVC	5.0	16.5	8.0	Y	-2.4	3926050.54	1429676.64
MW-179B	MW-179B-50	On-site	9/21/2010	Aug-2013	496.75	2.68	494.1	50.82	443.25	—	2.00	45.80	448.27	50.29	443.78	4.49	0.02	PVC	PVC	40.0	51.5	8.0	N	37.8	3926047.16	1429680.75
MW-179C	MW-179C-90	On-site	9/20/2010	Aug-2013	497.26	2.85	494.4	90.43	403.98	—	2.00	85.41	409.00	89.90	404.51	4.49	0.02	PVC	PVC	75.0	91.5	8.5	N	76.9	3926045.58	1429674.43
MW-179D	MW-179D-135	On-site																								

Table 3-1
Well Construction Parameters
Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen						Riser Material	Filter Pack		WATER TABLE			ALASKA STATE PLANE		
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)	Screen Slot Size (inches)		Material	Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NAD83, ZONE 3	
																									NORTHING	EASTING
MW-193A	MW-193A-15	Off-site	8/30/2011	Nov-2012	487.70	-0.43	488.1	15.68	472.45	—	2.00	5.00	483.13	15.50	472.63	10.50	0.02	PVC	PVC	5.0	15.5	6.8	Y	-1.8	3930483.21	1424590.71
MW-193B	MW-193B-60	Off-site	8/30/2011	Nov-2012	487.40	-0.61	488.0	59.88	428.13	61.0	2.00	54.72	433.29	59.41	428.60	4.69	0.02	PVC	PVC	45.0	60.0	6.5	N	48.2	3930481.25	1424593.75
MW-194A	MW-194A-15	Off-site	8/31/2011	July-2013	475.58	-0.72	476.3	15.76	460.54	—	2.00	6.00	470.30	15.36	460.94	9.36	0.02	PVC	PVC	4.0	15.0	6.5	Y	-0.5	3939634.55	1418923.90
MW-194B	MW-194B-40	Off-site	8/31/2011	July-2013	475.58	-0.72	476.3	39.45	436.85	39.0	2.00	34.38	441.92	38.96	437.34	4.58	0.02	PVC	PVC	24.0	40.0	6.5	N	27.9	3939630.80	1418924.87
MW-195A	MW-195A-15	On-site	10/11/2011	Nov-2012	496.10	2.76	493.3	15.35	477.99	—	2.00	5.15	488.19	14.95	478.39	9.80	0.01	PVC	PVC	4.0	16.0	8.0	Y	-2.9	3926110.91	1428572.63
MW-195B	MW-195B-150	On-site	12/5/2011	Nov-2012	496.12	2.66	493.5	149.90	343.56	—	2.00	144.80	348.66	149.50	343.96	4.70	0.01	PVC	PVC	130.0	149.9	8.0	N	136.8	3926110.92	1428566.32
MW-196	MW-196-15	On-site	10/11/2011	Nov-2012	497.37	3.31	494.1	15.20	478.86	—	2.00	5.01	489.05	14.73	479.33	9.72	0.01	PVC	PVC	4.0	16.5	7.5	Y	-2.5	3925033.44	1429646.49
MW-197A	MW-197A-65	On-site	6/6/2012	Sept-2013	495.27	2.57	492.7	66.06	426.64	—	2.00	61.09	431.61	65.74	426.96	4.65	0.01	PVC	PVC	Natural pack	7.0	N	54.1	3926959.84	1429490.28	
MW-197B	MW-197B-150	On-site	10/16/2011	Sept-2013	495.30	2.57	492.7	149.69	343.04	—	2.00	144.61	348.12	149.08	343.65	4.47	0.01	PVC	PVC	135.0	152.0	9.0	N	135.6	3926950.83	1429491.74
MW-198	MW-198-150	On-site	12/10/2011	Nov-2012	493.32	-0.28	493.6	149.81	343.79	—	2.00	144.73	348.87	149.38	344.22	4.65	0.01	PVC	PVC	135.0	150.0	8.0	N	136.7	3925820.02	1429027.70
MW-199	MW-199-150	On-site	12/2/2011	Sept-2013	495.90	2.61	493.3	149.83	343.46	—	2.00	144.65	348.64	149.44	343.85	4.79	0.01	PVC	PVC	140.0	151.5	9.0	N	135.7	3926959.18	1428830.82
MW-300	MW-300-150	On-site	12/6/2011	Nov-2012	496.00	1.94	494.1	150.30	343.76	—	2.00	145.00	349.06	149.70	344.36	4.65	0.01	PVC	PVC	130.0	150.3	9.0	N	136.0	3926139.62	1429895.14
MW-301-60	MW-301-60	On-site	10/26/2011	Sept-2013	492.61	3.12	489.5	60.85	428.64	—	2.00	55.61	433.88	60.26	429.23	4.65	0.01	PVC	PVC	50.0	62.0	5.0	N	50.6	3927435.06	1427867.56
MW-301-70	MW-301-70	On-site	10/9/2011	Sept-2013	492.65	3.05	489.6	70.75	418.85	71.5	2.00	65.70	423.90	70.14	419.46	4.44	0.01	PVC	PVC	60.0	70.0	5.0	N	60.7	3927422.66	1427894.40
MW-301-CMT-10	MW-301-CMT-10	On-site	10/26/2011	Nov-2012	492.88	3.44	489.4	10.00	479.44	—	2.00	9.87	479.57	10.13	479.31	0.25	CMT	PVC	PVC	8.0	12.0	5.0	N	4.9	3927444.5	1427850.40
MW-301-CMT-20	MW-301-CMT-20	On-site	10/26/2011	Nov-2012	492.88	3.44	489.4	20.00	469.44	—	2.00	19.87	469.57	20.13	469.31	0.25	CMT	PVC	PVC	18.0	22.0	5.0	N	14.9	3927444.5	1427850.40
MW-301-CMT-30	MW-301-CMT-30	On-site	10/26/2011	Nov-2012	492.88	3.44	489.4	30.00	459.44	—	2.00	29.87	459.57	30.13	459.31	0.25	CMT	PVC	PVC	28.0	32.0	5.0	N	24.9	3927444.5	1427850.40
MW-301-CMT-40	MW-301-CMT-40	On-site	10/26/2011	Nov-2012	492.88	3.44	489.4	40.00	449.44	—	2.00	39.87	449.57	40.13	449.31	0.25	CMT	PVC	PVC	38.0	42.0	5.0	N	34.9	3927444.5	1427850.40
MW-301-CMT-50	MW-301-CMT-50	On-site	10/26/2011	Nov-2012	492.88	3.44	489.4	50.00	439.44	—	2.00	49.87	439.57	50.13	439.31	0.25	CMT	PVC	PVC	48.0	52.0	5.0	N	44.9	3927444.5	1427850.40
MW-302-110	MW-302-110	On-site	10/17/2011	Nov-2012	493.65	2.96	490.7	110.18	380.51	110.0	2.00	105.11	385.58	109.58	381.11	4.47	0.01	PVC	PVC	95.0	110.5	9.0	N	96.1	3927616.89	1428196.81
MW-302-70	MW-302-70	On-site	11/5/2011	Nov-2012	493.29	3.02	490.3	70.87	419.40	—	2.00	65.75	424.52	70.40	419.87	4.65	0.01	PVC	PVC	60.0	71.0	9.0	N	56.8	3927612.39	1428219.37
MW-302-80	MW-302-80	On-site	11/3/2011	Nov-2012	493.49	3.04	490.5	81.45	409.00	—	2.00	76.33	414.12	80.98	409.47	4.65	0.01	PVC	PVC	70.0	81.5	9.0	N	67.3	3927614.39	1428208.27
MW-302-95	MW-302-95	On-site	10/25/2011	Nov-2012	493.00	2.72	490.3	95.20	395.08	—	2.00	90.15	400.13	94.81	395.47	4.66	0.01	PVC	PVC	Natural pack	9.0	N	81.2	3927608.27	1428231.29	
MW-302-CMT-10	MW-302-CMT-10	On-site	10/25/2011	Nov-2012	494.32	3.58	490.7	10.00	480.74	—	2.00	9.87	480.87	10.13	480.61	0.25	CMT	PVC	PVC	8.0	12.0	5.0	N	4.9	3927605.7	1428194.16
MW-302-CMT-20	MW-302-CMT-20	On-site	10/25/2011	Nov-2012	494.32	3.58	490.7	20.00	470.74	—	2.00	19.87	470.87	20.13	470.61	0.25	CMT	PVC	PVC	18.0	22.0	5.0	N	14.9	3927605.7	1428194.16
MW-302-CMT-30	MW-302-CMT-30	On-site	10/25/2011	Nov-2012	494.32	3.58	490.7	30.00	460.74	—	2.00	29.87	460.87	30.13	460.61	0.25	CMT	PVC	PVC	28.0	32.0	5.0	N	24.9	3927605.7	1428194.16
MW-302-CMT-40	MW-302-CMT-40	On-site	10/25/2011	Nov-2012	494.32	3.58	490.7	40.00	450.74	—	2.00	39.87	450.87	40.13	450.61	0.25	CMT	PVC	PVC	38.0	41.5	5.0	N	34.9	3927605.7	1428194.16
MW-302-CMT-50	MW-302-CMT-50	On-site	10/25/2011	Nov-2012	494.32	3.58	490.7	50.00	440.74	—	2.00	49.87	440.87	50.13	440.61	0.25	CMT	PVC	PVC	47.0	50.5	5.0	N	44.9	3927605.7	1428194.16
MW-303-130	MW-303-130	On-site	10/18/2011	Nov-2012	495.15	3.16	492.0	130.70	361.29	130.0	2.00	125.60	366.39	130.23	361.76	4.63	0.01	PVC	PVC	115.0	131.0	9.0	N	116.6	3927682.57	1428479.64
MW-303-70	MW-303-70	On-site	11/1/2011	Nov-2012	495.06	2.87	492.2	70.44	421.75	—	2.00	65.24	426.95	70.04	422.15	4.80	0.01	PVC	PVC	60.0	70.5	9.0	N	56.2	3927668.05	1428484.37
MW-303-80	MW-303-80	On-site	11/2/2011	Nov-2012	495.12	2.92	492.2	80.73	411.47	—	2.00	75.54	416.66	80.33	411.87	4.79	0.01	PVC	PVC	70.0	81.0	9.0	N	66.5	3927660.37	1428485.11
MW-303-95	MW-303-95	On-site	4/17/2012	Nov-2012	495.12	3.12	492.0	95.18	396.82	—	2.00	90.13	401.87	94.78	397.22	4.65	0.01	PVC	PVC	Natural pack	9.0	N	81.1	3927651.67	1428487.31	
MW-303-CMT-19	MW-303-CMT-19	On-site	10/20/2011	Nov-2012	495.85	3.55	492.3	19.00	473.30	—	2.00	18.87	473.43	19.13	473.17	0.25	CMT	PVC	PVC	17.0	21.0	4.0	N	14.9	3927676.0	1428481.84
MW-303-CMT-29	MW-303-CMT-29	On-site	10/20/2011	Nov-2012	495.85	3.55	492.3	29.00	463.30	—	2.00	28.87	463.43	29.13	463.17	0.25	CMT	PVC	PVC	27.0	31.0	4.0	N	24.9	3927676.0	1428481.84
MW-303-CMT-39	MW-303-CMT-39	On-site	10/20/2011	Nov-2012	495.85	3.55	492.3	39.00	453.30	—	2.00	38.87	453.43	39.13	453.17	0.25	CMT	PVC	PVC	37.0	41.0	4.0	N	34.9	3927676.0	1428481.84
MW-303-CMT-49	MW-303-CMT-49	On-site	10/20/2011	Nov-2012	495.85	3.55	492.3	49.00	443.30	—	2.00	48.87	443.43	49.13	443.17	0.25	CMT	PVC	PVC	47.0	51.0	4.0	N	44.9	3927676.0	1428481.84
MW-303-CMT-59	MW-303-CMT-59	On-site	10/20/2011	Nov-2012	495.85	3.55	492.3	59.00	433.30	—	2.00	58.87	433.43	59.13	433.17	0.25	CMT	PVC	PVC	57.0	59.5	4.0	N	54.9	3927676.0	1428481.84
MW-303-CMT-9	MW-303-CMT-9	On-site	10/20/2011	Nov-2012	495.85	3.55	492.3	9.00	483.30	—	2.00	8.87	483.43	9.13	483.17	0.25	CMT	PVC	PVC	7.0	11.0	4.0	N	4.9	3927676.0	1428481.84
MW-304-125	MW-304-125	On-site	10/14/2011	Sept-2013	497.31	3.58	493.7	125.92	367.81	—	2.00	120.89	372.84	125.32	368.41	4.43	0.01	PVC	PVC	115.0	126.0	10.5	N	110.4	3927730.33	1428833.79
MW-304-15	MW-304-15	On-site	4/18/2012	Sept-2013	496.97	3.36	493.6	18.17	475.44	—	2.00	8.02	485.59	17.83	475.78	9.81	0.01	PVC	PVC	3.4	18.7	10.5	Y	-2.5	3927723.82	1428828.03
MW-304-150	MW-304-150	On-site	10/14/2011	Sept-2013	497.16	3.07	494.1	150.65	343.44	—	2.00	145.53	348.56	150.18	343.91	4.65	0.01	PVC	PVC	135.0	150.0	10.5	N	135.1	3927769.24	1428870.53
MW-304-70	MW-304-70	On-site	10/20/2011	Nov-2012	496.99	2.75	494.2	70.66	423.58	—	2.00	65.54	428.70	70.20	424.04	4.66	0.01	PVC	PVC	58.0	71.0	10.5	N	55.1	3927751.83	1428854.08
MW-304-80	MW-304-80	On-site	10/31/2011	Sept-2013	496.72	2.69	494.0	81.14	412.89	—	2.00	76.02	418.01	80.67	413.36	4.65	0.01	PVC	PVC	71.5	81.5	10.5	N	65.6	3927740.60	1428843.75
MW-304-96	MW-304-96	On-site	4/18/2012	Nov-20																						

Table 3-1

Well Construction Parameters

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen							Riser Material	Filter Pack		WATER TABLE			ALASKA STATE PLANE NAD83, ZONE 3	
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)	Screen Slot Size (inches)	Material		Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NORTHING	EASTING
MW-310-110	MW-310-110	On-site	5/29/2012	Aug-2013	494.28	3.33	491.0	110.42	380.53	—	2.00	105.28	385.67	109.94	381.01	4.66	0.01	PVC	PVC			6.0	N	99.3	3926802.76	1428044.57
MW-310-15	MW-310-15	On-site	4/26/2012	Aug-2013	494.26	3.01	491.3	14.72	476.53	—	2.00	4.58	486.67	14.38	476.87	9.80	0.01	PVC	PVC			6.0	Y	-1.4	3926810.88	1428028.92
MW-310-65	MW-310-65	On-site	4/20/2012	Nov-2012	494.38	3.00	491.4	65.53	425.85	—	2.00	60.47	430.91	65.13	426.25	4.66	0.01	PVC	PVC	Natural pack		6.0	N	54.5	3926805.71	1428036.73
MW-311-15	MW-311-15	Off-site	4/26/2012	Aug-2013	466.78	-0.50	467.3	15.43	451.85	—	2.00	5.24	462.04	15.04	452.24	9.80	0.01	PVC	PVC			4.5	N	0.7	3946536.13	1415602.20
MW-311-46	MW-311-46	Off-site	4/28/2012	Aug-2013	466.96	-0.14	467.1	45.74	421.36	48.0	2.00	40.60	426.50	45.26	421.84	4.66	0.01	PVC	PVC	Natural pack		4.5	N	36.1	3946534.99	1415612.86
MW-312-15	MW-312-15	Off-site	4/26/2012	Aug-2013	464.30	-0.28	464.6	15.52	449.06	—	2.00	5.34	459.24	15.13	449.45	9.79	0.01	PVC	PVC			5.7	Y	-0.4	3951394.25	1415642.38
MW-312-50	MW-312-50	Off-site	5/2/2012	Aug-2013	464.25	-0.39	464.6	50.36	414.28	50.0	2.00	44.90	419.74	49.56	415.08	4.66	0.01	PVC	PVC	Natural pack		7.0	N	37.9	3951399.72	1415642.19
MW-313-15	MW-313-15	Off-site	4/30/2012	Nov-2012	465.79	-0.43	466.2	15.18	451.04	—	2.00	4.99	461.23	14.79	451.43	9.80	0.01	PVC	PVC			9.5	Y	-4.5	3951374.78	1423235.06
MW-313-150	MW-313-150	Off-site	5/8/2012	Nov-2012	465.88	-0.29	466.2	149.94	316.23	—	2.00	144.69	321.48	149.34	316.83	4.65	0.01	PVC	PVC	Natural pack		9.5	N	135.2	3951370.40	1423237.65
MW-314-15	MW-314-15	Off-site	4/30/2012	Nov-2012	476.29	-0.29	476.6	15.56	461.02	—	2.00	5.38	471.20	15.16	461.42	9.78	0.01	PVC	PVC			7.0	Y	-1.6	3943869.90	1427115.02
MW-314-150	MW-314-150	Off-site	5/11/2012	Nov-2012	476.12	-0.33	476.5	150.51	325.94	—	2.00	145.31	331.14	150.13	326.32	4.82	0.01	PVC	PVC	Natural pack		7.0	N	138.3	3943874.84	1427119.27
MW-315-15	MW-315-15	Off-site	5/1/2012	Nov-2012	458.44	-0.74	459.2	15.83	443.35	—	2.00	5.70	453.48	15.49	443.69	9.79	0.01	PVC	PVC			7.0	Y	-1.3	3949804.15	1403467.06
MW-315-150	MW-315-150	Off-site	5/2/2012	Nov-2012	458.96	-0.41	459.4	150.63	308.74	—	2.00	145.58	313.79	150.23	309.14	4.65	0.01	PVC	PVC	Natural pack		7.0	N	138.6	3949809.75	1403467.06
MW-316-15	MW-316-15	Off-site	5/1/2012	Nov-2012	486.34	-0.29	486.6	15.67	470.96	—	2.00	5.46	481.17	15.26	471.37	9.80	0.01	PVC	PVC			7.0	Y	-1.5	3932950.20	1428372.65
MW-316-56	MW-316-56	Off-site	5/16/2012	Nov-2012	486.15	-0.48	486.6	56.00	430.63	57.0	2.00	50.95	435.68	55.59	431.04	4.64	0.01	PVC	PVC	Natural pack		7.0	N	44.0	3932950.03	1428377.41
MW-317-15	MW-317-15	Off-site	5/3/2012	Nov-2012	488.86	-0.44	489.3	15.66	473.64	—	2.00	5.46	483.84	15.25	474.05	9.79	0.01	PVC	PVC			9.0	Y	-3.5	3930184.86	1428701.63
MW-317-71	MW-317-71	Off-site	5/21/2012	Nov-2012	488.79	-0.56	489.4	71.23	418.12	—	2.00	66.10	423.25	70.73	418.62	4.63	0.01	PVC	PVC	Natural pack		9.0	N	57.1	3930185.90	1428666.62
MW-318-20	MW-318-20	Off-site	5/3/2012	Sept-2013	493.05	2.98	490.1	20.48	469.59	—	2.00	10.29	479.78	20.08	469.99	9.79	0.01	PVC	PVC			10.0	Y	0.3	3928866.23	1424726.43
MW-318-135	MW-318-135	Off-site	5/10/2012	Sept-2013	493.10	3.29	489.8	135.29	354.52	—	2.00	130.15	359.66	134.80	355.01	4.65	0.01	PVC	PVC	Natural pack		7.0	N	123.2	3928883.99	1424703.15
MW-319-15	MW-319-15	Off-site	5/4/2012	Nov-2012	456.10	-0.35	456.5	15.28	441.17	—	2.00	5.08	451.37	14.89	441.56	9.81	0.01	PVC	PVC			7.0	Y	-1.9	3953109.18	1404197.93
MW-319-45	MW-319-45	Off-site	5/7/2012	Nov-2012	455.96	-0.69	456.7	45.52	411.13	45.5	2.00	40.44	416.21	45.10	411.55	4.66	0.01	PVC	PVC	Natural pack		7.0	N	33.4	3953109.18	1404192.73
MW-320-130	MW-320-130	Off-site	5/9/2012	Mar-2013	450.96	-0.53	451.5	131.38	320.11	—	2.00	126.32	325.17	130.97	320.52	4.65	0.01	PVC	PVC	Natural pack		10.0	N	116.3	3963539.90	1402678.14
MW-320-20	MW-320-20	Off-site	5/4/2012	Mar-2013	450.89	-0.31	451.2	20.15	431.05	—	2.00	9.96	441.24	19.76	431.44	9.80	0.01	PVC	PVC			10.2	Y	-0.2	3963542.54	1402682.33
MW-321-15	MW-321-15	On-site	5/5/2012	Nov-2012	495.59	2.74	492.9	15.77	477.08	—	2.00	5.62	487.23	15.41	477.44	9.79	0.01	PVC	PVC			7.0	Y	-1.4	3926256.76	1428855.78
MW-321-151	MW-321-151	On-site	5/26/2012	Nov-2012	495.13	2.20	492.9	150.54	342.39	—	2.00	145.41	347.52	150.06	342.87	4.65	0.01	PVC	PVC	Natural pack		7.0	N	138.4	3926273.73	1428856.06
MW-321-65	MW-321-65	On-site	5/5/2012	Nov-2012	495.26	2.44	492.8	66.04	426.78	—	2.00	60.89	431.93	65.55	427.27	4.66	0.01	PVC	PVC	Natural pack		7.0	N	53.9	3926265.14	1428856.30
MW-322-15	MW-322-15	Off-site	5/8/2012	June-2013	472.14	2.77	469.4	15.73	453.64	—	2.00	5.55	463.82	15.34	454.03	9.79	0.01	PVC	PVC			7.0	Y	-1.5	3940670.73	1410082.02
MW-322-150	MW-322-150	Off-site	10/9/2012	June-2013	472.04	2.65	469.4	151.07	318.32	—	2.00	145.94	323.45	150.59	318.80	4.65	0.01	PVC	PVC	Natural pack		7.0	N	138.9	3940646.94	1410074.03
MW-323-15	MW-323-15	Off-site	5/7/2012	Nov-2012	485.27	3.01	482.3	15.55	466.71	—	2.00	5.42	476.84	15.21	467.05	9.79	0.01	PVC	PVC			7.0	Y	-1.6	3931840.58	1422094.72
MW-323-50	MW-323-50	Off-site	10/8/2012	Sept-2013	484.76	2.58	482.2	49.93	432.25	55.0	2.00	44.90	437.28	49.46	432.72	4.56	0.01	PVC	PVC	Natural pack		7.0	N	37.9	3931846.38	1422088.29
MW-324-15	MW-324-15	Off-site	5/8/2012	Nov-2012	463.41	-0.37	463.8	15.35	448.43	—	2.00	5.17	458.61	14.96	448.82	9.79	0.01	PVC	PVC			7.0	Y	-1.8	3945444.19	1404965.19
MW-324-151	MW-324-151	Off-site	5/23/2012	Nov-2012	462.90	-0.70	463.6	150.92	312.68	—	2.00	145.78	317.82	150.44	313.16	4.66	0.01	PVC	PVC	Natural pack		7.0	N	138.8	3945446.0	1404958.62
MW-325-150	MW-325-150	Off-site	5/14/2012	Mar-2013	486.85	-0.60	487.5	150.54	336.91	—	2.00	145.48	341.97	150.13	337.32	4.65	0.01	PVC	PVC	Natural pack		12.0	N	133.5	3937085.15	1430633.64
MW-325-18	MW-325-18	Off-site	5/18/2012	Mar-2013	486.13	-0.81	486.9	18.68	468.26	—	2.00	8.53	478.41	18.33	468.61	9.80	0.01	PVC	PVC			12.0	Y	-3.5	3937079.28	1430639.29
MW-326-150	MW-326-150	Off-site	5/15/2012	June-2013	500.48	3.09	497.4	150.51	346.88	—	2.00	145.45	351.94	150.10	347.29	4.65	0.01	PVC	PVC	Natural pack		7.0	N	138.5	3921145.09	1430276.63
MW-326-20	MW-326-20	Off-site	6/8/2012	June-2013	500.57	3.20	497.4	20.75	476.62	—	2.00	10.61	486.76	20.40	476.97	9.79	0.01	PVC	PVC			7.0	N	3.6	3921150.73	1430277.63
MW-327-15	MW-327-15	Off-site	5/21/2012	Nov-2012	467.82	-0.25	468.1	15.40	452.67	—	2.00	5.21	462.86	15.01	453.06	9.80	0.01	PVC	PVC			7.0	Y	-1.8	3951301.83	1420336.90
MW-327-150	MW-327-150	Off-site	5/19/2012	Nov-2012	467.61	-0.44	468.1	150.92	317.13	—	2.00	145.79	322.26	150.44	317.61	4.65	0.01	PVC	PVC	Natural pack		7.0	N	138.8	3951297.90	1420342.92
MW-328-15	MW-328-15	Off-site	5/21/2012	Mar-2013	472.35	-0.63	473.0	15.77	457.21	—	2.00	5.83	467.15	15.33	457.65	9.50	0.01	PVC	PVC			8.5	Y	-2.7	3945516.60	1422777.24
MW-328-151	MW-328-151	Off-site	5/24/2012	Mar-2013	472.67	-0.52	473.2	150.66	322.53	—	2.00	145.58	327.61	150.25	322.94	4.67	0.01	PVC	PVC	Natural pack		8.5	N	137.1	3945525.83	1422876.28
MW-329-15	MW-329-15	Off-site	4/10/2012	Nov-2012	482.91	2.93	480.0	14.82	465.16	—	2.00	5.40	474.58	14.34	465.64	8.94	0.01	PVC	PVC			7.0	Y	-1.6	3937284.38	1421278.22
MW-329-66	MW-329-66	Off-site	5/22/2012	Nov-2012	479.23	-0.47	479.7	65.67	414.03	67.0	2.00	60.53	419.17	65.19	414.51	4.66	0.01	PVC	PVC	Natural pack		7.0	N	53.5	3937283.6	1421283.36
MW-330-150	MW-330-150	On-site	6/2/2012	Nov-2012	499.65	2.40	497.3	150.42	346.83	—	2.00	145.36	351.89	150.02	347.23	4.66	0.01	PVC	PVC	Natural pack		12.0	N	133.4	3926206.19	1428288.44
MW-330-20	MW-330-20	On-site	6/4/2012	Nov-2012	500.03	2.73	497.3	19.62	477.68	—	2.00	9.46	487.84	19.21	478.09	9.75	0.01	PVC	PVC			12.0	Y	-2.5	3926218.84	1428281.49
MW-330-65	MW-330-65	On-site</																								

Table 3-1
Well Construction Parameters
Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen						Riser Material	Filter Pack		WATER TABLE			ALASKA STATE PLANE		
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)	Screen Slot Size (inches)		Material	Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NAD83, ZONE 3	
MW-344-55	MW-344-55	On-site	10/10/2013	Nov-2013	493.93	2.90	490.9	56.63	434.27	—	2.00	51.60	439.30	56.15	434.75	4.55	0.01	PVC	PVC	45	56.63	5.5	N	46.10	3926967.82	1428697.9
MW-344-75	MW-344-75	On-site	10/9/2013	Nov-2013	493.35	2.64	490.71	75.65	415.06	—	2.00	70.79	419.92	75.34	415.37	4.55	0.01	PVC	PVC	65	75.65	5.5	N	65.29	3926970.71	1428702.91
MW-345-15	MW-345-15	On-site	7/26/2013	Sept-2013	495.48	3.34	492.7	15.67	477.03	—	2.00	5.77	486.93	15.34	477.36	9.57	0.01	PVC	PVC	4	15.0	7.0	Y	N/A	3927056.25	1428877.68
MW-345-55	MW-345-55	On-site	10/10/2013	Nov-2013	495.99	3.15	492.75	55.43	437.32	—	2.00	50.34	442.41	54.87	437.88	4.53	0.01	PVC	PVC	44	55.43	8.0	N	42.34	3927055.97	1428883.16
MW-345-75	MW-345-75	On-site	10/11/2013	Nov-2013	495.62	2.78	492.75	75.56	417.19	—	2.00	70.98	421.77	75.00	417.75	4.02	0.01	PVC	PVC	64	75	8.0	N	62.98	3927061.21	1428881.21
MW-346-15	MW-346-15	Off-site	7/31/2013	Sept-2013	473.12	-0.22	473.2	15.48	457.74	—	2.00	5.37	467.85	15.00	458.22	9.63	0.01	PVC	PVC	3.0	15.5	5.7	Y	N/A	3943140.80	1425712.83
MW-346-150	MW-346-150	Off-site	7/30/2013	Sept-2013	472.69	-0.38	473.2	149.28	323.92	—	2.00	144.17	329.03	148.73	324.47	4.56	0.01	PVC	PVC	Natural pack		4.5	N	139.67	3943135.64	1425713.20
MW-346-65	MW-346-65	Off-site	8/1/2013	Sept-2013	472.71	-0.37	473.1	64.71	408.39	—	2.00	59.60	413.50	64.16	408.94	4.56	0.01	PVC	PVC	Natural pack		5.8	N	53.80	3943130.73	1425713.68
MW-347-150	MW-347-150	Off-site	8/5/2013	Sept-2013	482.58	-0.43	483.1	151.52	331.56	—	2.00	146.48	336.60	151.05	332.03	4.57	0.01	PVC	PVC	Natural pack		9.5	N	136.98	3939728.75	1428360.93
MW-347-20	MW-347-20	Off-site	9/3/2013	Sept-2013	482.93	-0.30	483.5	20.40	463.10	—	2.00	10.20	473.30	19.80	463.70	9.60	0.01	PVC	PVC	7.6	20.4	12.0	Y	N/A	3939722.42	1428356.90
MW-347-65	MW-347-65	Off-site	9/3/2013	Sept-2013	481.79	-0.30	483.1	65.20	417.93	—	2.00	60.20	422.93	64.80	418.33	4.60	0.01	PVC	PVC	Natural pack		12.0	N	48.20	3939728.76	1428364.88
MW-348-15	MW-348-15	On-site	8/8/2013	Nov-2013	493.74	-0.45	494.2	15.46	478.72	—	2.00	5.30	488.88	15.11	479.07	9.81	0.01	PVC	PVC	3.0	15.0	7.3	Y	N/A	3926037.27	1429537.47
MW-348-65	MW-348-65	On-site	8/7/2013	Nov-2013	493.89	-0.42	494.3	64.32	429.98	—	2.00	59.20	435.10	63.77	430.53	4.57	0.01	PVC	PVC	Natural pack		7.0	N	52.20	3926043.62	1429537.42
MW-349-15	MW-349-15	Off-site	8/12/2013	Aug-2013	484.58	-0.33	484.9	15.04	469.88	—	2.00	4.98	479.94	14.60	470.32	9.62	0.01	PVC	PVC	3.6	15.0	6.0	Y	N/A	3933772.41	1426241.57
MW-349-45	MW-349-45	Off-site	8/12/2013	Aug-2013	484.46	-0.42	484.9	45.50	439.35	46.5	2.00	40.40	444.45	44.95	439.90	4.55	0.01	PVC	PVC	35.0	45.5	6.0	N	34.40	3933774.54	1426236.89
MW-350-15	MW-350-15	Off-site	8/18/2013	Sept-2013	483.64	-0.77	484.4	16.04	468.34	—	2.00	5.86	478.52	15.48	468.90	9.62	0.01	PVC	PVC	3.0	15.0	7.0	Y	N/A	3936446.66	1426044.58
MW-350-50	MW-350-50	Off-site	8/18/2013	Sept-2013	483.98	-0.32	484.2	47.06	437.18	50.0	2.00	42.12	442.12	46.67	437.57	4.55	0.01	PVC	PVC	Natural pack		7.0	N	35.12	3936444.80	1426049.18
MW-351-150	MW-351-150	On-site	10/14/2013	Nov-2013	493.76	3.04	490.62	150.83	339.79	—	2.00	145.74	344.88	150.25	340.37	4.51	0.01	PVC	PVC	139	150.83	8.3	N	137.44	3927226.08	1428320.28
MW-351-15	MW-351-15	On-site	10/17/2013	Nov-2013	493.42	3.10	490.47	15.48	474.99	—	2.00	5.32	485.15	15.08	475.39	9.76	0.01	PVC	PVC	4	15.48	6.3	Y	-0.98	3927232.35	1428305.33
MW-351-55	MW-351-55	On-site	10/15/2013	Nov-2013	493.57	3.13	490.35	55.68	434.67	—	2.00	50.60	439.75	55.12	435.23	4.52	0.01	PVC	PVC	44	55.68	8.3	N	42.30	3927228.1	1428314.81
MW-351-75	MW-351-75	On-site	10/16/2013	Nov-2013	493.44	3.13	490.34	76.39	413.95	—	2.00	71.39	418.95	75.91	414.43	4.52	0.01	PVC	PVC	64	75	6.30	N	65.09	3927230.22	1428309.94
MW-352-15	MW-352-15	Off-site	9/1/2013	Sept-2013	474.76	-0.40	475.1	15.59	459.51	—	2.00	5.52	469.58	15.17	459.93	9.65	0.01	PVC	PVC	2.4	15.6	9.0	Y	N/A	3943661.73	1423829.82
MW-352-40	MW-352-40	Off-site	9/1/2013	Sept-2013	474.89	-0.68	475.5	38.18	437.27	42.5	2.00	33.28	442.17	37.87	437.58	4.59	0.01	PVC	PVC	Natural pack		9.0	N	24.28	3943661.39	1423825.02
MW-353-100	MW-353-100	Off-site	9/5/2013	Sept-2013	480.58	-0.43	481.1	100.61	380.48	110.0	2.00	95.50	385.59	100.05	381.04	4.55	0.01	PVC	PVC	Natural pack		8.0	N	87.50	3936222.41	1423377.69
MW-353-15	MW-353-15	Off-site	9/6/2013	Sept-2013	480.16	-0.53	480.7	15.50	465.15	—	2.00	5.50	475.15	14.50	466.15	9.00	0.01	PVC	PVC	3.0	15.5	8.0	Y	N/A	3936216.06	1423370.00
MW-353-65	MW-353-65	Off-site	9/6/2013	Sept-2013	480.40	-0.42	480.9	65.50	415.41	—	2.00	60.03	420.88	64.63	416.28	4.60	0.01	PVC	PVC	Natural pack		7.8	N	52.28	3936219.34	1423374.04
MW-354-15	MW-354-15	On-site	9/18/2013	Nov-2013	496.33	2.78	493.5	16.09	477.43	—	2.00	6.06	487.46	15.62	477.90	9.56	0.01	PVC	PVC	3	16.27	7.00	Y	-0.94	3926404.9	1429496.4
MW-354-35	MW-354-35	On-site	9/19/2013	Nov-2013	496.83	2.87	494.0	34.84	459.12	—	2.00	29.79	464.17	34.29	459.67	4.50	0.01	PVC	PVC	28	34.84	8.00	N	21.79	3926404.6	1429492.8
MW-354-65	MW-354-65	On-site	9/16/2013	Nov-2013	497.70	3.51	494.3	60.02	434.23	—	2.00	54.99	439.26	59.55	434.70	4.56	0.01	PVC	PVC	51	60.02	8.00	N	46.99	3926403.8	1429485.7
MW-355-15	MW-355-15	On-site	9/25/2013	Nov-2013	497.63	2.59	495.1	16.05	479.04	—	2.00	5.81	489.28	15.35	479.74	9.54	0.01	PVC	PVC	3	16.05	8.00	Y	-2.19	3926095.2	1428312.6
MW-355-55	MW-355-55	On-site	9/24/2013	Nov-2013	497.49	2.58	495.0	55.78	439.22	—	2.00	50.56	444.44	55.13	439.87	4.57	0.01	PVC	PVC	43	55.78	7.50	N	43.06	3926094.9	1428317.2
MW-356-20	MW-356-20	Off-site	10/17/2013	Nov-2013	478.67	-0.72	479.4	18.39	461.01	—	2.00	8.24	471.16	18.04	461.36	9.80	0.01	PVC	PVC	5	18.39	8.5	Y	-0.26	3941381.39	1429217.1
MW-356-65	MW-356-65	Off-site	10/17/2013	Nov-2013	478.75	-0.46	479.28	65.77	413.51	—	2.00	60.68	418.60	65.24	414.04	4.56	0.01	PVC	PVC	54	65.77	9.0	N	51.68	3941376.9	1429218.74
MW-356-90	MW-356-90	Off-site	10/16/2013	Nov-2013	478.74	-0.43	479.49	88.73	390.76	90.0	2.00	83.72	395.77	88.24	391.25	4.52	0.01	PVC	PVC	76	88.73	9.0	N	74.72	3941371.87	1429221.14
MW-357-15	MW-357-15	Off-site	10/21/2013	Nov-2013	487.73	2.80	484.99	15.59	469.40	—	2.00	5.49	479.50	15.27	469.72	9.78	0.01	PVC	PVC	3	15.59	8.5	Y	-3.01	3935720.9	1430665.73
MW-357-150	MW-357-150	Off-site	10/18/2013	Nov-2013	488.01	3.09	484.92	150.46	334.46	—	2.00	145.47	339.45	149.97	334.95	4.50	0.01	PVC	PVC	139	150.46	8.5	Y	136.97	3935727.84	1430657.06
MW-357-65	MW-357-65	Off-site	10/21/2013	Nov-2013	487.9	2.87	485.05	66.00	419.05	—	2.00	60.93	424.12	65.44	419.61	4.51	0.01	PVC	PVC	8.5	66	8.5	N	52.43	3935724.61	1430661.02
MW-358-15	MW-358-15	On-site	11/2/2013	Dec-2013	495.53	3.08	492.3	15.22	477.05	—	2.00	5.12	487.15	14.89	477.38	9.77	0.01	PVC	PVC	3.5	15	9.51	Y	-4.39	3927849.5	1428011.1
MW-358-150	MW-358-150	On-site	10/30/2013	Dec-2013	495.43	3.11	492.2	150.57	341.62	—	2.00	145.61	346.58	150.11	342.08	4.50	0.01	PVC	PVC	139	150.57	10.0	N	135.61	3927835.1	1427992.2
MW-358-20	MW-358-20	On-site	11/2/2013	Dec-2013	495.65	3.15	492.3	20.72	471.61	—	2.00	15.68	476.65	20.23	472.10	4.55	0.01	PVC	PVC	14	20.72	9.57	N	6.11	3927845.2	1428005.6
MW-358-40	MW-358-40	On-site	11/2/2013	Dec-2013	495.40	2.98	492.4	40.25	452.13	—	2.00	35.24	457.14	39.78	452.60	4.54	0.01	PVC	PVC	29	40.25	9.63	N	25.61	3927841.9	1428001.8
MW-358-60	MW-358-60	On-site	10/31/2013	Dec-2013	495.46	2.96	492.4	60.69	431.72	—	2.00	55.66	436.75	60.22	432.19	4.56	0.01	PVC	PVC	50	60.22	8.5	N	47.16	3927838.6	1427996.5
MW-359-15	MW-359-15	On-site	11/5/2013	Dec-2013	495.05	2.69	492.1	15.51	476.63	—	2.00	5.49	486.65	15.05	477.09	9.56	0.01	PVC	PVC	3.1	15.51	9.3	Y	-3.81	3927845.2	1428005.6
MW-359-35	MW-359-35	On-site	11/18/2013	Dec-2013	494.97	2.69	492.4	35.06	457.32	—																

Table 3-1
Well Construction Parameters
Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen						Riser Material	Filter Pack		WATER TABLE			ALASKA STATE PLANE			
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)	Screen Slot Size (inches)		Material	Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NAD83, ZONE 3		
																									NORTHING	EASTING	
O-12	O-12	On-site	9/21/2011	Sept-2013	496.28	3.66	492.6	16.99	475.63	--	2.00	6.79	485.83	16.60	476.02	9.81	0.01	PVC	PVC	Natural pack	3.0	15.5	9.0	Y	-2.2	3927268.21	1429161.41
O-12-65	O-12-65	On-site	7/13/2013	Sept-2013	495.79	2.89	493.1	65.68	427.38	--	2.00	60.75	432.31	65.31	427.75	4.56	0.01	PVC	PVC	Natural pack	7.0	N	53.75	3927268.19	1429167.30		
O-13	O-13	On-site	9/21/2011	Aug-2013	495.38	3.47	491.9	15.88	476.03	--	2.00	5.68	486.23	15.49	476.42	9.81	0.01	PVC	PVC	Natural pack	3.0	14.7	8.0	Y	-2.3	3927268.35	1429254.10
O-14	O-14	On-site	10/1/2011	Nov-2012	494.90	-0.36	495.3	15.30	479.96	--	2.00	5.12	490.14	14.91	480.35	9.79	0.01	PVC	PVC	Natural pack	4.0	16.0	8.0	Y	-2.9	3925995.33	1430224.22
O-15	O-15	On-site	10/6/2011	Nov-2012	498.70	3.15	495.6	15.37	480.18	--	2.00	5.19	490.36	14.97	480.58	9.78	0.01	PVC	PVC	Natural pack	4.0	16.0	8.0	Y	-2.8	3925553.75	1430177.50
O-16	O-16	On-site	10/7/2011	Nov-2012	493.09	-0.50	493.6	14.60	478.99	--	2.00	4.41	489.18	14.20	479.39	9.79	0.01	PVC	PVC	Natural pack	4.0	16.0	9.0	Y	-4.6	3925819.74	1429033.87
O-17	O-17	On-site	10/13/2011	Nov-2012	493.26	-0.34	493.6	15.04	478.56	--	2.00	4.87	488.73	14.56	479.04	9.69	0.01	PVC	PVC	Natural pack	4.0	16.5	7.5	Y	-2.6	3926546.15	1429036.74
O-18	O-18	On-site	10/12/2011	Nov-2012	492.70	-0.39	493.1	15.32	477.77	--	2.00	5.15	487.94	14.85	478.24	9.70	0.01	PVC	PVC	Natural pack	4.0	16.0	9.0	Y	-3.9	3926309.43	1429007.34
O-19	O-19	On-site	10/15/2011	Sept-2013	496.50	3.23	493.3	15.34	477.93	--	2.00	5.15	488.12	14.87	478.40	9.72	0.01	PVC	PVC	Natural pack	4.0	16.0	8.0	Y	-2.9	3926814.98	1429229.93
O-2	O-2	On-site	9/23/2010	Sept-2013	496.89	3.17	493.7	15.03	478.69	--	2.00	4.88	488.84	14.61	479.11	9.73	0.02	PVC	PVC	Natural pack	3.0	18.6	11.3	Y	-6.4	3927114.04	1429130.05
O-19-55	O-19-55	On-site	11/4/2013	Dec-2013	496.56	2.92	493.5	54.41	439.12	--	2.00	49.47	444.06	53.94	439.59	4.47	0.01	PVC	PVC	Natural pack	45	55	8.5	N	40.97	3926819.8	1429242.7
O-19-90	O-19-90	On-site	10/30/2013	Dec-2013	496.38	2.79	493.5	90.72	402.79	--	2.00	85.69	407.82	90.17	403.34	4.48	0.01	PVC	PVC	Natural pack	79	90.72	8.0	N	77.69	3926820.0	1429247.9
O-20	O-20	On-site	10/13/2011	Nov-2012	497.41	3.12	494.3	15.84	478.45	--	2.00	5.64	488.65	15.44	478.85	9.80	0.01	PVC	PVC	Natural pack	3.0	18.0	8.5	Y	-2.9	3925863.81	1429729.04
O-21	O-21	On-site	10/14/2011	Nov-2012	493.12	-0.46	493.6	15.69	477.89	--	2.00	5.49	488.09	15.29	478.29	9.80	0.01	PVC	PVC	Natural pack	3.0	15.5	10.3	Y	-4.8	3925656.97	1429631.77
O-22	O-22	On-site	11/14/2011	Nov-2012	496.76	1.92	494.8	18.59	476.25	--	2.00	8.30	486.54	18.05	476.79	9.75	0.01	PVC	PVC	Natural pack	3.0	16.5	12.4	Y	-4.1	3926789.25	1430139.00
O-23	O-23	On-site	12/5/2011	Nov-2012	495.83	2.37	493.5	16.32	477.14	--	2.00	6.03	487.43	15.78	477.68	9.75	0.01	PVC	PVC	Natural pack	3.0	15.0	8.6	Y	-2.6	3927110.81	1429926.50
O-24	O-24	On-site	9/16/2011	Sept-2013	496.89	2.54	494.4	15.24	479.11	--	2.00	4.95	489.40	14.70	479.65	9.75	0.01	PVC	PVC	Natural pack	5.0	17.4	10.8	Y	-5.9	3927281.16	1429428.42
O-24-65	O-24-65	On-site	8/21/2013	Nov-2013	497.00	2.56	494.4	65.35	429.01	--	2.00	60.32	434.04	64.88	429.48	4.56	0.01	PVC	PVC	Natural pack	11.0	N	49.32	3927287.12	1429429.10		
O-25	O-25	On-site	11/10/2011	Nov-2012	497.75	2.59	495.2	16.41	478.75	--	2.00	6.12	489.04	15.87	479.29	9.75	0.01	PVC	PVC	Natural pack	3.0	16.0	6.0	Y	0.1	3927402.44	1429242.45
O-5-65	O-5-65	On-site	7/11/2013	Sept-2013	495.66	2.61	493.0	64.70	428.25	--	2.00	59.58	433.37	64.15	428.80	4.57	0.01	PVC	PVC	Natural pack	7.0	N	52.58	3926947.60	1428824.90		
O-26	O-26	On-site	11/9/2011	Nov-2012	496.82	2.89	493.9	14.96	478.97	--	2.00	4.67	489.26	14.42	479.51	9.75	0.01	PVC	PVC	Natural pack	3.0	18.2	10.9	Y	-6.2	3927363.19	1429037.48
O-26-65	O-26-65	On-site	8/22/2013	Nov-2013	496.58	2.79	493.8	65.95	427.89	--	2.00	60.86	432.98	65.42	428.42	4.56	0.01	PVC	PVC	Natural pack	8.4	N	52.42	3927370.10	1429035.34		
O-27	O-27	On-site	11/10/2011	Nov-2012	496.86	1.86	495.0	17.37	477.63	--	2.00	7.08	487.92	16.83	478.17	9.75	0.01	PVC	PVC	Natural pack	4.0	15.8	9.0	Y	-1.9	3927278.05	1428804.68
O-27-65	O-27-65	On-site	11/26/2013	Dec-2013	497.40	2.55	494.6	66.18	428.40	--	2.00	60.98	433.60	65.53	429.05	4.55	0.01	PVC	PVC	Natural pack	54.0	66.2	8.0	N	53.0	3927273.9	1428844.4
O-27-150	O-27-150	On-site	11/24/2013	Dec-2013	497.57	2.64	495.8	150.28	345.49	--	2.00	145.27	350.50	149.83	345.94	4.56	0.01	PVC	PVC	Natural pack	139.0	150.28	8.0	N	137.27	3927277.6	1428825.7
O-28	O-28	On-site	11/14/2011	Nov-2012	494.65	2.16	492.5	14.84	477.65	--	2.00	4.55	487.94	14.30	478.19	9.75	0.01	PVC	PVC	Natural pack	4.0	16.5	8.0	Y	-3.5	3925637.58	1428886.20
O-29	O-29	On-site	11/12/2011	Nov-2012	498.61	2.37	496.2	18.16	478.08	--	2.00	7.87	488.37	17.62	478.62	9.75	0.01	PVC	PVC	Natural pack	4.5	16.5	7.5	Y	0.4	3926600.52	1430083.48
O-30	O-30	On-site	8/14/2012	Nov-2012	497.97	2.97	495.0	15.82	479.18	--	2.00	6.71	488.29	15.36	479.64	9.75	0.01	PVC	PVC	Natural pack	3.5	16.0	8.0	Y	-1.3	3926425.91	1430292.76
O-3	O-3	On-site	9/23/2010	Sept-2013	497.83	3.35	494.5	14.57	479.91	--	2.00	4.43	490.05	14.16	480.32	9.73	0.02	PVC	PVC	Natural pack	3.5	16.0	6.0	Y	-1.6	3927090.75	1429551.50
O-4	O-4	On-site	9/16/2010	Sept-2013	496.53	2.61	493.9	15.11	478.81	--	2.00	4.98	488.94	14.64	479.28	9.66	0.02	PVC	PVC	Natural pack	3.5	16.0	8.0	Y	-3.0	3927159.11	1428795.47
O-5	O-5	On-site	9/13/2011	Sept-2013	496.19	2.89	493.3	15.08	478.22	--	2.00	4.97	488.33	14.68	478.62	9.71	0.01	PVC	PVC	Natural pack	4.0	16.0	8.5	Y	-3.5	3926951.41	1428829.08
O-6	O-6	On-site	9/14/2011	Sept-2013	495.02	2.78	492.2	15.58	476.66	--	2.00	5.47	486.77	15.17	477.07	9.70	0.01	PVC	PVC	Natural pack	4.0	18.0	8.0	Y	-2.5	3926744.06	1428769.81
O-7	O-7	On-site	9/14/2011	Nov-2012	496.01	2.52	493.5	15.33	478.16	--	2.00	5.22	488.27	14.92	478.57	9.70	0.01	PVC	PVC	Natural pack	3.5	16.0	8.0	?	-2.8	3926757.84	1429911.88
O-8	O-8	On-site	9/15/2011	Nov-2012	496.72	2.74	494.0	15.86	478.12	--	2.00	5.75	488.23	15.45	478.53	9.70	0.01	PVC	PVC	Natural pack	4.0	16.0	8.0	Y	-2.3	3926131.00	1429895.90
O-9	O-9	On-site	9/15/2011	Nov-2012	496.95	3.11	493.8	15.14	478.70	--	2.00	5.03	488.81	14.73	479.11	9.70	0.01	PVC	PVC	Natural pack	4.0	18.0	9.0	Y	-4.0	3926505.32	1429912.51
O-31	O-31	On-site	9/3/2013	Nov-2013	496.11	3.67	492.2	15	477.19	--	4.00	5	487.19	15	477.19	10.00	0.02	SS	PVC	Natural pack	4	16	7.5	Y	-2.50	3927266.76	1429326.59
O-32	O-32	On-site	9/4/2013	Nov-2013	496.36	3.49	492.8	16	476.82	--	4.00	6	486.82	16	476.82	10.00	0.02	SS	PVC	Natural pack	4	17	10	Y	-4.00	3927043.28	1429214.60
O-33	O-33	On-site	9/5/2013	Nov-2013	496.53	3.43	493.1	16	477.13	--	4.00	6	487.13	16	477.13	10.00	0.02	SS	PVC	Natural pack	4	18	8.7	Y	-2.70	3926714.93	1429442.08
O-34	O-34	On-site	9/18/2013	Nov-2013	496.31	3	493.4	16	477.35	--	4.00	6	487.35	16	477.35	10.00	0.02	SS	PVC	Natural pack	5	18	8	Y	-2.00	3926268.90	1429394.51
O-35	O-35	On-site	9/20/2013	Nov-2013	496.88	3	493.8	15	478.75	--	4.00	5	488.75	15	478.75	10.00	0.02	SS	PVC	Natural pack	3	18	7	Y	-2.00	3925985.05	1429404.33
O-36	O-36	On-site	9/21/2013	Nov-2013	496.49	3	493.7	16	477.70	--	4.00	6	487.70	16	477.70	10.00	0.02	SS	PVC	Natural pack	4	18	8.9	Y	-2.90	3926763.54	1429779.47
O-37	O-37	On-site	9/17/2013	Nov-2013	496.42	3	493.0	16	476.98	--	4.00	6	486.98	16	476.98	10.00	0.02	SS	PVC	Natural pack	4	18	7.5	Y	-1.50	3926618.61	1429780.51
O-38	O-38	On-site	9/20/2013	Nov-2013	496.60	3	493.5	15	478.45	--	4.00	5	488.45	15	478.45	10.00	0.02	SS	PVC	Natural pack	3	18	6.8	Y	-1.80	3926444.05	1429913.39
PZ-1-15	PZ-1-15	On-site	10/8/2013	Nov-2013	497.98	3	495.2	15	480.16	--	2.00	5	490.16	15	480.16	10.00	0.01	PVC	PVC	Natural pack	4	15	9	Y	-4.00	3926374.96	1427865.00
PZ-1-20	PZ-1-20	On-site	10/23/2013	Nov-2013	500.58	3	497.7	21	477.14	--	2.00	16	482.23	20	477.71	4.52	0.01	PVC	PVC	Natural Pack	12	20	13.5				

Table 3-1
Well Construction Parameters
Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen							Riser Material	Filter Pack		WATER TABLE			ALASKA STATE PLANE NAD83, ZONE 3		
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)	Screen Slot Size (inches)	Material		Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NORTHING	EASTING	
R-45	R-45	On-site	3/8/2013	Aug-2013	495.97	2.91	493.1	32.25	460.81	—	12.00	7.26	485.80	32.25	460.81	24.99	0.008	ss	ss	Natural pack	7.0	Y	0.3	3927018.85	1429353.89		
R-46	R-46	On-site	3/15/2013	Aug-2013	496.10	1.92	494.2	30.88	463.30	—	12.00	6.00	488.18	30.88	463.30	24.88	0.008	ss	ss	Natural pack	8.0	Y	-2.0	3927033.10	1429663.67		
R-5	R-5	On-site	6/15/1986	Nov-2012	495.33	1.83	493.5	7.23	486.27	—	38.00	--	--	--	--	--	NA	culvert		--	--	9.0	?	?	3925824.93	1429309.40	
S-21	S-21	On-site	5/15/1987	Nov-2012	497.19	2.84	494.4	13.40	480.95	—	2.00	2.92	491.43	12.67	481.68	9.75	0.02	PVC	PVC		--	--	9.0	Y	-6.1	3926670.65	1429597.64
S-22	S-22	On-site	5/15/1987	Nov-2012	496.70	1.90	494.8	14.70	480.10	—	2.00	4.50	490.30	14.20	480.60	9.70	0.02	PVC	PVC		--	--	9.0	Y	-4.5	3926430.46	1429717.90
S-32	S-32	On-site	11/15/1987	Sept-2013	495.81	2.96	492.9	11.30	481.55	—	4.00	1.30	491.55	11.30	481.55	10.00	0.02	ABS	ABS		--	--	9.0	Y	-7.7	3926946.66	1429732.57
S-39	S-39	On-site	12/15/1989	Nov-2012	494.07	1.02	493.1	13.00	480.05	—	2.00	7.53	485.52	12.53	480.52	5.00	?	PVC	PVC		--	--	9.0	Y	-1.5	3927009.82	1429395.60
S-41R	S-41R	On-site	10/4/2013	Nov-2013	496.68	3.23	493.37	14.84	478.53	—	2.00	9.76		14.28		4.52	0.01	PVC	PVC	7.5	15	7.5	N	2.26	3925833.81	1429139.24	
S-43	S-43	On-site	6/15/1991	Sept-2013	496.29	2.21	494.1	13.00	481.08	—	4.00	3.37	490.71	12.70	481.38	9.33	?	PVC	PVC		--	--	9.0	Y	-5.6	3926779.68	1429530.33
S-44	S-44	On-site	6/15/1991	Sept-2013	495.03	2.47	492.6	13.00	479.56	—	4.00	3.16	489.40	12.64	479.92	9.48	?	PVC	PVC		--	--	9.0	Y	-5.8	3926922.12	1429493.51
S-50	S-50	On-site	7/15/1997	Sept-2013	496.70	2.77	493.9	15.00	478.93	—	4.00	3.88	490.05	13.56	480.37	9.68	0.02	PVC	PVC		--	--	9.0	Y	-5.1	3926779.29	1429065.48
S-51	S-51	On-site	6/15/1997	Sept-2013	495.92	2.94	493.0	15.00	477.98	—	2.00	4.75	488.23	14.43	478.55	9.68	0.02	PVC	PVC		--	--	9.0	Y	-4.3	3926824.07	1429045.61
S-54	S-54	On-site	7/15/1998	Nov-2012	497.01	3.03	494.0	15.00	478.98	—	2.00	10.00	483.98	15.00	478.98	5.00	0.02	PVC	PVC		--	--	12.0	Y	-2.0	3928055.37	1429680.65
S-9	S-9	On-site	8/15/2001	Nov-2012	495.12	2.89	492.2	19.80	472.43	—	2.00	4.88	487.35	18.88	473.35	14.00	0.01	PVC	PVC		--	--	7.5	Y	-2.6	3927494.32	1429112.46

Acronyms and Abbreviations:

- BGS = below ground surface
- CMT =continuous multi-channel tubing
- MSL = mean sea level
- SS = stainless steel
- PVC = polyvinyl chloride
- ABS = acrylonitrile butadiene styrene
- NA =not applicable
- PF = permafrost
- = information not available
- * = measured in field or calculated from the difference between the riser elevation and the ground elevatior

**Table 3-2
Groundwater Elevation Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Proximity	Zone	Group
MW-101-60	On-site	10-55	Vertical Gradient
MW-101A-25	On-site	Water Table	Vertical Gradient
MW-102-70	On-site	55-90	
MW-104-65	On-site	10-55	
MW-105-65	On-site	10-55	
MW-105A-25	On-site	Water Table	
MW-106-25	On-site	Water Table	
MW-109-15	On-site	Water Table	
MW-110-20	On-site	Water Table	
MW-113-15	On-site	Water Table	
MW-125-25	On-site	Water Table	
MW-129-40	On-site	10-55	
MW-130-25	On-site	Water Table	
MW-131-25	On-site	Water Table	Vertical Gradient
MW-133-20	On-site	Water Table	
MW-135-20	On-site	Water Table	
MW-140-25	On-site	Water Table	
MW-141-20	On-site	Water Table	
MW-143-20	On-site	Water Table	Vertical Gradient
MW-144A-25	On-site	Water Table	
MW-144BR-90	On-site	55-90	
MW-145-20	On-site	Water Table	
MW-146A-15	On-site	Water Table	
MW-146B-30	On-site	10-55	
MW-147B-25	On-site	10-55	
MW-148A-15	On-site	Water Table	Vertical Gradient
MW-148B-30	On-site	10-55	Vertical Gradient
MW-148C-55	On-site	10-55	Vertical Gradient
MW-148D-150	On-site	90-160	Vertical Gradient
MW-149A-15	On-site	Water Table	
MW-150A-10	Off-site	Water Table	
MW-150B-25	Off-site	10-55	
MW-151A-15	Off-site	Water Table	
MW-151C-60	Off-site	10-55	
MW-152A-15	Off-site	Water Table	
MW-152B-25	Off-site	10-55	
MW-152C-65	Off-site	10-55	
MW-153A-15	Off-site	Water Table	
MW-153B-55	Off-site	10-55	
MW-154A-75	On-site	55-90	
MW-155A-15	Off-site	Water Table	
MW-156A-15	Off-site	Water Table	
MW-156B-50	Off-site	10-55	
MW-157A-15	Off-site	Water Table	
MW-157B-30	Off-site	10-55	
MW-158A-15	Off-site	Water Table	
MW-158B-60	Off-site	10-55	
MW-159A-15	Off-site	Water Table	
MW-159B-45	Off-site	10-55	

**Table 3-2
Groundwater Elevation Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Proximity	Zone	Group
MW-159C-70	Off-site	55-90	
MW-160B-90	Off-site	55-90	
MW-161A-15	Off-site	Water Table	
MW-161B-50	Off-site	10-55	
MW-162A-15	Off-site	Water Table	
MW-162B-65	Off-site	10-55	
MW-163A-15	Off-site	Water Table	
MW-163B-40	Off-site	10-55	
MW-164A-15	Off-site	Water Table	
MW-164B-50	Off-site	10-55	
MW-164C-60	Off-site	10-55	
MW-165A-15	Off-site	Water Table	
MW-165B-50	Off-site	10-55	
MW-166A-15	Off-site	Water Table	
MW-166B-30	Off-site	10-55	
MW-167A-15	Off-site	Water Table	
MW-167B-35	Off-site	10-55	
MW-168A-15	Off-site	Water Table	
MW-168B-50	Off-site	10-55	
MW-169A-15	Off-site	Water Table	
MW-169B-50	Off-site	10-55	
MW-169C-60	Off-site	10-55	
MW-170A-15	Off-site	Water Table	
MW-170B-75	Off-site	55-90	
MW-170C-130	Off-site	90-160	
MW-170D-50	Off-site	10-55	
MW-171A-15	Off-site	Water Table	
MW-171B-40	Off-site	10-55	
MW-172A-15	Off-site	Water Table	
MW-172B-150	Off-site	90-160	
MW-173A-15	On-site	Water Table	
MW-173B-150	On-site	90-160	
MW-174A-50	On-site	10-55	
MW-174B-90	On-site	55-90	
MW-175-90	On-site	55-90	
MW-176B-50	On-site	10-55	
MW-176C-90	On-site	55-90	
MW-177-90	On-site	55-90	
MW-178C-90	On-site	55-90	
MW-179A-15	On-site	Water Table	Vertical Gradient
MW-179B-50	On-site	10-55	Vertical Gradient
MW-179C-90	On-site	55-90	Vertical Gradient
MW-179D-135	On-site	90-160	Vertical Gradient
MW-180B-50	On-site	10-55	
MW-180C-90	On-site	55-90	
MW-181A-15	Off-site	Water Table	Vertical Gradient
MW-181B-50	Off-site	10-55	Vertical Gradient
MW-181C-150	Off-site	90-160	Vertical Gradient
MW-182A-15	Off-site	Water Table	
MW-182B-45	Off-site	10-55	
MW-183A-15	Off-site	Water Table	
MW-183B-60	Off-site	10-55	

**Table 3-2
Groundwater Elevation Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Proximity	Zone	Group
MW-184-45	Off-site	10-55	
MW-185A-15	Off-site	Water Table	Vertical Gradient
MW-185B-50	Off-site	10-55	Vertical Gradient
MW-185C-120	Off-site	90-160	Vertical Gradient
MW-186A-15	On-site	Water Table	Vertical Gradient
MW-186B-60	On-site	10-55	Vertical Gradient
MW-186C-100	On-site	90-160	Vertical Gradient
MW-186D-135	On-site	90-160	Vertical Gradient
MW-186E-75	On-site	55-90	Vertical Gradient
MW-187-15	Off-site	Water Table	
MW-188A-15	Off-site	Water Table	
MW-188B-40	Off-site	10-55	
MW-189A-15	Off-site	Water Table	
MW-189B-60	Off-site	10-55	
MW-190A-15	Off-site	Water Table	
MW-190BR-60	Off-site	10-55	
MW-191A-15	Off-site	Water Table	
MW-191B-60	Off-site	10-55	
MW-192A-15	On-site	Water Table	
MW-192B-55	On-site	10-55	
MW-193A-15	Off-site	Water Table	
MW-193B-60	Off-site	10-55	
MW-194A-15	Off-site	Water Table	
MW-194B-40	Off-site	10-55	
MW-195A-15	On-site	Water Table	
MW-195B-150	On-site	90-160	
MW-197A-65	On-site	10-55	
MW-198-150	On-site	90-160	
MW-199-150	On-site	90-160	
MW-300-150	On-site	90-160	
MW-301-60	On-site	10-55	Vertical Gradient
MW-301-70	On-site	55-90	Vertical Gradient
MW-301-CMT-10	On-site	Water Table	Vertical Gradient
MW-301-CMT-20	On-site	10-55	Vertical Gradient
MW-301-CMT-30	On-site	10-55	Vertical Gradient
MW-301-CMT-40	On-site	10-55	Vertical Gradient
MW-301-CMT-50	On-site	10-55	Vertical Gradient
MW-302-110	On-site	90-160	Vertical Gradient
MW-302-70	On-site	55-90	Vertical Gradient
MW-302-80	On-site	55-90	Vertical Gradient
MW-302-95	On-site	55-90	Vertical Gradient
MW-302-CMT-10	On-site	Water Table	Vertical Gradient
MW-302-CMT-20	On-site	10-55	Vertical Gradient
MW-302-CMT-30	On-site	10-55	Vertical Gradient
MW-302-CMT-40	On-site	10-55	Vertical Gradient
MW-302-CMT-50	On-site	10-55	Vertical Gradient
MW-303-130	On-site	90-160	Vertical Gradient
MW-303-70	On-site	55-90	Vertical Gradient
MW-303-80	On-site	55-90	Vertical Gradient
MW-303-95	On-site	55-90	Vertical Gradient
MW-303-CMT-9	On-site	Water Table	Vertical Gradient
MW-303-CMT-19	On-site	10-55	Vertical Gradient

**Table 3-2
Groundwater Elevation Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Proximity	Zone	Group
MW-303-CMT-29	On-site	10-55	Vertical Gradient
MW-303-CMT-39	On-site	10-55	Vertical Gradient
MW-303-CMT-49	On-site	10-55	Vertical Gradient
MW-303-CMT-59	On-site	10-55	Vertical Gradient
MW-304-125	On-site	90-160	Vertical Gradient
MW-304-15	On-site	Water Table	Vertical Gradient
MW-304-150	On-site	90-160	Vertical Gradient
MW-304-70	On-site	55-90	Vertical Gradient
MW-304-80	On-site	55-90	Vertical Gradient
MW-304-96	On-site	55-90	Vertical Gradient
MW-304-CMT-10	On-site	Water Table	Vertical Gradient
MW-304-CMT-20	On-site	10-55	Vertical Gradient
MW-304-CMT-30	On-site	10-55	Vertical Gradient
MW-304-CMT-40	On-site	10-55	Vertical Gradient
MW-304-CMT-50	On-site	10-55	Vertical Gradient
MW-304-CMT-60	On-site	10-55	Vertical Gradient
MW-305-100	On-site	90-160	Vertical Gradient
MW-305-70	On-site	55-90	Vertical Gradient
MW-305-80	On-site	55-90	Vertical Gradient
MW-305-CMT-8	On-site	Water Table	Vertical Gradient
MW-305-CMT-18	On-site	10-55	Vertical Gradient
MW-305-CMT-28	On-site	10-55	Vertical Gradient
MW-305-CMT-38	On-site	10-55	Vertical Gradient
MW-305-CMT-48	On-site	10-55	Vertical Gradient
MW-305-CMT-58	On-site	10-55	Vertical Gradient
MW-306-100	On-site	55-90	Vertical Gradient
MW-306-15	On-site	Water Table	Vertical Gradient
MW-306-150	On-site	90-160	Vertical Gradient
MW-306-70	On-site	55-90	Vertical Gradient
MW-306-80	On-site	55-90	Vertical Gradient
MW-306-CMT-10	On-site	Water Table	Vertical Gradient
MW-306-CMT-20	On-site	10-55	Vertical Gradient
MW-306-CMT-30	On-site	10-55	Vertical Gradient
MW-306-CMT-40	On-site	10-55	Vertical Gradient
MW-306-CMT-50	On-site	10-55	Vertical Gradient
MW-306-CMT-60	On-site	10-55	Vertical Gradient
MW-307-150	On-site	90-160	
MW-309-15	On-site	Water Table	
MW-309-66	On-site	10-55	
MW-310-110	On-site	90-160	
MW-310-15	On-site	Water Table	
MW-310-65	On-site	10-55	
MW-311-15	Off-site	Water Table	
MW-311-46	Off-site	10-55	
MW-312-15	Off-site	Water Table	
MW-312-50	Off-site	10-55	
MW-313-15	Off-site	Water Table	
MW-315-15	Off-site	Water Table	
MW-315-150	Off-site	90-160	
MW-317-71	Off-site	55-90	
MW-318-135	Off-site	90-160	
MW-318-20	Off-site	Water Table	

**Table 3-2
Groundwater Elevation Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Proximity	Zone	Group
MW-319-15	Off-site	Water Table	
MW-319-45	Off-site	10-55	
MW-321-15	On-site	Water Table	
MW-321-65	On-site	10-55	
MW-322-15	Off-site	Water Table	
MW-322-150	Off-site	90-160	
MW-324-15	Off-site	Water Table	
MW-324-151	Off-site	90-160	
MW-326-20	Off-site	Water Table	
MW-326-150	Off-site	90-160	
MW-327-15	Off-site	Water Table	
MW-327-150	Off-site	90-160	
MW-328-15	Off-site	Water Table	
MW-328-151	Off-site	90-160	
MW-330-65	On-site	10-55	
MW-332-15	Off-site	Water Table	
MW-332-150	Off-site	90-160	
MW-333-16	Off-site	Water Table	
MW-333-150	Off-site	90-160	
MW-334-65	On-site	10-55	
O-1	On-site	Water Table	
O-2	On-site	Water Table	
O-3	On-site	Water Table	
O-4	On-site	Water Table	
O-5	On-site	Water Table	
O-6	On-site	Water Table	
O-8	On-site	Water Table	
O-12	On-site	Water Table	
O-14	On-site	Water Table	
O-15	On-site	Water Table	
O-17	On-site	Water Table	
O-18	On-site	Water Table	
O-22	On-site	Water Table	
O-23	On-site	Water Table	
O-24	On-site	Water Table	
O-26	On-site	Water Table	
O-27	On-site	Water Table	
O-28	On-site	Water Table	
O-29	On-site	Water Table	
O-30	On-site	Water Table	
R-14A	On-site	Water Table	
R-21	On-site	Water Table	
R-35R	On-site	Water Table	
R-39	On-site	Water Table	
R-40	On-site	Water Table	
R-42	On-site	Water Table	
S-32	On-site	Water Table	
S-39	On-site	Water Table	
S-43	On-site	Water Table	
S-44	On-site	Water Table	
S-50	On-site	Water Table	
S-54	On-site	Water Table	

**Table 3-2
Groundwater Elevation Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Proximity	Zone	Group
South Gravel Pit	On-site	Water Table	Surface Water
North Gravel Pit	On-site	Water Table	Surface Water

General Notes:

Wells are measured quarterly. During inclement weather, wells are prioritized based on accessibility and the assigned priorities included in the BTEX (Table 3-5) and sulfolane (Tables 3-6a and 3-6b) monitoring networks.

Wells included on the LNAPL Thickness (Table 3-3) and LNAPL Migration (Table 3-4) monitoring networks will also provide groundwater elevation data quarterly.

Acronyms and Abbreviations:

BTEX = benzene, toluene, ethylbenzene and total xylenes

LNAPL = light nonaqueous phase liquids

**Table 3-3
LNAPL Thickness Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

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

General Notes:

The groundwater monitoring network is under development and will be updated as wells are installed.

S-20 is to be decommissioned.

LNAPL appropriate observation wells (O-series) were installed to monitor product boundary and replace.

MW-111, MW-113, MW-115, MW-116, MW-132, MW-134, MW-135, MW-136, and MW-137.

**Table 3-4
LNAPL Migration Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

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

General Notes:

LNAPL appropriate observation wells (O-series) were installed to monitor product boundary and replace MW-111, MW-113, MW-115, MW-116, MW-132, MW-134, MW-135, MW-136, and MW-137.

Acronyms and Abbreviations:

LNAPL = Light Non-Aqueous Phase Liquid
 NW = Northwest
 NE = Northeast

**Table 3-5
BTEX Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - BTEX Monitoring (Semi-Annual)	Notes
MW-101A	MW-101A-25	Annually	2	Downgradient		
MW-105A	MW-105A-25	Annually	2	Upgradient		
MW-106	MW-106-25	Semi-annual	2	Near gravel pit		
MW-109	MW-109-15	Semi-annual	2	Plume leading edge		
MW-110	MW-110-20	Semi-annual	2	Plume		
MW-113	MW-113-15	Semi-annual	1	Performance Monitoring	X	
MW-115	MW-115-15	Semi-annual	2	Plume		
MW-116	MW-116-15	Semi-annual	2	Plume		
MW-124	MW-124-25	Semi-annual	2	Plume		
MW-125	MW-125-25	Semi-annual	1	Performance Monitoring	X	
MW-126	MW-126-25	Quarterly	2	Plume leading edge		
MW-127	MW-127-25	Semi-annual	1	Plume leading edge	X	
MW-129	MW-129-40	Semi-annual	1	Performance Monitoring	X	
MW-130	MW-130-25	Semi-annual	1	Performance Monitoring	X	
MW-131	MW-131-25	Annually	2	Downgradient		
MW-132	MW-132-20	Semi-annual	2	Plume		
MW-133	MW-133-20	Semi-annual	2	Plume		
MW-134	MW-134-20	Quarterly	2	Upgradient		Used to monitor for any potential changes as a result of the leak in sump 5002
MW-135	MW-135-20	Semi-annual	2	Plume		
MW-136	MW-136-20	Semi-annual	2	Plume		
MW-137	MW-137-20	Quarterly	2	Plume		
MW-138	MW-138-20	Annually	2	Source		
MW-139	MW-139-25	Semi-annual	1	Plume	X	
MW-140	MW-140-25	Semi-annual	2	Plume leading edge		
MW-141	MW-141-20	Semi-annual	2	Near gravel pit		
MW-142	MW-142-20	Semi-annual	1	Plume leading edge	X	
MW-143	MW-143-20	Semi-annual	2	Plume leading edge		
MW-144A	MW-144A-25	Semi-annual	2	Plume leading edge		
MW-145	MW-145-20	Quarterly	1	Plume leading edge	X	
MW-148A	MW-148A-15	Semi-annual	2	Downgradient property boundary		
MW-149A	MW-149A-15	Semi-annual	2	Downgradient property boundary		
MW-153A	MW-153A-15	Semi-annual	2	Downgradient property boundary		
MW-176A	MW-176A-15	Semi-annual	2	Plume		
MW-179A	MW-179A-15	Semi-annual	2	Plume		

**Table 3-5
BTEX Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - BTEX Monitoring (Semi-Annual)	Notes
MW-180A	MW-180A-15	Semi-annual	2	Plume		
MW-186A	MW-186A-15	Semi-annual	1	Performance Monitoring	X	
MW-192A	MW-192A-15	Annually	2	Upgradient		Southwest property boundary
MW-196	MW-196-15	Annually	2	Upgradient		Replaced S-19
MW-309-15	MW-309-15	Semi-annual	1	West edge of plume	X	
MW-321-15	MW-321-15	Semi-annual	2	West edge of plume		
MW-334-15	MW-334-15	Quarterly	1	Plume boundary	X	
MW-344-15	MW-344-15	Semi-annual	1	EGWRT	X	
MW-344-55	MW-344-55	Semi-annual	1	EGWRT	X	
MW-345-15	MW-345-15	Semi-annual	1	EGWRT	X	
MW-345-55	MW-345-55	Semi-annual	1	EGWRT	X	
MW-351-15	MW-351-15	Semi-annual	1	EGWRT	X	
MW-351-55	MW-351-55	Semi-annual	1	EGWRT	X	
MW-336-15	MW-336-15	Quarterly	1	Plume		
MW-336-20	MW-336-20	Quarterly	1	Plume		
MW-336-35	MW-336-35	Quarterly	1	Plume		
MW-336-55	MW-336-55	Quarterly	1	Plume		
MW-337-20	MW-337-20	Quarterly	1	Plume		
MW-369	MW-369	Semi-annual	1	EGWRT	X	Shallow well from cluster, once installed
MW-370-15	MW-370-15	Semi-annual	1	EGWRT	X	
MW-371	MW-371	Semi-annual	1	EGWRT	X	Shallow well from cluster, once installed
O-12	O-12	Quarterly	1	Plume delineation	X	
O-14	O-14	Quarterly	2	Upgradient		Used to monitor for any potential changes as a result of the leak in sump 5002
O-16	O-16	Semi-annual	2	Plume		
O-17	O-17	Semi-annual	2	Plume		
O-18	O-18	Semi-annual	2	Plume		
O-19	O-19	Semi-annual	1	Performance Monitoring	X	
O-19-55	O-19-55	Semi-annual	1	Performance Monitoring	X	
O-2	O-2	Semi-annual	1	Performance Monitoring	X	
O-24	O-24	Semi-annual	1	Performance Monitoring	X	
O-26	O-26	Semi-annual	1	Performance Monitoring	X	
O-3	O-3	Semi-annual	1	Performance Monitoring	X	
O-4	O-4	Semi-annual	1	Performance Monitoring	X	
O-5	O-5	Semi-annual	1	Performance Monitoring	X	
O-6	O-6	Semi-annual	1	Performance Monitoring	X	
S-43	S-43	Semi-annual	1	Performance Monitoring	X	
S-44	S-44	Semi-annual	2	Plume		

**Table 3-5
BTEX Monitoring Network**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - BTEX Monitoring (Semi-Annual)	Notes
S-50	S-50	Semi-annual	2	Plume		
S-9	S-9	Quarterly	1	Plume delineation		

General Notes:

Semi-annual wells will be sampled during the first and third quarters of the year.
Annual wells will be sampled during the third quarter of the year.

Acronyms and Abbreviations:

EGWRT = expanded groundwater recovery and treatment
BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes

Table 3-6a
Sulfolane Monitoring Network - Onsite

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - Sulfolane Monitoring (Quarterly)	Notes
MW-101	MW-101-60	Annual	-	Downgradient of remediation		
MW-101A	MW-101A-25	Annual	-	Downgradient of remediation		Dedicated pump
MW-104	MW-104-65	Annual	-	Plume		
MW-105	MW-105-65	Annual	-	Upgradient		
MW-105A	MW-105A-25	Annual	-	Upgradient		
MW-106	MW-106-25	Semi-annual	4	Plume		
MW-109	MW-109-15	Annual	-	Plume		
MW-110	MW-110-20	Quarterly	1	Plume		Dedicated pump
MW-110-65	MW-110-65	Quarterly	2	Phase 8		
MW-113	MW-113-15	Quarterly	1	Plume	X	
MW-115	MW-115-15	Semi-annual	4	Plume		
MW-116	MW-116-15	Semi-annual	4	Plume		
MW-125	MW-125-25	Quarterly	1	Plume Delineation	X	
MW-127	MW-127-25	Quarterly	1	Downgradient of remediation	X	Dedicated pump
MW-129	MW-129-40	Quarterly	1	Plume	X	Dedicated pump
MW-130	MW-130-25	Quarterly	1	Plume	X	
MW-131	MW-131-25	Quarterly	1	Downgradient of remediation		
MW-132	MW-132-20	Annual	-	Plume		Dedicated pump
MW-133	MW-133-20	Annual	-	Plume Delineation		
MW-134	MW-134-20	Annual	-	Plume Delineation		
MW-135	MW-135-20	Semi-annual	4	Plume		
MW-138	MW-138-20	Quarterly	1	Plume		
MW-139	MW-139-25	Quarterly	1	Downgradient of remediation	X	
MW-141	MW-141-20	Semi-annual	4	Plume (downgradient property boundary)		Dedicated pump
MW-142	MW-142-20	Quarterly	1	Downgradient of remediation	X	
MW-142-150	MW-142-150	Quarterly	2	Phase 8		
MW-142-65	MW-142-65	Quarterly	2	Phase 8		
MW-143	MW-143-20	Quarterly	1	Downgradient of remediation		
MW-144A	MW-144A-25	Annual	-	Plume		
MW-144BR	MW-144BR-90	Annual	-	Plume Delineation		
MW-145	MW-145-20	Quarterly	1	Plume	X	
MW-147B	MW-147B-25	Quarterly	4	Plume (downgradient property boundary)		
MW-149A	MW-149A-15	Quarterly	3	Plume (downgradient property boundary)		
MW-149B	MW-149B-20	Quarterly	3	Plume (downgradient property boundary)		
MW-154A	MW-154A-75	Quarterly	1	Plume Delineation	X	Dedicated pump
MW-154B	MW-154B-95	Quarterly	1	Plume Delineation	X	
MW-173A	MW-173A-15	Annual	-	Property boundary (east)		Dedicated pump
MW-173B	MW-173B-150	Annual	-	Property boundary (east)		
MW-174-15	MW-174-15	Quarterly	2	Phase 8		
MW-174A	MW-174A-50	Quarterly	4	Plume Delineation		
MW-174B	MW-174B-90	Semi-annual	4	Plume Delineation		
MW-175	MW-175-90	Quarterly	1	Plume Delineation	X	
MW-176A	MW-176A-15	Quarterly	1	Plume Delineation		

Table 3-6a
Sulfolane Monitoring Network - Onsite

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - Sulfolane Monitoring (Quarterly)	Notes
MW-176B	MW-176B-50	Quarterly	1	Plume Delineation		
MW-176C	MW-176C-90	Semi-annual	1	Plume Delineation		Dedicated pump
MW-177	MW-177-90	Annual	-	Upgradient		
MW-178A	MW-178A-15	Quarterly	1	Plume Delineation		
MW-178B	MW-178B-50	Quarterly	1	Plume Delineation		
MW-178C	MW-178C-90	Semi-annual	1	Plume Delineation		
MW-179A	MW-179A-15	Quarterly	4	Plume Delineation		
MW-179B	MW-179B-50	Semi-annual	4	Plume Delineation		
MW-179C	MW-179C-90	Annual	-	Plume Delineation		
MW-179D	MW-179D-135	Semi-annual	4	Plume Delineation		
MW-180A	MW-180A-15	Semi-annual	4	Plume Delineation		
MW-180B	MW-180B-50	Annual	-	Plume Delineation		
MW-180C	MW-180C-90	Annual	-	Plume Delineation		Dedicated pump
MW-186A	MW-186A-15	Quarterly	1	Monitor Recovery System Effects	X	
MW-186B	MW-186B-60	Quarterly	1	Monitor Recovery System Effects	X	
MW-186C	MW-186C-100	Annual	-	Monitor Recovery System Effects		
MW-186D	MW-186D-135	Annual	-	Monitor Recovery System Effects		
MW-186E	MW-186E-75	Quarterly	1	Monitor Recovery System Effects	X	
MW-192A	MW-192A-15	Annual	-	Upgradient		
MW-192B	MW-192B-55	Annual	-	Upgradient		
MW-195A	MW-195A-15	Quarterly	1	Plume		
MW-195B	MW-195B-150	Annual	-	Plume		
MW-196	MW-196-15	Annual	-	Plume		
MW-197A	MW-197A-65	Quarterly	4	Plume		
MW-197B	MW-197B-150	Annual	-	Plume		
MW-198	MW-198-150	Quarterly	4	Plume		
MW-199	MW-199-150	Quarterly	1	Plume	X	
MW-300	MW-300-150	Annual	-	Plume		
MW-301-60	MW-301-60	Quarterly	2	Vertical Profiling Transect		
MW-301-70	MW-301-70	Quarterly	2	Vertical Profiling Transect		
MW-301-CMT-10	MW-301-CMT-10	Quarterly	2	Vertical Profiling Transect		
MW-301-CMT-20	MW-301-CMT-20	Quarterly	2	Vertical Profiling Transect		
MW-301-CMT-30	MW-301-CMT-30	Quarterly	2	Vertical Profiling Transect		
MW-301-CMT-40	MW-301-CMT-40	Quarterly	2	Vertical Profiling Transect		
MW-301-CMT-50	MW-301-CMT-50	Quarterly	2	Vertical Profiling Transect		
MW-302-110	MW-302-110	Semi-annual	2	Vertical Profiling Transect		
MW-302-70	MW-302-70	Quarterly	2	Vertical Profiling Transect		
MW-302-80	MW-302-80	Quarterly	2	Vertical Profiling Transect		
MW-302-95	MW-302-95	Quarterly	2	Vertical Profiling Transect		
MW-302-CMT-10	MW-302-CMT-10	Quarterly	2	Vertical Profiling Transect		
MW-302-CMT-20	MW-302-CMT-20	Quarterly	2	Vertical Profiling Transect		
MW-302-CMT-30	MW-302-CMT-30	Quarterly	2	Vertical Profiling Transect		
MW-302-CMT-40	MW-302-CMT-40	Quarterly	2	Vertical Profiling Transect		

Table 3-6a
Sulfolane Monitoring Network - Onsite

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - Sulfolane Monitoring (Quarterly)	Notes
MW-302-CMT-50	MW-302-CMT-50	Quarterly	2	Vertical Profiling Transect		
MW-303-130	MW-303-130	Semi-annual	2	Vertical Profiling Transect		
MW-303-70	MW-303-70	Quarterly	2	Vertical Profiling Transect		
MW-303-80	MW-303-80	Quarterly	2	Vertical Profiling Transect		
MW-303-95	MW-303-95	Quarterly	2	Vertical Profiling Transect		
MW-303-CMT-19	MW-303-CMT-19	Quarterly	2	Vertical Profiling Transect		
MW-303-CMT-29	MW-303-CMT-29	Quarterly	2	Vertical Profiling Transect		
MW-303-CMT-39	MW-303-CMT-39	Quarterly	2	Vertical Profiling Transect		
MW-303-CMT-49	MW-303-CMT-49	Quarterly	2	Vertical Profiling Transect		
MW-303-CMT-59	MW-303-CMT-59	Quarterly	2	Vertical Profiling Transect		
MW-303-CMT-9	MW-303-CMT-9	Quarterly	2	Vertical Profiling Transect		
MW-304-125	MW-304-125	Semi-annual	2	Vertical Profiling Transect		
MW-304-15	MW-304-15	Quarterly	2	Vertical Profiling Transect		
MW-304-150	MW-304-150	Annual	-	Vertical Profiling Transect		
MW-304-70	MW-304-70	Quarterly	2	Vertical Profiling Transect		
MW-304-80	MW-304-80	Quarterly	2	Vertical Profiling Transect		
MW-304-96	MW-304-96	Quarterly	2	Vertical Profiling Transect		
MW-304-CMT-10	MW-304-CMT-10	Quarterly	2	Vertical Profiling Transect		
MW-304-CMT-20	MW-304-CMT-20	Quarterly	2	Vertical Profiling Transect		
MW-304-CMT-30	MW-304-CMT-30	Quarterly	2	Vertical Profiling Transect		
MW-304-CMT-40	MW-304-CMT-40	Quarterly	2	Vertical Profiling Transect		
MW-304-CMT-50	MW-304-CMT-50	Quarterly	2	Vertical Profiling Transect		
MW-304-CMT-60	MW-304-CMT-60	Quarterly	2	Vertical Profiling Transect		
MW-305-100	MW-305-100	Semi-annual	2	Vertical Profiling Transect		
MW-305-70	MW-305-70	Semi-annual	2	Vertical Profiling Transect		
MW-305-80	MW-305-80	Semi-annual	2	Vertical Profiling Transect		
MW-305-CMT-18	MW-305-CMT-18	Quarterly	2	Vertical Profiling Transect		
MW-305-CMT-28	MW-305-CMT-28	Quarterly	2	Vertical Profiling Transect		
MW-305-CMT-38	MW-305-CMT-38	Quarterly	2	Vertical Profiling Transect		
MW-305-CMT-48	MW-305-CMT-48	Semi-annual	2	Vertical Profiling Transect		
MW-305-CMT-58	MW-305-CMT-58	Semi-annual	2	Vertical Profiling Transect		
MW-305-CMT-8	MW-305-CMT-8	Quarterly	2	Vertical Profiling Transect		
MW-306-100	MW-306-100	Annual	-	Vertical Profiling Transect		
MW-306-15	MW-306-15	Annual	-	Vertical Profiling Transect		
MW-306-150	MW-306-150	Annual	-	Vertical Profiling Transect		
MW-306-70	MW-306-70	Annual	-	Vertical Profiling Transect		
MW-306-80	MW-306-80	Annual	-	Vertical Profiling Transect		
MW-306-CMT-10	MW-306-CMT-10	Quarterly	4	Vertical Profiling Transect		
MW-306-CMT-20	MW-306-CMT-20	Annual	-	Vertical Profiling Transect		
MW-306-CMT-30	MW-306-CMT-30	Annual	-	Vertical Profiling Transect		
MW-306-CMT-40	MW-306-CMT-40	Annual	-	Vertical Profiling Transect		
MW-306-CMT-50	MW-306-CMT-50	Annual	-	Vertical Profiling Transect		
MW-306-CMT-60	MW-306-CMT-60	Annual	-	Vertical Profiling Transect		

Table 3-6a
Sulfolane Monitoring Network - Onsite

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - Sulfolane Monitoring (Quarterly)	Notes
MW-307	MW-307-150	Quarterly	4	Plume Semiannual		
MW-309-15	MW-309-15	Quarterly	1	Plume	X	
MW-309-150	MW-309-150	Annual	-	Plume Delineation		
MW-309-66	MW-309-66	Quarterly	1	Plume	X	
MW-310-110	MW-310-110	Annual	-	Plume Delineation		
MW-310-15	MW-310-15	Quarterly	1	Plume (Gravel pit)		
MW-310-65	MW-310-65	Quarterly	1	Plume		
MW-321-15	MW-321-15	Quarterly	1	Plume (NE corner Lagoon A)		
MW-321-151	MW-321-151	Annual	-	Plume Delineation		
MW-321-65	MW-321-65	Quarterly	4	Plume Delineation		
MW-330-150	MW-330-150	Annual	-	Plume Delineation		
MW-330-20	MW-330-20	Quarterly	1	Plume		
MW-330-65	MW-330-65	Semi-annual	1	Plume Delineation		
MW-331-150	MW-331-150	Annual	-	Plume Delineation		
MW-334-15	MW-334-15	Quarterly	1	Plume Delineation	X	
MW-334-65	MW-334-65	Quarterly	1	Plume Delineation	X	
MW-334-85	MW-334-85	Quarterly	2	Phase 8		
MW-336-15	MW-336-15	Quarterly	1	Phase 8		
MW-336-20	MW-336-20	Quarterly	1	Phase 8		
MW-336-35	MW-336-35	Quarterly	1	Phase 8		
MW-336-55	MW-336-55	Quarterly	1	Phase 8		
MW-337-20	MW-337-20	Quarterly	2	Phase 8		
MW-344-15	MW-344-15	Quarterly	1	EGWRT	X	
MW-344-55	MW-344-55	Quarterly	1	EGWRT	X	
MW-344-75	MW-344-75	Quarterly	1	EGWRT	X	
MW-345-15	MW-345-15	Quarterly	1	EGWRT	X	
MW-345-55	MW-345-55	Quarterly	1	EGWRT	X	
MW-345-75	MW-345-75	Quarterly	1	EGWRT	X	
MW-348-15	MW-348-15	Quarterly	1	Phase 8		
MW-348-65	MW-348-65	Quarterly	1	Phase 8		
MW-351-15	MW-351-15	Quarterly	1	EGWRT	X	
MW-351-150	MW-351-150	Quarterly	1	EGWRT	X	
MW-351-55	MW-351-55	Quarterly	1	EGWRT	X	
MW-351-75	MW-351-75	Quarterly	1	EGWRT	X	
MW-354-15	MW-354-15	Quarterly	1	Phase 8		
MW-354-35	MW-354-35	Quarterly	1	Phase 8		
MW-354-60	MW-354-65	Quarterly	1	Phase 8		
MW-355-15	MW-355-15	Quarterly	1	Phase 8		
MW-355-55	MW-355-55	Quarterly	2	Phase 8		
MW-358-15	MW-358-15	Quarterly	2	Phase 8		
MW-358-150	MW-358-150	Quarterly	2	Phase 8		
MW-358-20	MW-358-20	Quarterly	2	Phase 8		
MW-358-40	MW-358-40	Quarterly	2	Phase 8		

Table 3-6a
Sulfolane Monitoring Network - Onsite

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - Sulfolane Monitoring (Quarterly)	Notes
MW-358-60	MW-358-60	Quarterly	2	Phase 8		
MW-359-15	MW-359-15	Quarterly	1	Phase 8		
MW-359-150	MW-359-150	Quarterly	1	Phase 8		
MW-359-35	MW-359-35	Quarterly	1	Phase 8		
MW-359-60	MW-359-60	Quarterly	1	Phase 8		
MW-359-80	MW-359-80	Quarterly	1	Phase 8		
MW-360-15	MW-360-15	Quarterly	1	Phase 8		
MW-360-150	MW-360-150	Quarterly	1	Phase 8		
MW-360-35	MW-360-35	Quarterly	1	Phase 8		
MW-360-50	MW-360-50	Quarterly	1	Phase 8		
MW-360-80	MW-360-80	Quarterly	1	Phase 8		
MW-361-15	MW-361-15	Quarterly	2	Phase 8		
MW-362-15	MW-362-15	Quarterly	2	Phase 8		
MW-362-150	MW-362-150	Quarterly	2	Phase 8		
MW-362-25	MW-362-25	Quarterly	2	Phase 8		
MW-362-35	MW-362-35	Quarterly	2	Phase 8		
MW-362-50	MW-362-50	Quarterly	2	Phase 8		
MW-362-80	MW-362-80	Quarterly	2	Phase 8		
MW-363-15	MW-363-15	Quarterly	2	Phase 8		
MW-364-15	MW-364-15	Quarterly	1	Phase 8		
MW-364-150	MW-364-150	Quarterly	1	Phase 8		
MW-364-30	MW-364-30	Quarterly	1	Phase 8		
MW-364-65	MW-364-65	Quarterly	1	Phase 8		
MW-364-90	MW-364-90	Quarterly	1	Phase 8		
MW-365-15	MW-365-15	Quarterly	2	Phase 8		
MW-366-15	MW-366-15	Quarterly	2	Phase 8		
MW-367-15	MW-367-15	Quarterly	2	Phase 8		
MW-368-15	MW-368-15	Quarterly	2	Phase 8		
MW-369	MW-369-cluster	Quarterly	1	EGWRT	X	To be installed Spring 2014
MW-370-15	MW-370-15	Quarterly	1	EGWRT	X	
MW-370-55	MW-370-55	Quarterly	1	EGWRT	X	
MW-370-75	MW-370-75	Quarterly	1	EGWRT	X	
MW-371	MW-371-cluster	Quarterly	1	EGWRT	X	To be installed Spring 2014
O-1	O-1	Quarterly	1	Plume		
O-12	O-12	Quarterly	1	Plume	X	
O-12-65	O-12-65	Quarterly	1	Phase 8	X	
O-14	O-14	Annual	-	Crossgradient		
O-19	O-19	Quarterly	1	Plume	X	
O-19-55	O-19-55	Quarterly	1	Phase 8	X	
O-19-90	O-19-90	Quarterly	1	Phase 8	X	
O-2	O-2	Quarterly	1	Plume	X	
O-20	O-20	Quarterly	4	Plume		
O-24	O-24	Quarterly	1	Plume	X	

Table 3-6a
Sulfolane Monitoring Network - Onsite

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

"Old" Well Name	"New" Well Name	Frequency	Cold Weather Priority	Category	Groundwater Extraction System - Sulfolane Monitoring (Quarterly)	Notes
O-24-65	O-24-65	Quarterly	1	Phase 8	X	
O-26	O-26	Quarterly	1	Plume	X	
O-26-65	O-26-65	Quarterly	1	Phase 8	X	
O-27-150	O-27-150	Quarterly	2	Phase 8		
O-27-65	O-27-65	Quarterly	2	Phase 8		
O-3	O-3	Quarterly	1	Plume	X	
O-31	O-31	Quarterly	2	Phase 8		
O-32	O-32	Quarterly	2	Phase 8		
O-33	O-33	Quarterly	2	Phase 8		
O-34	O-34	Quarterly	2	Phase 8		
O-35	O-35	Quarterly	2	Phase 8		
O-36	O-36	Quarterly	2	Phase 8		
O-37	O-37	Quarterly	2	Phase 8		
O-38	O-38	Quarterly	2	Phase 8		
O-4	O-4	Quarterly	1	Plume	X	
O-5	O-5	Quarterly	1	Plume	X	
O-5-65	O-5-65	Quarterly	1	Phase 8	X	
O-6	O-6	Quarterly	1	Plume	X	
R-21	R-21	Monthly	1	Plume		With GAC sampling
R-32R	R-32R	Quarterly	2	Phase 8		
R-35R	R-35R	Monthly	1	Plume		With GAC sampling
R-42	R-42	Monthly	1	Plume		With GAC sampling
R-43	R-43	Monthly	1	Plume		With GAC sampling
R-44	R-44	Monthly	1	Plume		With GAC sampling
R-45	R-45	Monthly	1	Plume		With GAC sampling
R-46	R-46	Monthly	1	Plume		With GAC sampling
R-47	R-47	Monthly	1	Plume		With GAC sampling; once installed
R-48	R-48	Monthly	1	Plume		With GAC sampling; once installed
S-21	S-21	Semi-annual	4	Plume		
S-39	S-39	Quarterly	4	Monitor Recovery Well R-36		
S-41R	S-41R	Quarterly	1	Phase 8		
S-43	S-43	Quarterly	1	Plume	X	
S-50	S-50	Semi-annual	4	Plume		
S-51	S-51	Quarterly	4	Monitor Recovery Well R-38	X	

General Notes:

Semi-annual wells will be sampled during the first and third quarters of the year.
Annual wells will be sampled during the third quarter of the year.

Acronyms and Abbreviations:

NE = Northeast
EGWRT = Expanded groundwater recovery and treatment
Phase 8 = Phase 8 Monitoring Well

**Table 3-6b
Sulfolane Monitoring Network - Offsite**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

"Old" Well Name	"New" Well Name	Frequency	Priority	Category	Notes
MW-148-100	MW-148-100	Quarterly	1	Phase 8	
MW-148-80	MW-148-80	Quarterly	1	Phase 8	
MW-148A	MW-148A-15	Quarterly	1	Plume (downgradient property boundary)	
MW-148B	MW-148B-30	Quarterly	1	Plume (downgradient property boundary)	
MW-148C	MW-148C-55	Quarterly	1	Plume (downgradient property boundary)	
MW-148D	MW-148D-150	Quarterly	1	Plume (downgradient property boundary)	
MW-150A	MW-150A-10	Semi-annual	3	Plume Delineation	
MW-150B	MW-150B-25	Semi-annual	3	Plume Delineation	
MW-150C	MW-150C-60	Quarterly	3	Plume Delineation	
MW-151A	MW-151A-15	Quarterly	1	Plume Delineation	
MW-151B	MW-151B-25	Quarterly	1	Plume Delineation	
MW-151C	MW-151C-60	Quarterly	1	Plume Delineation	
MW-152A	MW-152A-15	Quarterly	4	Plume Delineation	
MW-152B	MW-152B-25	Quarterly	4	Plume Delineation	
MW-152C	MW-152C-65	Quarterly	4	Plume Delineation	
MW-153A	MW-153A-15	Quarterly	2	Plume Delineation	
MW-153B	MW-153B-55	Quarterly	2	Plume Delineation	
MW-155A	MW-155A-15	Semi-annual	4	Plume Delineation	
MW-155B	MW-155B-65	Semi-annual	4	Plume Delineation	Dedicated pump
MW-156A	MW-156A-15	Semi-annual	4	Plume Delineation	
MW-156B	MW-156B-50	Semi-annual	4	Plume Delineation	
MW-157A	MW-157A-15	Quarterly	1	Plume Delineation	
MW-157B	MW-157B-30	Quarterly	1	Plume Delineation	
MW-158A	MW-158A-15	Semi-annual	1	Plume Delineation	
MW-158B	MW-158B-60	Semi-annual	1	Plume Delineation	
MW-159A	MW-159A-15	Quarterly	4	Plume Delineation	
MW-159B	MW-159B-45	Quarterly	4	Plume Delineation	
MW-159C	MW-159C-70	Quarterly	4	Plume Delineation	
MW-160AR-15	MW-160AR-15	Quarterly	1	Phase 8	
MW-160B	MW-160B-90	Quarterly	1	Plume Delineation	
MW-161-30	MW-161-30	Quarterly	1	Phase 8	
MW-161A	MW-161A-15	Quarterly	1	Plume Delineation	
MW-161B	MW-161B-50	Quarterly	1	Plume Delineation	
MW-162A	MW-162A-15	Semi-annual	3	Plume Delineation	
MW-162B	MW-162B-65	Quarterly	3	Plume Delineation	
MW-163A	MW-163A-15	Quarterly	3	Plume Delineation	
MW-163B	MW-163B-40	Semi-annual	3	Plume Delineation	
MW-164A	MW-164A-15	Quarterly	1	Plume Delineation	
MW-164B	MW-164B-50	Quarterly	1	Plume Delineation	

**Table 3-6b
Sulfolane Monitoring Network - Offsite**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

"Old" Well Name	"New" Well Name	Frequency	Priority	Category	Notes
MW-164C	MW-164C-60	Quarterly	1	Plume Delineation	
MW-165A	MW-165A-15	Quarterly	2	Plume Delineation	
MW-165B	MW-165B-50	Quarterly	2	Plume Delineation	
MW-166A	MW-166A-15	Quarterly	1	Plume Delineation	
MW-166B	MW-166B-30	Quarterly	1	Plume Delineation	
MW-167A	MW-167A-15	Quarterly	1	Plume Delineation	
MW-167B	MW-167B-35	Quarterly	1	Plume Delineation	
MW-168A	MW-168A-15	Quarterly	1	Plume Delineation	
MW-168B	MW-168B-50	Quarterly	1	Plume Delineation	
MW-169A	MW-169A-15	Quarterly	4	Plume Delineation	
MW-169C	MW-169C-60	Quarterly	4	Plume Delineation	
MW-170A	MW-170A-15	Semi-annual	4	Plume Delineation	
MW-170B	MW-170B-75	Semi-annual	4	Plume Delineation	Dedicated pump
MW-170C	MW-170C-130	Semi-annual	4	Plume Delineation	
MW-170D	MW-170D-50	Semi-annual	4	Plume Delineation	Dedicated pump
MW-171A	MW-171A-15	Semi-annual	4	Plume Delineation	
MW-171B	MW-171B-40	Semi-annual	4	Plume Delineation	Dedicated pump
MW-172A	MW-172A-15	Quarterly	4	Plume Delineation	
MW-172B	MW-172B-150	Quarterly	4	Plume Delineation	
MW-181A	MW-181A-15	Quarterly	1	Plume Delineation	
MW-181B	MW-181B-50	Quarterly	1	Plume Delineation	
MW-181C	MW-181C-150	Quarterly	1	Plume Delineation	
MW-182A	MW-182A-15	Quarterly	1	Plume Delineation	
MW-182B	MW-182B-45	Quarterly	1	Plume Delineation	
MW-183A	MW-183A-15	Quarterly	1	Plume Delineation	
MW-183B	MW-183B-60	Quarterly	1	Plume Delineation	
MW-184	MW-184-45	Quarterly	4	Plume Delineation	
MW-185A	MW-185A-15	Quarterly	2	Plume Delineation	
MW-185B	MW-185B-50	Quarterly	2	Plume Delineation	
MW-185C	MW-185C-120	Quarterly	2	Plume Delineation	
MW-187	MW-187-15	Quarterly	2	Plume Delineation	
MW-189A	MW-189A-15	Quarterly	2	Plume Delineation	
MW-189B	MW-189B-60	Quarterly	2	Plume Delineation	
MW-190-150	MW-190-150	Quarterly	2	Phase 8	
MW-190A	MW-190A-15	Quarterly	2	Plume Delineation	
MW-190BR-60	MW-190BR-60	Quarterly	2	Phase 8	
MW-191A	MW-191A-15	Quarterly	4	Plume Delineation	
MW-191B	MW-191B-60	Quarterly	4	Plume Delineation	
MW-193A	MW-193A-15	Quarterly	4	Plume Delineation	

Table 3-6b
Sulfolane Monitoring Network - Offsite

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

"Old" Well Name	"New" Well Name	Frequency	Priority	Category	Notes
MW-193B	MW-193B-60	Quarterly	4	Plume Delineation	
MW-194A	MW-194A-15	Quarterly	1	Plume Delineation	
MW-194B	MW-194B-40	Quarterly	1	Plume	
MW-308-15	MW-308-15	Quarterly	1	Plume Delineation	
MW-308-30	MW-308-30	Quarterly	1	Plume Delineation	
MW-311-15	MW-311-15	Semi-annual	4	Plume Delineation	
MW-311-46	MW-311-46	Semi-annual	4	Plume Delineation	
MW-314-15	MW-314-15	Quarterly	4	Plume Delineation	
MW-314-150	MW-314-150	Quarterly	4	Plume Delineation	
MW-316-15	MW-316-15	Quarterly	4	Plume Delineation	
MW-316-56	MW-316-56	Quarterly	4	Plume Delineation	
MW-317-15	MW-317-15	Quarterly	4	Plume	
MW-317-71	MW-317-71	Quarterly	4	Plume	
MW-318-135	MW-318-135	Annual	-	Plume Delineation	
MW-318-20	MW-318-20	Annual	-	Plume Delineation	
MW-322-15	MW-322-15	Annual	-	Plume Delineation	
MW-322-150	MW-322-150	Annual	-	Plume Delineation	
MW-323-15	MW-323-15	Semi-annual	4	Plume Delineation	
MW-323-61	MW-323-61	Semi-annual	4	Plume Delineation	
MW-325-150	MW-325-150	Quarterly	4	Plume Delineation	
MW-325-18	MW-325-18	Quarterly	4	Plume Delineation	
MW-328-15	MW-328-15	Quarterly	1	Plume Delineation	
MW-328-151	MW-328-151	Quarterly	1	Plume Delineation	
MW-329-15	MW-329-15	Quarterly	3	Plume	
MW-329-66	MW-329-66	Quarterly	3	Plume	
MW-332-110	MW-332-110	Quarterly	1	Phase 8	
MW-332-15	MW-332-15	Quarterly	1	Plume Delineation	
MW-332-150	MW-332-150	Quarterly	1	Plume Delineation	
MW-332-41	MW-332-41	Quarterly	1	Phase 8	
MW-332-75	MW-332-75	Quarterly	1	Phase 8	
MW-335-41	MW-335-41	Quarterly	1	Plume Delineation	
MW-338-15	MW-338-15	Quarterly	1	Phase 8	
MW-338-50	MW-338-50	Quarterly	1	Phase 8	
MW-339-15	MW-339-15	Quarterly	1	Phase 8	
MW-339-50	MW-339-50	Quarterly	1	Phase 8	
MW-340-150	MW-340-150	Quarterly	2	Phase 8	
MW-340-18	MW-340-18	Quarterly	2	Phase 8	
MW-340-65	MW-340-65	Quarterly	2	Phase 8	
MW-341-15	MW-341-15	Quarterly	2	Phase 8	

**Table 3-6b
Sulfolane Monitoring Network - Offsite**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

"Old" Well Name	"New" Well Name	Frequency	Priority	Category	Notes
MW-341-40	MW-341-40	Quarterly	2	Phase 8	
MW-342-15	MW-342-15	Quarterly	1	Phase 8	
MW-342-65	MW-342-65	Quarterly	1	Phase 8	
MW-343-15	MW-343-15	Quarterly	1	Phase 8	
MW-343-50	MW-343-50	Quarterly	1	Phase 8	
MW-346-15	MW-346-15	Quarterly	2	Phase 8	
MW-346-150	MW-346-150	Quarterly	2	Phase 8	
MW-346-65	MW-346-65	Quarterly	2	Phase 8	
MW-347-150	MW-347-150	Quarterly	2	Phase 8	
MW-347-20	MW-347-20	Quarterly	2	Phase 8	
MW-347-65	MW-347-65	Quarterly	2	Phase 8	
MW-349-15	MW-349-15	Quarterly	1	Phase 8	
MW-349-45	MW-349-45	Quarterly	1	Phase 8	
MW-350-15	MW-350-15	Quarterly	1	Phase 8	
MW-350-50	MW-350-50	Quarterly	1	Phase 8	
MW-352-15	MW-352-15	Quarterly	1	Phase 8	
MW-352-40	MW-352-40	Quarterly	1	Phase 8	
MW-353-100	MW-353-100	Quarterly	2	Phase 8	
MW-353-15	MW-353-15	Quarterly	2	Phase 8	
MW-353-65	MW-353-65	Quarterly	2	Phase 8	
MW-356-15	MW-356-20	Quarterly	2	Phase 8	
MW-356-65	MW-356-65	Quarterly	2	Phase 8	
MW-356-90	MW-356-90	Quarterly	2	Phase 8	
MW-357-15	MW-357-15	Quarterly	2	Phase 8	
MW-357-150	MW-357-150	Quarterly	2	Phase 8	
MW-357-65	MW-357-65	Quarterly	2	Phase 8	

General Notes:

Semi-annual wells will be sampled during the first and third quarters of the year.
Annual wells will be sampled during the third quarter of the year.

Acronyms and Abbreviations:

Phase 8 = Phase 8 Monitoring Well

Table 4-1
Groundwater Well Field Parameter Results
Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Date	Proximity	New Location Name	Sample	Analysis	Depth to ice (ft.)	Depth to Water (ft.)	Depth to LNAPL (ft.)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes	Additional Notes
10/14/2013	On-site	MW-101-60	EB-101-60	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-101-60	
10/14/2013	On-site	MW-101-60	MW-101-60	S	--	11.11	--	4.95	0.20	240.0	7.35	29.5	clear	Parameters stabilized	
10/14/2013	On-site	MW-101A-25	MW-101A-25	S	--	11.64	--	4.20	0.34	257.0	7.37	-11.2	clear	Parameters stabilized	
10/14/2013	On-site	MW-101A-25	MW-201A-25	S	--	--	--	--	--	--	--	--	--	DUP of MW-101A-25	
10/31/2013	On-site	MW-104-65	MW-104-65	S	--	12.82	--	--	0.18	252.9	7.03	28.3	clear	Parameters stabilized	
10/28/2013	On-site	MW-105-65	EB-105-65	S	--	--	--	--	--	--	--	--	--	EB collected at office after sampling MW-105-65	
10/28/2013	On-site	MW-105-65	MW-105-65	S	--	11.37	--	3.60	0.45	212.0	7.03	-29.9	clear	Parameters stabilized	
10/3/2013	On-site	MW-106-25	MW-106-25	S, B, PAH	--	14.47	--	3.9	0.11	225.6	7.12	-9.3	clear	Parameters stabilized	
11/1/2013	On-site	MW-109-15	MW-109-15	S, B	--	10.36	--	11.8	0.11	356.8	6.82	-85.2	clear	Parameters stabilized	
10/15/2013	On-site	MW-110-20	MW-110-20	S, B, thiolane	--	11.89	--	7.05	0.19	458	7.02	-143.8	clear	>3 well volumes purged	
10/25/2013	On-site	MW-110-65	MW-110-65	S	--	11.67	--	5.90	0.36	250.9	7.20	-38.7	clear	Parameters stabilized	
10/22/2013	On-site	MW-113-15	MW-113-15	S, B	--	10.79	--	4.90	0.12	347.7	6.75	-70.1	clear	>3 well volumes purged	
10/22/2013	On-site	MW-113-15	MW-213-15	B	--	--	--	--	--	--	--	--	--	DUP of MW-113-15	
11/17/2013	On-site	MW-115-15	MW-115-15	S, B	--	10.30	10.20	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/17/2013	On-site	MW-116-15	MW-116-15	S, B	--	10.56	--	6.34	0.97	554	6.80	-102.9	clear	>3 well volumes purged	
11/17/2013	On-site	MW-116-15	MW-216-15	B	--	--	--	--	--	--	--	--	--	DUP of MW-116-15	
11/1/2013	On-site	MW-124-25	MW-124-25	B	--	14.68	--	5.30	0.21	335.9	6.76	-64.9	clear	Parameters stabilized	
11/1/2013	On-site	MW-125-25	MW-125-25	S, B	--	12.49	--	4.90	0.17	295.7	7.15	-124.3	clear	Parameters stabilized	
11/16/2013	On-site	MW-126-25	MW-126-25	B	--	11.78	--	3.85	0.84	275	7.18	-65.2	clear	>3 well volumes purged	
11/16/2013	On-site	MW-126-25	MW-226-25	B	--	--	--	--	--	--	--	--	--	DUP of MW-126-25	
10/19/2013	On-site	MW-127-25	MW-127-25	S, B	--	13.04	--	6.05	0.51	299.0	7.18	-51.0	clear	Parameters stabilized	
10/19/2013	On-site	MW-129-40	MW-129-40	S, B	--	12.02	--	3.40	0.13	241.0	6.79	-33.8	clear	>3 well volumes purged	
11/11/2013	On-site	MW-130-25	MW-130-25	S, B	--	13.23	sheen	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
10/22/2013	On-site	MW-131-25	MW-131-25	S	--	12.43	--	3.80	0.17	302.0	6.78	-8.10	clear	>3 well volumes purged	
11/7/2013	On-site	MW-132-20	MW-132-20	S, B	--	15.09	--	4.20	0.12	234.9	7.13	-39.0	clear	Parameters stabilized	
11/7/2013	On-site	MW-132-20	MW-232-20	B	--	--	--	--	--	--	--	--	--	DUP of MW-132-20	
11/7/2013	On-site	MW-133-20	MW-133-20	S, B, i/m	--	13.99	--	4.10	0.13	224.3	7.17	-9.90	clear	>3 well volumes purged	
11/16/2013	On-site	MW-134-20	EB-134-20	S, B	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-134-20	
11/16/2013	On-site	MW-134-20	MW-134-20	S, B	--	12.29	--	3.40	0.44	282.0	7.04	-117.3	clear	>3 well volumes purged	
11/7/2013	On-site	MW-135-20	MW-135-20	S, B	--	13.28	13.25	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/1/2013	On-site	MW-136-20	MW-136-20	B	--	13.07	sheen	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/16/2013	On-site	MW-137-20	MW-137-20	B	--	13.20	--	4.69	0.28	331.0	6.73	-31.2	clear	>3 well volumes purged	
11/14/2013	On-site	MW-138-20	MW-138-20	S	--	11.34	11.16	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
10/16/2013	On-site	MW-139-25	MW-139-25	S, B	--	13.54	--	3.52	0.46	260.0	7.02	-95.2	clear	Parameters stabilized	
10/16/2013	On-site	MW-139-25	MW-239-25	S	--	--	--	--	--	--	--	--	--	DUP of MW-139-25	
10/31/2013	On-site	MW-140-25	MW-140-25	B	--	11.52	--	3.90	1.75	337.9	6.74	12.9	clear	Parameters stabilized	
10/3/2013	On-site	MW-141-20	MW-141-20	S, B, PAH	--	8.75	--	6.2	0.12	232.0	7.13	-9.2	clear	>3 well volumes purged	
10/15/2013	On-site	MW-142-20	MW-142-20	S, B	--	12.12	--	4.12	1.12	262.0	7.26	-128.7	clear	>3 well volumes purged	
10/15/2013	On-site	MW-142-20	MW-242-20	S	--	--	--	--	--	--	--	--	--	DUP of MW-142-20	
10/15/2013	On-site	MW-143-20	MW-143-20	S, B	--	11.84	--	5.24	2.39	299.0	6.84	96.3	clear	Parameters stabilized	
10/15/2013	On-site	MW-143-20	MW-243-20	S	--	--	--	--	--	--	--	--	--	DUP of MW-143-20	
10/30/2013	On-site	MW-144A-25	MW-144A-25	S	--	11.73	--	3.50	0.16	331.2	6.58	-11.5	clear	Parameters stabilized	
10/30/2013	On-site	MW-144BR-90	MW-144BR-90	S	--	11.43	--	4.40	0.08	240.0	7.08	16.7	clear	Parameters stabilized	
10/19/2013	On-site	MW-145-20	MW-145-20	S, B	--	11.95	--	5.24	5.40	402	6.87	49.1	clear	>3 well volumes purged	
11/12/2013	On-site	MW-146A-15	MW-146A-15	S	--	11.84	--	5.10	1.88	234.0	6.66	40.3	clear	>3 well volumes purged	Sampled as part of North Gravel Pit Study; not on Q4 schedule
11/12/2013	On-site	MW-146B-30	MW-146B-30	S	--	11.69	--	6.30	0.24	212.9	7.20	-32.5	clear	>3 well volumes purged	Sampled as part of North Gravel Pit Study; not on Q4 schedule
11/12/2013	On-site	MW-147A-15	MW-147A-15	S	--	8.99	--	4.50	0.51	214.5	7.20	-12.8	clear	Parameters stabilized	Sampled as part of North Gravel Pit Study; not on Q4 schedule
10/28/2013	On-site	MW-147B-25	MW-147B-25	S, i/m	--	9.51	--	5.60	0.43	240.4	6.98	16.0	clear	>3 well volumes purged	
10/17/2013	On-site	MW-154A-75	MW-154A-75	S, i/m, B	--	14.36	--	5.03	0.35	233.0	7.34	-28.6	clear	Parameters stabilized	
10/17/2013	On-site	MW-154B-95	MW-154B-95	S, B, i/m	--	14.12	--	4.90	0.13	242.8	7.17	-123.5	clear	Parameters stabilized	
10/17/2013	On-site	MW-154B-95	MW-254B-95	S	--	--	--	--	--	--	--	--	--	DUP of MW-154B-95	
10/29/2013	On-site	MW-173A-15	MW-173A-15	S, i/m	--	12.44	--	3.00	0.44	273.1	6.65	25.4	clear	Parameters stabilized	
10/29/2013	On-site	MW-173B-150	MW-173B-150	S, i/m	--	12.67	--	4.70	0.18	231.1	7.03	-25.1	clear	Parameters stabilized	
10/23/2013	On-site	MW-174-15	MW-174-15	S, B	--	10.35	--	6.60	0.20	298.0	8.69	-95.8	clear	>3 well volumes purged	

**Table 4-1
Groundwater Well Field Parameter Results**

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Date	Proximity	New Location Name	Sample	Analysis	Depth to ice (ft.)	Depth to Water (ft.)	Depth to LNAPL (ft.)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes	Additional Notes
10/23/2013	On-site	MW-174A-50	MW-174A-50	S	--	10.09		5.22	0.78	211.0	8.64	-57.6	clear	>3 well volumes purged	
10/23/2013	On-site	MW-174B-90	MW-174B-90	S	--	9.31	--	5.70	0.15	247.9	6.97	-29.8	clear	Parameters stabilized	
11/4/2013	On-site	MW-175-90	EB-175-90	B	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-175-90	
11/4/2013	On-site	MW-175-90	MW-175-90	S,B	--	13.11	--	5.10	0.13	253.2	6.84	-89.7	clear	Parameters stabilized	
11/11/2013	On-site	MW-176A-15	MW-176A-15	S,B,i/m	--	15.42	11.99	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/11/2013	On-site	MW-176B-50	MW-176B-50	S	--	12.44	--	5.90	0.31	199.0	7.36	-26.0	clear	Parameters stabilized	
11/27/2013	On-site	MW-176C-90	MW-176C-90	S, i/m	--	11.08	--	3.40	0.27	188.8	6.89	-34.2	clear	Parameters stabilized	
10/31/2013	On-site	MW-177-90	MW-177-90	S	--	11.96	--	4.50	0.14	242.3	7.12	-69.7	clear	Parameters stabilized	
11/7/2013	On-site	MW-178A-15	MW-178A-15	S	--	11.83	--	5.50	0.16	306.6	7.15	-117.3	clear	>3 well volumes purged	
11/11/2013	On-site	MW-178B-50	MW-178B-50	S	--	11.51	--	4.10	0.12	235.6	7.21	-38.0	clear	Parameters stabilized	
11/11/2013	On-site	MW-178B-50	MW-278B-50	S	--	--	--	--	--	--	--	--	--	DUP of MW-178B-50	
11/15/2013	On-site	MW-178C-90	MW-178C-90	S	--	12.18	--	4.50	0.16	195.5	6.28	43.2	clear	Parameters stabilized	
11/12/2013	On-site	MW-179A-15	MW-179A-15	S,B	--	12.23	--	4.40	2.10	262.9	6.93	-21.8	clear	>3 well volumes purged	
11/12/2013	On-site	MW-179B-50	EB-179B-50	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-179B-50	
11/12/2013	On-site	MW-179B-50	MW-179B-50	S	--	11.97	--	4.10	1.00	204.1	6.99	55.4	clear	Parameters stabilized	
11/15/2013	On-site	MW-179C-90	MW-179C-90	S	--	12.08	--	4.40	0.14	194.7	6.82	1.10	clear	Parameters stabilized	
11/12/2013	On-site	MW-179D-135	MW-179D-135	S	--	12.32	--	4.20	1.10	190.7	6.74	83.1	clear	Parameters stabilized	
11/11/2013	On-site	MW-180A-15	MW-180A-15	S,B,i/m	--	12.92	--	4.40	0.14	284.0	6.86	-79.1	clear	Parameters stabilized	
11/11/2013	On-site	MW-180A-15	MW-280A-15	B	--	--	--	--	--	--	--	--	--	DUP of MW-180A-15	
11/11/2013	On-site	MW-180B-50	MW-180B-50	S	--	12.03	--	3.70	0.10	213.2	7.19	-34.3	clear	Parameters stabilized	
11/11/2013	On-site	MW-180C-90	MW-180C-90	S,i/m	--	12.22	--	4.20	0.10	204.5	7.16	-78.2	clear	Parameters stabilized	
11/5/2013	On-site	MW-186A-15	MW-186A-15	S,B,i/m	--	12.91	12.51	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/5/2013	On-site	MW-186B-60	MW-186B-60	S, B	--	12.28	--	4.90	0.09	257.9	7.10	34.0	clear	Parameters stabilized	
11/5/2013	On-site	MW-186C-100	MW-186C-100	S	--	12.11	--	5.20	0.13	250.3	7.12	18.6	clear	Parameters stabilized	
11/5/2013	On-site	MW-186D-135	MW-186D-135	S,i/m	--	12.04	--	4.70	0.13	237.3	7.00	-7.50	clear	Parameters stabilized	
11/5/2013	On-site	MW-186E-75	MW-186E-75	S,B,i/m	--	12.11	--	4.70	0.12	253.5	7.04	3.86	clear	Parameters stabilized	
10/23/2013	On-site	MW-195A-15	MW-195A-15	S, i/m	--	11.62	--	6.80	0.17	384.6	6.49	77.6	clear	>3 well volumes purged	
10/23/2013	On-site	MW-195A-15	MW-295A-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-195A-15	
10/23/2013	On-site	MW-195B-150	MW-195B-150	S, i/m	--	11.56	--	5.72	0.39	225.0	8.62	94.7	clear	Parameters stabilized	
10/15/2013	On-site	MW-196-15	MW-196-15	S, thiolane	--	11.20	--	5.95	0.78	233.0	7.14	-31.0	clear	>3 well volumes purged	
11/4/2013	On-site	MW-197A-65	MW-197A-65	S, i/m	--	11.43	--	4.40	0.11	257.8	6.76	24.7	clear	Parameters stabilized	
11/4/2013	On-site	MW-197B-150	MW-197B-90	S, i/m	--	11.40	--	4.80	0.15	235.5	6.94	16.5	clear	Parameters stabilized	
11/15/2013	On-site	MW-198-150	MW-198-150	S	--	8.00	--	5.05	0.58	198.0	7.46	-35.4	clear	Parameters stabilized	
10/30/2013	On-site	MW-199-150	MW-199-150	S, B, i/m	--	12.15	--	4.80	0.13	232.4	7.03	62.5	clear	Parameters stabilized	
11/6/2013	On-site	MW-300-150	MW-300-150	S	--	11.25	--	4.90	0.13	203.6	7.22	-15.4	clear	Parameters stabilized	
10/16/2013	On-site	MW-301-60	MW-301-60	S	--	9.25	--	6.10	0.10	254.1	7.07	23.9	clear	Parameters stabilized	
10/16/2013	On-site	MW-301-70	EB-301-70	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-301-70	
10/16/2013	On-site	MW-301-70	MW-301-70	S, i/m	--	9.21	--	6.10	0.11	248.6	7.22	-8.10	CLEAR	Parameters stabilized	
10/16/2013	On-site	MW-301-CMT-10	MW-301-CMT-10	S	--	9.52	--	9.04	0.58	328.0	6.69	10.9	clear	Parameters stabilized	
10/16/2013	On-site	MW-301-CMT-20	MW-301-CMT-20	S, i/m	--	9.51	--	8.55	0.42	269.0	7.38	-57.8	clear	Parameters stabilized	
10/16/2013	On-site	MW-301-CMT-30	MW-301-CMT-30	S	--	9.50	--	7.55	0.45	252.0	7.29	-47.4	clear	Parameters stabilized	
10/16/2013	On-site	MW-301-CMT-40	MW-301-CMT-40	S	--	9.51	--	6.66	0.45	253.0	7.28	-27.3	clear	Parameters stabilized	
10/16/2013	On-site	MW-301-CMT-50	MW-301-CMT-50	S	--	9.51	--	6.63	0.40	256.0	7.28	-28.5	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-110	MW-302-110	S, i/m	--	10.12	--	5.42	0.41	224.0	7.36	92.5	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-70	MW-302-70	S	--	9.78	--	5.15	0.39	241.0	7.31	119.7	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-80	MW-302-80	S	--	9.87	--	5.31	0.32	239.0	7.31	87.1	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-95	MW-302-95	S	--	9.47	--	5.49	0.74	225.0	7.34	175.5	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-CMT-10	MW-302-CMT-10	S	--	9.56	--	5.50	0.29	283.5	6.89	-42.2	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-CMT-20	MW-302-CMT-20	S,i/m	--	9.76	--	4.60	0.15	265.7	7.08	-65.5	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-CMT-20	MW-402-CMT-20	S	--	--	--	--	--	--	--	--	--	DUP of MW-302-CMT-20	
10/14/2013	On-site	MW-302-CMT-30	MW-302-CMT-30	S	--	9.77	--	4.50	0.13	259.6	7.13	-39.4	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-CMT-40	MW-302-CMT-40	S	--	9.76	--	4.90	0.14	241.4	7.15	-70.0	clear	Parameters stabilized	
10/14/2013	On-site	MW-302-CMT-50	MW-302-CMT-50	S, i/m	--	9.78	--	5.00	0.13	244.8	7.18	-72.1	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-130	MW-303-130	S, i/m	--	11.61	--	4.99	0.27	211.0	7.34	23.4	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-70	MW-303-70	S	--	11.63	--	5.06	0.27	229.0	7.31	27.0	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-80	MW-303-80	S	--	11.66	--	5.13	0.33	221.0	7.31	125.6	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-95	MW-303-95	S	--	11.62	--	5.06	0.54	218.0	7.31	144.6	clear	Parameters stabilized	

**Table 4-1
Groundwater Well Field Parameter Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
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North Pole Refinery, North Pole, Alaska**

Date	Proximity	New Location Name	Sample	Analysis	Depth to ice (ft.)	Depth to Water (ft.)	Depth to LNAPL (ft.)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes	Additional Notes
10/15/2013	On-site	MW-303-CMT-19	MW-303-CMT-19	S, i/m	--	12.17	--	4.80	0.16	288.8	7.11	-95.4	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-CMT-19	MW-403-CMT-19	S	--	--	--	--	--	--	--	--	--	DUP of MW-303-CMT-19	
10/15/2013	On-site	MW-303-CMT-29	MW-303-CMT-29	S	--	12.17	--	4.20	0.23	261.6	7.30	-110.0	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-CMT-39	MW-303-CMT-39	S	--	12.16	--	4.40	0.17	241.9	7.29	-99.4	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-CMT-49	MW-303-CMT-49	S, i/m	--	12.17	--	4.60	0.20	241.4	7.29	-115.0	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-CMT-59	MW-303-CMT-59	S	--	12.16	--	4.80	0.23	240.8	7.30	-110.2	clear	Parameters stabilized	
10/15/2013	On-site	MW-303-CMT-9	MW-303-CMT-9	S	--	12.23	--	5.80	0.75	323.0	6.65	19.7	clear	Parameters stabilized	
10/16/2013	On-site	MW-304-125	MW-304-125	S	--	13.75	--	4.67	0.32	185.0	7.11	15.7	clear	Parameters stabilized	
11/18/2013	On-site	MW-304-15	MW-304-15	S, i/m	--	13.19	--	2.97	0.58	319.0	6.60	-40.7	clear	Parameters stabilized	
11/18/2013	On-site	MW-304-15	MW-404-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-304-15	
11/18/2013	On-site	MW-304-150	MW-304-150	S, i/m	--	13.19	--	4.48	0.74	194.0	7.37	129.7	clear	Parameters stabilized	
11/18/2013	On-site	MW-304-70	MW-304-70	S, i/m	--	13.17	--	4.45	0.43	207.0	7.34	120.8	clear	Parameters stabilized	
10/15/2013	On-site	MW-304-80	EB-304-80	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-304-80	
10/15/2013	On-site	MW-304-80	MW-304-80	S	--	13.17	--	4.72	0.25	192.0	7.34	-20.4	clear	Parameters stabilized	
10/15/2013	On-site	MW-304-95	MW-304-95	S	--	13.38	--	4.76	0.43	191.0	7.33	17.4	clear	Parameters stabilized	
11/19/2013	On-site	MW-304-CMT-10	no sample	S	--	DRY	--	--	--	--	--	--	--	Well dry	
11/19/2013	On-site	MW-304-CMT-20	MW-304-CMT-20	S	--	13.81	--	2.34	1.93	350.0	R	-6.7	clear	>3 well volumes purged	pH probe malfunction
11/19/2013	On-site	MW-304-CMT-30	MW-304-CMT-30	S	--	13.80	--	2.41	1.14	247.0	R	-25.8	clear	>3 well volumes purged	pH probe malfunction; dye observed in sample (bright green)
11/19/2013	On-site	MW-304-CMT-40	MW-304-CMT-40	S	--	13.80	--	2.73	0.91	218.0	R	17.7	clear	>3 well volumes purged	pH probe malfunction
11/19/2013	On-site	MW-304-CMT-50	MW-304-CMT-50	S	--	13.79	--	2.93	0.70	197.0	6.43	35.6	clear	>3 well volumes purged	
11/19/2013	On-site	MW-304-CMT-60	MW-304-CMT-60	S	--	13.78	--	2.72	0.35	194.0	6.50	23.1	clear	>3 well volumes purged	
11/18/2013	On-site	MW-305-100	MW-305-100	S, i/m	--	12.01	--	4.51	0.93	204.0	7.29	167.9	clear	Parameters stabilized	
11/18/2013	On-site	MW-305-70	MW-305-70	S	--	12.11	--	4.43	0.70	205.0	7.34	167.5	clear	Parameters stabilized	
11/18/2013	On-site	MW-305-80	MW-305-80	S	--	11.70	--	4.46	0.56	204.0	7.33	167.4	clear	Parameters stabilized	
11/18/2013	On-site	MW-305-CMT-18	MW-305-CMT-18	S, i/m	--	12.72	--	3.66	0.70	263.0	6.82	6.90	clear	>3 well volumes purged	
11/18/2013	On-site	MW-305-CMT-28	MW-305-CMT-28	S	--	12.71	--	3.25	0.29	221.0	6.82	25.3	clear	Parameters stabilized	
11/18/2013	On-site	MW-305-CMT-38	MW-305-CMT-38	S	--	12.69	--	3.15	0.51	204.0	6.64	28.3	clear	>3 well volumes purged	
11/18/2013	On-site	MW-305-CMT-48	MW-305-CMT-48	S, i/m	--	12.67	--	3.22	0.39	201.0	6.60	19.6	clear	Parameters stabilized	
11/18/2013	On-site	MW-305-CMT-58	MW-305-CMT-58	S	--	12.68	--	3.26	0.67	198.0	6.52	15.1	clear	>3 well volumes purged	
11/18/2013	On-site	MW-305-CMT-8	no sample	S	--	DRY	--	--	--	--	--	--	--	Well dry	
10/17/2013	On-site	MW-306-100	MW-306-100	S	--	12.20	--	4.40	0.13	219.5	7.11	20.3	clear	Parameters stabilized	
10/17/2013	On-site	MW-306-15	MW-306-15	S, i/m	--	13.35	--	4.01	0.55	259.0	6.62	67.8	clear	>3 well volumes purged	
10/17/2013	On-site	MW-306-150	MW-306-150	S, i/m	--	12.67	--	4.50	0.15	212.7	6.99	43.4	clear	Parameters stabilized	
10/17/2013	On-site	MW-306-70	MW-306-70	S	--	13.35	--	4.10	0.13	225.7	7.09	48.8	clear	Parameters stabilized	
10/17/2013	On-site	MW-306-80	EB-306-80	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-306-80	
10/17/2013	On-site	MW-306-80	MW-306-80	S, i/m	--	13.18	--	4.24	0.35	194.0	6.95	63.4	clear	Parameters stabilized	
10/28/2013	On-site	MW-306-CMT-10	MW-306-CMT-10	S	--	DRY	--	--	--	--	--	--	--	Well dry	
10/17/2013	On-site	MW-306-CMT-20	MW-306-CMT-20	S	--	13.51	--	3.54	0.67	282.0	7.01	61.1	clear	>3 well volumes purged	
10/17/2013	On-site	MW-306-CMT-30	MW-306-CMT-30	S	--	13.50	--	3.24	0.71	260.0	7.13	32.8	clear	>3 well volumes purged	
10/17/2013	On-site	MW-306-CMT-40	MW-306-CMT-40	S	--	13.51	--	3.48	0.59	255.0	7.17	39.0	clear	>3 well volumes purged	
10/17/2013	On-site	MW-306-CMT-50	MW-306-CMT-50	S	--	13.52	--	3.78	0.56	222.0	7.29	35.6	clear	>3 well volumes purged	
10/17/2013	On-site	MW-306-CMT-60	MW-306-CMT-60	S	--	13.51	--	3.89	0.54	223.0	7.33	23.2	clear	>3 well volumes purged	
11/1/2013	On-site	MW-307-150	MW-307-150	S	--	11.50	--	4.80	0.19	243.3	7.14	-1.80	clear	Parameters stabilized	
10/22/2013	On-site	MW-309-15	MW-309-15	S, B	--	11.14	--	2.60	0.55	351.0	6.70	46.9	clear	Parameters stabilized	
10/22/2013	On-site	MW-309-15	MW-409-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-309-15	
10/22/2013	On-site	MW-309-150	MW-309-150	S	--	11.04	--	4.10	0.86	224.0	7.33	194.2	clear	Parameters stabilized	
10/22/2013	On-site	MW-309-66	MW-309-66	S, B	--	11.38	--	4.34	0.45	251.0	7.36	52.3	clear	Parameters stabilized	
10/28/2013	On-site	MW-310-110	MW-310-110	S	--	10.35	--	6.00	0.50	228.0	6.77	140.2	clear	Parameters stabilized	
10/16/2013	On-site	MW-310-15	MW-310-15	S	--	10.27	--	6.60	0.10	361.1	6.72	-61.4	clear	Parameters stabilized	
10/16/2013	On-site	MW-310-65	MW-310-65	S	--	10.40	--	6.60	0.13	253.2	7.29	35.0	clear	Parameters stabilized	
10/25/2013	On-site	MW-321-15	MW-321-15	S, B	--	11.31	--	4.68	0.70	353.0	7.57	-118	clear	>3 well volumes purged	
10/25/2013	On-site	MW-321-15	MW-421-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-321-15	
10/25/2013	On-site	MW-321-150	MW-321-150	S	--	11.84	--	4.60	0.33	233.0	7.05	23.0	clear	Parameters stabilized	
10/25/2013	On-site	MW-321-65	MW-321-65	S	--	11.02	--	5.00	0.16	252.8	7.13	-69.3	clear	Parameters stabilized	
10/23/2013	On-site	MW-330-150	MW-330-150	S	--	15.25	--	5.24	0.48	221.0	8.65	51.9	clear	Parameters stabilized	
10/23/2013	On-site	MW-330-20	MW-330-20	S	--	15.62	--	5.20	0.16	322.2	6.55	50.3	clear	>3 well volumes purged	

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Groundwater Well Field Parameter Results**

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Date	Proximity	New Location Name	Sample	Analysis	Depth to ice (ft.)	Depth to Water (ft.)	Depth to LNAPL (ft.)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes	Additional Notes
10/23/2013	On-site	MW-330-20	MW-430-20	S	--	--	--	--	--	--	--	--	--	DUP of MW-330-20	
10/23/2013	On-site	MW-330-65	MW-330-65	S	--	15.44	--	6.22	0.27	250.0	8.49	54.0	clear	Parameters stabilized	
10/30/2013	On-site	MW-331-150	MW-331-150	S	--	12.28	--	4.40	0.10	231.7	7.11	11.3	clear	Parameters stabilized	
11/7/2013	On-site	MW-334-15	MW-334-15	S,B	--	13.85	12.28	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/6/2013	On-site	MW-334-65	EB-334-65	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-334-65	
11/6/2013	On-site	MW-334-65	MW-334-65	S,B	--	12.17	--	4.50	0.14	207.4	7.27	26.2	Clear	Parameters stabilized	
10/22/2013	On-site	MW-344-15	MW-344-15	S, B	--	7.35	--	4.40	0.39	330.1	6.69	-49.0	clear	Parameters stabilized	
10/22/2013	On-site	MW-345-15	MW-345-15	S, B	--	12.18	--	4.60	0.32	330.9	6.68	-93.7	clear	Parameters stabilized	
11/15/2013	On-site	MW-348-15	MW-348-15	S	--	8.89	--	6.80	0.18	513	6.68	-90.6	clear	>3 well volumes purged	
11/15/2013	On-site	MW-348-65	MW-348-65	S	--	8.73	--	4.60	0.15	204.3	7.01	-27.3	clear	Parameters stabilized	
11/25/2013	On-site	MW-355-15	MW-155-15	S	--	12.31	--	4.60	0.17	215.2	6.95	-26.1	clear	Parameters stabilized	resampled to verify initial phase 8 results
11/25/2013	On-site	MW-355-55	MW-355-55	S	--	11.21	--	5.40	0.19	208.3	7.04	23.8	clear	Parameters stabilized	resampled to verify initial phase 8 results
11/11/2013	On-site	O-1	O-1	S	--	12.53	sheen	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
10/19/2013	On-site	O-12	O-12	S, B	--	12.55	--	7.26	0.73	519	6.95	-77.1	clear	Parameters stabilized	
10/19/2013	On-site	O-12	O-22	S	--	--	--	--	--	--	--	--	--	DUP of O-12	
10/19/2013	On-site	O-12-65	O-12-65	S, B	--	11.92	--	5.00	0.12	231.0	7.12	-0.60	clear	Parameters stabilized	
11/25/2013	On-site	O-14	O-14	S, B	--	8.88	--	2.00	0.57	238.3	6.57	-17.6	clear	Parameters stabilized	
11/15/2013	On-site	O-16	O-16	B	--	7.84	--	6.53	1.01	339.0	7.15	-41.2	clear	>3 well volumes purged	
11/15/2013	On-site	O-17	O-17	B	--	8.77	--	6.81	1.04	446	6.74	52.9	clear	>3 well volumes purged	
11/15/2013	On-site	O-18	O-18	B	--	7.95	--	6.18	0.94	304.0	6.75	-53.0	clear	>3 well volumes purged	
11/7/2013	On-site	O-19	O-19	S,B	--	14.27	12.35	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/16/2013	On-site	O-2	O-2	S, B	--	13.32	13.02	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/16/2013	On-site	O-2	O-200	B	--	--	--	--	--	--	--	--	--	DUP of O-2	
11/16/2013	On-site	O-24	O-24	S, B	--	12.92	--	5.12	1.19	404	6.57	-35.9	clear	>3 well volumes purged	
11/16/2013	On-site	O-26	O-26	S, B	--	12.99	--	4.62	0.74	286	7.23	-104	clear	>3 well volumes purged	
11/16/2013	On-site	O-26	O-260	B	--	--	--	--	--	--	--	--	--	DUP of O-26	
10/30/2013	On-site	O-27	O-27	B	--	13.46	13.35	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
10/30/2013	On-site	O-27	O-270	B	--	--	--	--	--	--	--	--	--	DUP of O-27	
11/16/2013	On-site	O-3	O-3	S, B	--	13.76	--	4.56	3.13	632.0	6.87	-50.8	clear	>3 well volumes purged	
11/16/2013	On-site	O-3	O-300	B	--	--	--	--	--	--	--	--	--	DUP of O-3	
10/16/2013	On-site	O-4	O-4	S,B	--	12.74	--	5.75	0.39	280.0	6.87	-44.5	clear	>3 well volumes purged	
10/16/2013	On-site	O-5	O-5	S,B	--	12.29	--	4.12	0.38	305.0	7.18	-87.9	clear	Parameters stabilized	
10/16/2013	On-site	O-5-65	O-5-65	S,B	--	11.69	--	5.11	0.24	206.0	7.30	-47.1	clear	Parameters stabilized	
10/22/2013	On-site	O-6	O-6	S, B	--	10.99	--	5.20	0.15	324.4	6.65	-35.2	clear	>3 well volumes purged	
11/4/2013	On-site	S-21	S-21	S	--	14.36	12.93	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/11/2013	On-site	S-39	no sample	S	--	11.56	10.91	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/4/2013	On-site	S-43	S-43	S,B	--	12.40	sheen	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/4/2013	On-site	S-44	S-44	S,B	--	12.51	11.02	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
11/7/2013	On-site	S-50	Frozen	-	12.56	--	--	--	--	--	--	--	--	Well frozen	
11/6/2013	On-site	S-51	S-51	S	--	13.91	12.89	--	--	--	--	--	--	No parameters taken, sub-LNAPL sample	
10/19/2013	On-site	S-9	S-9	B	--	11.47	--	5.70	0.15	291.3	6.92	-99.9	clear	>3 well volumes purged	
10/11/2013	Off-site	MW-148A-15	EB-148A-15	B	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-148A-15	
10/11/2013	Off-site	MW-148A-15	MW-148A-15	S, i/m, B	--	10.21	--	4.23	0.45	205.0	6.57	18.6	clear	>3 well volumes purged	
10/11/2013	Off-site	MW-148B-30	MW-148B-30	S, B	--	10.02	--	2.84	0.27	245.0	7.19	-38.1	clear	Parameters stabilized	
10/11/2013	Off-site	MW-148C-55	MW-148C-55	S, i/m	--	10.46	--	3.57	0.29	228.0	7.29	-39.2	clear	Parameters stabilized	
10/11/2013	Off-site	MW-148C-55	MW-248C-55	S	--	--	--	--	--	--	--	--	--	DUP of MW-148C-55	
10/11/2013	Off-site	MW-148D-150	MW-148D-150	S, i/m	--	10.50	--	4.51	0.44	198.0	7.30	87.9	clear	Parameters stabilized	
10/9/2013	Off-site	MW-149A-15	MW-149A-15	S, B	--	10.86	--	2.80	7.87	257.9	6.68	100.1	clear	>3 well volumes purged	
10/9/2013	Off-site	MW-149B-20	MW-149B-20	S, B	--	10.65	--	2.00	0.85	269.1	6.76	7.30	clear	Parameters stabilized	
10/8/2013	Off-site	MW-150A-10	MW-150A-10	S, i/m	--	5.73	--	4.00	0.24	264.2	6.91	-92.5	clear	>3 well volumes purged	
10/8/2013	Off-site	MW-150B-25	MW-150B-25	S	--	5.81	--	1.00	0.14	223.6	6.80	-37.1	clear	Parameters stabilized	
10/8/2013	Off-site	MW-150C-60	MW-150C-60	S, i/m	--	5.20	--	-0.10	0.14	184.0	6.94	27.9	clear	Parameters stabilized	
10/8/2013	Off-site	MW-150C-60	MW-250C-60	S	--	--	--	--	--	--	--	--	--	DUP of MW-150C-60	
10/7/2013	Off-site	MW-151A-15	MW-151A-15	S, i/m	--	5.50	--	1.80	0.12	244.1	6.83	-10.1	clear	>3 well volumes purged	
10/8/2013	Off-site	MW-151B-25	MW-151B-25	S	--	5.45	--	0.70	0.13	205.0	6.65	-49.3	clear	Parameters stabilized	

Table 4-1
Groundwater Well Field Parameter Results
Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Date	Proximity	New Location Name	Sample	Analysis	Depth to ice (ft.)	Depth to Water (ft.)	Depth to LNAPL (ft.)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes	Additional Notes
10/7/2013	Off-site	MW-151C-60	EB-151C-60	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-151C-60	
10/7/2013	Off-site	MW-151C-60	MW-151C-60	S, i/m	--	9.25	--	-0.20	0.14	193.1	7.05	26.1	clear	Parameters stabilized	
10/8/2013	Off-site	MW-152A-15	MW-152A-15	S, i/m	--	6.40	--	3.65	2.99	223.0	7.19	33.7	clear	Parameters stabilized	
10/8/2013	Off-site	MW-152A-15	MW-252A-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-152A-15	
10/8/2013	Off-site	MW-152B-25	MW-152B-25	S	--	6.18	--	3.42	1.20	221.0	7.18	50.4	clear	>3 well volumes purged	
10/8/2013	Off-site	MW-152C-65	MW-152C-65	S, i/m	--	6.24	--	1.82	0.33	189.0	7.31	169.4	clear	Parameters stabilized	
10/11/2013	Off-site	MW-153A-15	EB-153A-15	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-153A-15	
10/11/2013	Off-site	MW-153A-15	MW-153A-15	S, i/m, B	--	7.36	--	4.91	0.27	314.0	6.77	22.0	clear	Parameters stabilized	
10/11/2013	Off-site	MW-153B-55	MW-153B-55	S, i/m, B	--	7.04	--	4.21	0.14	230.0	7.32	-23.0	clear	Parameters stabilized	
10/11/2013	Off-site	MW-153B-55	MW-253B-55	S	--	--	--	--	--	--	--	--	--	DUP of MW-153B-55	
10/9/2013	Off-site	MW-155A-15	MW-155A-15	S, i/m	--	7.79	--	3.87	0.45	253.0	7.03	28.0	clear	>3 well volumes purged	
10/9/2013	Off-site	MW-155B-65	MW-155B-65	S, i/m	--	7.60	--	2.23	0.64	195.0	7.25	55.6	clear	Parameters stabilized	
10/7/2013	Off-site	MW-156A-15	MW-156A-15	S, i/m	--	6.26	--	2.60	0.15	324.6	6.67	-92.2	clear	Parameters stabilized	
10/7/2013	Off-site	MW-156B-50	MW-156B-50	S, i/m	--	9.89	--	-0.70	0.16	196.6	6.97	7.40	clear	Parameters stabilized	
10/8/2013	Off-site	MW-157A-15	MW-157A-15	S	--	6.50	--	3.10	0.37	263.3	7.10	-61.6	clear	Parameters stabilized	
10/8/2013	Off-site	MW-157A-15	MW-257A-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-157A-15	
10/8/2013	Off-site	MW-157B-30	EB-157B-30	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-157B-30	
10/8/2013	Off-site	MW-157B-30	MW-157B-30	S	--	7.25	--	1.10	0.18	239.6	7.05	-86.5	clear	Parameters stabilized	
10/8/2013	Off-site	MW-158A-15	MW-158A-15	S, i/m	--	7.10	--	2.60	0.40	383.6	6.34	0.00	clear	Parameters stabilized	
10/8/2013	Off-site	MW-158B-50	MW-158B-50	S, i/m	--	6.92	--	-0.30	0.20	192.9	6.96	34.02	clear	Parameters stabilized	
10/9/2013	Off-site	MW-159A-15	MW-159A-15	S, i/m	--	7.54	--	3.50	3.54	354.7	6.19	153.0	clear	Parameters stabilized	
10/9/2013	Off-site	MW-159A-15	MW-259A-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-159A-15	
10/9/2013	Off-site	MW-159B-45	EB-159B-45	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-159B-45	
10/9/2013	Off-site	MW-159B-45	MW-159B-45	S	--	7.32	--	1.40	4.90	199.0	7.23	240.1	clear	>3 well volumes purged	
10/9/2013	Off-site	MW-159C-70	MW-159C-70	S, i/m	--	7.63	--	0.98	0.67	192.0	7.27	245.0	clear	Parameters stabilized	
10/8/2013	Off-site	MW-160AR-15	MW-160AR-15	S, i/m	--	6.56	--	7.40	0.18	275.2	6.79	0.70	clear	>3 well volumes purged	
10/8/2013	Off-site	MW-160B-90	MW-160B-90	S, i/m	--	6.51	--	1.10	0.23	210.4	7.16	-82.5	clear	Parameters stabilized	
10/15/2013	Off-site	MW-161-30	MW-161-30	S	--	6.64	--	0.51	0.15	256.0	7.26	-56.8	clear	Parameters stabilized	
10/15/2013	Off-site	MW-161A-15	MW-161A-15	S, i/m	--	6.53	--	1.27	0.21	358.0	7.08	-71.4	clear	>3 well volumes purged	
10/15/2013	Off-site	MW-161B-50	MW-161B-50	S, i/m, thiolane	--	6.69	--	0.38	0.26	260.0	7.25	-49.4	clear	Parameters stabilized	
10/9/2013	Off-site	MW-162A-15	MW-162A-15	S, i/m	--	7.85	--	2.70	0.44	271.5	6.91	-78.5	clear	Parameters stabilized	
10/9/2013	Off-site	MW-162A-15	MW-262A-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-162A-15	
10/9/2013	Off-site	MW-162B-65	EB-162B-65	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-162B-65	
10/9/2013	Off-site	MW-162B-65	MW-162B-65	S, i/m	--	8.06	--	0.20	0.19	220.0	7.03	35.2	clear	Parameters stabilized	
10/9/2013	Off-site	MW-163A-15	MW-163A-15	S	--	8.96	--	2.00	0.42	243.9	6.75	17.8	clear	Parameters stabilized	
10/9/2013	Off-site	MW-163A-15	MW-263A-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-163A-15	
10/9/2013	Off-site	MW-163B-40	MW-163B-40	S	--	9.28	--	0.20	0.19	209.5	7.14	-73.1	clear	Parameters stabilized	
10/12/2013	Off-site	MW-164A-15	MW-164A-15	S, i/m	--	7.40	--	2.40	0.15	311.2	6.71	-70.2	clear	>3 well volumes purged	
10/21/2013	Off-site	MW-164A-15	MW-164A-15	i/m	--	7.21	--	2.40	0.20	324.9	6.61	-57.7	clear	>3 well volumes purged	
10/21/2013	Off-site	MW-164B-50	EB-164B-50	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-164B-50	
10/21/2013	Off-site	MW-164B-50	MW-164B-50	S	--	6.68	--	0.40	0.18	245.4	6.85	-54.9	clear	Parameters stabilized	
10/21/2013	Off-site	MW-164C-60	MW-164C-60	S, i/m	--	6.66	--	0.30	0.30	241.7	6.73	-50.4	clear	Parameters stabilized	
10/2/2013	Off-site	MW-165A-15	MW-165A-15	S, i/m	--	6.15	--	2.00	1.88	193.7	6.30	32.4	clear	>3 well volumes purged	
10/2/2013	Off-site	MW-165B-50	MW-165B-50	S, i/m	--	5.90	--	2.40	0.12	201.8	7.10	-47.5	clear	Parameters stabilized	
10/2/2013	Off-site	MW-166A-15	MW-166A-15	S, i/m	--	8.58	--	0.90	0.31	265.4	6.86	-86.7	clear	Parameters stabilized	
10/2/2013	Off-site	MW-166B-30	EB-166B-30	S	--	--	--	--	--	--	--	--	--	EB collected after sampling MW-166B-30	
10/2/2013	Off-site	MW-166B-30	MW-166B-30	S, i/m	--	8.84	--	0.20	0.11	262.8	7.03	-58.8	clear	Parameters stabilized	
10/4/2013	Off-site	MW-167A-15	MW-167A	S, i/m	--	9.30	--	-0.70	0.90	530	6.62	-1.80	clear	>3 well volumes purged	
10/4/2013	Off-site	MW-167B-35	MW-167B	S, i/m	--	9.12	--	-0.80	0.16	538	6.64	4.70	clear	Parameters stabilized	
10/5/2013	Off-site	MW-168A-15	MW-168A-15	S, i/m	--	8.98	--	1.50	0.18	219.0	6.90	-104.1	clear	Parameters stabilized	
10/5/2013	Off-site	MW-168B-50	MW-168B-50	S, i/m	--	9.05	--	-0.80	0.11	191.9	6.97	-89.4	clear	Parameters stabilized	
10/3/2013	Off-site	MW-169A-15	MW-169A-15	S, i/m	--	9.55	--	0.70	0.16	198.8	6.99	-71.8	clear	Parameters stabilized	
10/3/2013	Off-site	MW-169C-60	MW-169C-60	S, i/m	--	6.10	--	0.20	0.15	186.3	7.17	-84.2	clear	Parameters stabilized	
10/9/2013	Off-site	MW-170A-15	MW-170A-15	S, i/m	--	8.72	--	6.25	0.52	477.0	6.58	-0.90	clear	Parameters stabilized	none
10/9/2013	Off-site	MW-170B-75	MW-170B-75	S, i/m	--	8.75	--	2.90	0.13	185.7	6.95	-52.3	clear	Parameters stabilized	
10/9/2013	Off-site	MW-170C-130	MW-170C-130	S, i/m	--	8.84	--	4.58	0.36	190	7.29	-7.10	clear	Parameters stabilized	
10/9/2013	Off-site	MW-170D-50	MW-170D-50	S, i/m	--	8.55	--	3.30	0.07	254.4	6.95	-37.6	clear	Parameters stabilized	

**Table 4-1
Groundwater Well Field Parameter Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Date	Proximity	New Location Name	Sample	Analysis	Depth to ice (ft.)	Depth to Water (ft.)	Depth to LNAPL (ft.)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes	Additional Notes
10/11/2013	Off-site	MW-171A-15	MW-171A-15	S, i/m	--	8.89		4.00	0.21	348.6	6.63	42.0	clear	Parameters stabilized	
10/11/2013	Off-site	MW-171B-40	MW-171B-40	S, i/m	--	8.89	--	0.60	0.13	241.3	6.91	-90.6	clear	Parameters stabilized	
10/5/2013	Off-site	MW-172A-15	--	S, i/m	--	--	--	--	--	--	--	--	--	Well frozen; could not remove cap to obtain depth to ice	
10/5/2013	Off-site	MW-172B-150	--	S, i/m	--	--	--	--	--	--	--	--	--	Well frozen; could not remove cap to obtain depth to ice	
10/4/2013	Off-site	MW-181A-15	MW-181A	S, i/m	--	9.23	--	1.90	0.78	241.5	6.69	76.4	clear	Parameters stabilized	
10/4/2013	Off-site	MW-181B-50	MW-181B	S, i/m	--	9.07	--	1.80	0.11	208.5	6.94	40.9	clear	Parameters stabilized	
10/3/2013	Off-site	MW-181C-150	MW-181C	S, i/m	--	9.06	--	2.40	0.15	205.5	7.19	-89.9	clear	Parameters stabilized	
10/5/2013	Off-site	MW-182A-15	--	S, i/m	5.45	--	--	--	--	--	--	--	--	Well frozen	
10/5/2013	Off-site	MW-182B-45	MW-182B-45	S, i/m	--	6.23	--	-0.90	0.18	239.2	6.78	-45.9	clear	Parameters stabilized	
10/3/2013	Off-site	MW-183A-15	MW-183A-15	S, i/m	--	6.54	--	0.70	1.75	229.2	6.71	-20.6	clear	Parameters stabilized	
10/3/2013	Off-site	MW-183A-15	MW-283A-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-183A-15	
10/3/2013	Off-site	MW-183B-60	MW-183B-60	S, i/m	--	6.83	--	0.20	0.19	234.3	6.98	40.7	clear	Parameters stabilized	
10/11/2013	Off-site	MW-184-45	MW-184-45	S	--	7.82	--	0.40	0.20	194.9	7.13	19.6	clear	Parameters stabilized	
10/5/2013	Off-site	MW-185A-15	MW-185A-15	S, i/m	--	7.15	--	2.30	0.25	359.4	7.02	-110.0	clear	Parameters stabilized	
10/5/2013	Off-site	MW-185B-50	MW-185B-50	S	--	7.80	--	3.20	0.10	224.0	7.33	-118.6	clear	Parameters stabilized	
10/5/2013	Off-site	MW-185C-120	MW-185C-120	S, i/m	--	7.57	--	2.60	0.09	162.6	7.22	-75.2	clear	Parameters stabilized	
10/4/2013	Off-site	MW-187-15	MW-187-15	S, i/m	--	12.39	--	3.20	1.22	231.2	7.10	8.00	clear	Parameters stabilized	
10/3/2013	Off-site	MW-189A-15	--	S, i/m	5.99	4.71	--	--	--	--	--	--	--	Well frozen	
10/3/2013	Off-site	MW-189B-60	--	S, i/m	6.31	--	--	--	--	--	--	--	--	Well frozen	
10/5/2013	Off-site	MW-190-150	MW-190-150	S	--	8.47	--	3.00	0.11	159.8	7.29	-78.9	clear	Parameters stabilized	
10/5/2013	Off-site	MW-190A-15	MW-190A-15	S, i/m	--	7.20	--	2.90	0.13	210.4	6.74	-33.3	clear	Parameters stabilized	
10/8/2013	Off-site	MW-190BR-60	MW-190BR-60	S, i/m	--	8.36	--	3.35	0.25	174.0	7.35	-25.1	clear	Parameters stabilized	
10/2/2013	Off-site	MW-191A-15	MW-191A-15	S, i/m	--	5.70	--	5.30	1.70	223.9	6.85	49.9	clear	Parameters stabilized	
10/2/2013	Off-site	MW-191B-60	MW-191B-60	S, i/m	--	5.62	--	3.40	0.13	207.8	7.19	4.10	clear	Parameters stabilized	
10/4/2013	Off-site	MW-193A-15	MW-193A-15	S, i/m	--	8.84	--	2.60	0.36	419.8	6.57	-26.0	clear	Parameters stabilized	
10/4/2013	Off-site	MW-193B-60	MW-193B-60	S, i/m	--	8.46	--	0.30	0.27	183.6	7.06	-35.9	clear	Parameters stabilized	
10/2/2013	Off-site	MW-194A-15	MW-194A-15	S, i/m	--	8.03	--	1.80	0.23	245.7	7.00	-56.8	clear	>3 well volumes purged	
10/2/2013	Off-site	MW-194A-15	MW-294A-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-194A-15	
10/2/2013	Off-site	MW-194B-40	MW-194B-40	S, i/m	--	8.00	--	0.20	0.21	231.9	7.09	-24.6	clear	>3 well volumes purged	
10/2/2013	Off-site	MW-308-15	MW-308-15	S	--	10.50	--	3.30	0.14	288.7	6.55	-33.4	clear	Parameters stabilized	
10/2/2013	Off-site	MW-308-30	--	S	9.41	--	--	--	--	--	--	--	--	Well frozen	
10/2/2013	Off-site	MW-311-15	MW-311-15	S	--	3.62	--	3.10	0.13	253.2	6.76	-33.9	clear	Parameters stabilized	
10/2/2013	Off-site	MW-311-46	MW-311-46	S	--	3.79	--	-0.50	0.12	209.5	6.77	59.6	clear	Parameters stabilized	
12/20/2013	Off-site	MW-312-15	MW-312-15	i/m	--	5.69	--	0.20	0.12	281.7	6.79	-83.3	clear	>3 well volumes purged	
12/20/2013	Off-site	MW-312-50	MW-312-50	i/m	--	5.69	--	0.10	0.12	241.3	6.98	-84.8	clear	Parameters stabilized	
12/10/2013	Off-site	MW-313-15	MW-313-15	i/m	--	4.39	--	1.20	0.19	204.2	7.10	-91.3	clear	Parameters stabilized	Sampled for microbial and isotope only
12/10/2013	Off-site	MW-313-150	MW-313-150	i/m	--	4.38	--	3.10	0.16	173.4	7.26	-103.2	clear	Parameters stabilized	Sampled for microbial and isotope only
10/3/2013	Off-site	MW-314-15	MW-314-15	S, i/m	--	8.44	--	0.00	4.69	284.1	6.65	68.6	clear	Parameters stabilized	
10/3/2013	Off-site	MW-314-150	MW-314-150	S, i/m	--	8.14	--	1.60	0.13	227.7	7.14	-80.5	clear	Parameters stabilized	
12/20/2013	Off-site	MW-315-15	MW-315-15	i/m	--	5.67	--	1.40	0.19	276.4	6.74	12.2	clear	>3 well volumes purged	
12/20/2013	Off-site	MW-315-150	MW-315-150	i/m	--	5.83	--	1.20	0.15	154.2	7.24	-104.3	clear	Parameters stabilized	
10/7/2013	Off-site	MW-316-15	MW-316-15	S, i/m	--	7.54	--	1.10	0.12	224.9	6.65	-48.7	clear	>3 well volumes purged	
10/7/2013	Off-site	MW-316-56	MW-316-56	S, i/m	--	7.57	--	-0.40	0.19	179.5	6.97	12.8	clear	Parameters stabilized	
10/11/2013	Off-site	MW-317-15	MW-317-15	S, i/m	--	7.02	--	3.90	0.56	261.7	6.72	1.50	clear	Parameters stabilized	
10/9/2013	Off-site	MW-317-71	MW-317-71	S, i/m	--	6.98	--	0.90	0.20	207.0	7.24	-29.7	clear	Parameters stabilized	
10/3/2013	Off-site	MW-318-135	MW-318-135	S, i/m	--	11.79	--	2.80	0.17	203.6	7.17	-27.3	clear	Parameters stabilized	
10/3/2013	Off-site	MW-318-20	MW-318-20	S, i/m	--	11.63	--	0.70	0.17	197.6	6.86	-52.5	clear	Parameters stabilized	
10/3/2013	Off-site	MW-322-15	MW-322-15	S, i/m	--	9.49	--	4.00	0.33	233.1	6.62	-3.30	clear	>3 well volumes purged	
10/3/2013	Off-site	MW-322-150	MW-322-150	S, i/m	--	9.44	--	3.70	0.17	176.8	7.10	-63.6	clear	Parameters stabilized	
10/4/2013	Off-site	MW-323-15	MW-323-15	S	--	8.25	--	0.60	0.23	215.7	6.90	-47.0	clear	Parameters stabilized	
10/4/2013	Off-site	MW-323-50	MW-323-50	S	--	7.78	--	0.20	0.26	218.1	7.00	-56.6	clear	Parameters stabilized	
12/10/2013	Off-site	MW-324-15	MW-324-15	i/m	--	6.81	--	3.30	0.12	216.4	7.08	-117.4	clear	Parameters stabilized	Sampled for microbial and isotope only

**Table 4-1
Groundwater Well Field Parameter Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Date	Proximity	New Location Name	Sample	Analysis	Depth to ice (ft.)	Depth to Water (ft.)	Depth to LNAPL (ft.)	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes	Additional Notes
12/10/2013	Off-site	MW-324-150	MW-324-150	i/m	--	6.21	--	1.70	0.18	178.2	7.10	-45.6	clear	Parameters stabilized	Sampled for microbial and isotope only
10/12/2013	Off-site	MW-325-150	MW-325-150	S, i/m	--	12.01	--	3.90	0.09	178.9	7.44	-145.8	clear	Parameters stabilized	
10/12/2013	Off-site	MW-325-18	MW-325-18	S, i/m	--	11.96	--	3.80	0.60	269.2	6.66	-31.6	Clear	>3 well volumes purged	
11/12/2013	Off-site	MW-326-150	MW-326-150	S	--	11.03	--	3.60	0.26	188.2	7.19	44.4	clear	Parameters stabilized	Sampled as part of North Gravel Pit Study; not on Q4 schedule
11/12/2013	Off-site	MW-326-20	MW-326-20	S	--	11.29	--	4.50	0.13	177.9	7.36	2.80	clear	Parameters stabilized	Sampled as part of North Gravel Pit Study; not on Q4 schedule
12/20/2013	Off-site	MW-327-15	MW-327-15	i/m	--	7.26	--	2.00	2.83	259.0	6.83	26.0	clear	>3 well volumes purged	
12/20/2013	Off-site	MW-327-150	MW-327-150	i/m	--	6.87	--	3.40	0.16	161.4	7.14	-123.9	clear	Parameters stabilized	
10/3/2013	Off-site	MW-328-15	MW-328-15	S, i/m	--	7.50	--	2.50	0.27	440.0	6.76	13.2	clear	Parameters stabilized	
10/3/2013	Off-site	MW-328-151	MW-328-151	S, i/m	--	7.81	--	1.10	0.13	180.2	6.87	-93.8	clear	Parameters stabilized	
10/4/2013	Off-site	MW-329-15	MW-329-15	S, i/m	--	10.25	--	3.30	0.19	295.3	6.76	-16.6	clear	Parameters stabilized	
10/4/2013	Off-site	MW-329-66	MW-329-66	S, i/m	--	6.71	--	0.40	0.18	223.2	6.98	2.00	clear	Parameters stabilized	
10/4/2013	Off-site	MW-329-66	MW-429-66	S	--	--	--	--	--	--	--	--	--	DUP of MW-329-66	
10/8/2013	Off-site	MW-332-110	MW-332-110	S	--	6.89	--	1.90	4.65	177.0	7.39	-44.6	clear	Parameters stabilized	
10/4/2013	Off-site	MW-332-15	MW-332-15	S, i/m	--	7.48	--	1.50	0.09	275.0	6.80	-58.5	clear	Parameters stabilized	
10/4/2013	Off-site	MW-332-150	MW-332-150	S, i/m	--	7.10	--	0.50	0.09	216.4	7.16	-87.8	clear	Parameters stabilized	
10/8/2013	Off-site	MW-332-41	MW-332-41	S	--	7.15	--	1.76	0.26	229.0	7.17	-55.1	clear	Parameters stabilized	
10/8/2013	Off-site	MW-332-75	MW-332-75	S	--	6.92	--	1.54	0.20	203.0	7.26	-59.8	clear	Parameters stabilized	
10/3/2013	Off-site	MW-335-41	--	S, i/m	5.70	5.27	--	--	--	--	--	--	--	Well frozen	
10/7/2013	Off-site	MW-338-15	MW-338-15	S	--	6.51	--	0.00	1.65	268.2	6.76	66.7	clear	>3 well volumes purged	
10/7/2013	Off-site	MW-338-50	MW-338-50	S	--	6.59	--	-0.90	0.18	207.6	6.83	-24.9	clear	Parameters stabilized	
10/5/2013	Off-site	MW-339-15	MW-339-15	S	--	8.72	--	-0.70	0.49	269.5	6.37	-36.8	clear/turbid	Parameters stabilized; water became turbid at time of sample collection	
10/5/2013	Off-site	MW-339-50	MW-339-50	S	--	8.63	--	0.20	0.12	240.2	6.64	-98.6	clear	Parameters stabilized	
10/5/2013	Off-site	MW-340-150	MW-340-150	S	--	4.50	--	4.40	0.19	186.2	7.50	-121.8	clear	Parameters stabilized	
10/5/2013	Off-site	MW-340-18	MW-340-18	S	--	4.59	--	3.90	0.07	261.2	7.00	-20.1	clear	Parameters stabilized	
10/5/2013	Off-site	MW-340-65	MW-340-65	S	--	5.01	--	3.10	0.14	188.2	7.08	40.0	clear	Parameters stabilized	
10/4/2013	Off-site	MW-341-15	MW-341-15	S	--	6.99	--	2.50	0.18	276.8	6.95	-1.30	clear	Parameters stabilized	
10/4/2013	Off-site	MW-341-15	MW-441-15	S	--	--	--	--	--	--	--	--	--	DUP of MW-341-15	
10/4/2013	Off-site	MW-341-40	MW-341-40	S	--	6.75	--	0.30	0.25	230.5	7.16	-4.10	clear	Parameters stabilized	
10/4/2013	Off-site	MW-342-15	MW-342-15	S	--	6.95	--	4.40	0.15	286.6	6.90	12.4	clear	Parameters stabilized	
10/4/2013	Off-site	MW-342-65	MW-342-65	S	--	7.12	--	0.60	0.24	231.0	7.27	12.1	clear	Parameters stabilized	
10/8/2013	Off-site	MW-343-50	MW-343-50	S, i/m	--	8.20	--	0.80	0.65	201.0	7.27	-53.2	clear	Parameters stabilized	
10/11/2013	Off-site	MW-349-15	MW-349-15	S	--	7.23	-	2.30	0.12	248.9	6.97	-72.9	clear	Parameters stabilized	
10/11/2013	Off-site	MW-349-45	MW-349-45	S	--	7.21	--	0.40	0.16	223.5	7.05	43.3	clear	Parameters stabilized	

Acronyms and Abbreviations:

- °C = degrees centigrade
- > = greater than
- µS/cm = microsiemens per centimeter
- B = benzene, toluene, ethylbenzene, and total xylenes (BTEX)
- DO = dissolved oxygen
- DUP = quality-control field-duplicate sample
- EB = equipment blank
- ft. = feet
- i/m = carbon stable isotope and/or microbial analysis (UAF lab)
- LNAPL = light non-aqueous-phase liquid
- mg/L = milligrams per liter
- mV = millivolts
- ORP = oxidation-reduction potential
- PAH = polycyclic aromatic hydrocarbons
- S = sulfolane
- UAF = University of Alaska - Fairbanks

**Table 4-2
Groundwater Elevation and Depth to LNAPL**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Date Measured	Riser Elevation (MSL feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Proximity	Zone	Group	Notes
MW-101-60	10/1/2013	494.59	No LNAPL	10.74	483.85	On-site	10-55	Vertical Gradient	
MW-101A-25	10/1/2013	495.01	No LNAPL	11.18	483.83	On-site	Water Table	Vertical Gradient	
MW-102-70	10/1/2013	496.02	No LNAPL	12.25	483.77	On-site	55-90		
MW-104-65	10/1/2013	496.02	--	12.11	483.91	On-site	10-55		
MW-105-65	10/1/2013	497.66	No LNAPL	10.61	487.05	On-site	10-55		
MW-105A-25	10/1/2013	499.21	No LNAPL	12.41	486.80	On-site	Water Table		
MW-106-25	10/1/2013	499.28	--	14.38	484.90	On-site	Water Table		
MW-109-15	10/1/2013	495.16	--	9.56	485.60	On-site	Water Table		
MW-110-20	10/1/2013	496.73	--	10.47	486.26	On-site	Water Table		
MW-113-15	10/1/2013	494.50	--	10.27	484.23	On-site	Water Table		
MW-125-25	9/30/2013	496.19	No LNAPL	11.63	484.56	On-site	Water Table		
MW-129-40	9/30/2013	496.05	No LNAPL	11.55	484.50	On-site	10-55		
MW-130-25	9/30/2013	496.92	No LNAPL	12.27	484.65	On-site	Water Table		
MW-131-25	10/1/2013	495.75	No LNAPL	11.90	483.85	On-site	Water Table	Vertical Gradient	
MW-133-20	10/1/2013	498.34	No LNAPL	13.10	485.24	On-site	Water Table		
MW-135-20	9/30/2013	496.93	12.28	12.30	484.65	On-site	Water Table		
MW-140-25	10/1/2013	494.90	--	10.79	484.11	On-site	Water Table		
MW-141-20	10/1/2013	492.38	--	8.66	483.72	On-site	Water Table		
MW-143-20	10/1/2013	495.37	No LNAPL	11.48	483.89	On-site	Water Table	Vertical Gradient	
MW-144A-25	10/1/2013	495.35	--	10.97	484.38	On-site	Water Table		
MW-144BR-90	10/1/2013	494.98	--	10.70	484.28	On-site	55-90		
MW-145-20	10/1/2013	495.61	No LNAPL	11.13	484.48	On-site	Water Table		
MW-146A-15	10/1/2013	495.09	--	11.27	483.82	On-site	Water Table		
MW-146B-30	10/1/2013	494.98	--	11.11	483.87	On-site	10-55		
MW-147B-25	10/1/2013	492.59	--	9.06	483.53	On-site	10-55		
MW-148A-15	10/1/2013	493.07	--	9.94	483.13	On-site	Water Table	Vertical Gradient	
MW-148B-30	10/1/2013	492.86	--	9.80	483.06	On-site	10-55	Vertical Gradient	
MW-148C-55	10/1/2013	493.33	--	10.21	483.12	On-site	10-55	Vertical Gradient	
MW-148D-150	10/1/2013	493.36	--	10.26	483.10	On-site	90-160	Vertical Gradient	
MW-149A-15	10/1/2013	493.72	--	10.61	483.11	On-site	Water Table		
MW-150A-10	10/1/2013	487.14	--	5.58	481.56	Off-site	Water Table		
MW-150B-25	10/1/2013	486.95	--	5.63	481.32	Off-site	10-55		
MW-151A-15	10/1/2013	487.27	--	5.32	481.95	Off-site	Water Table		
MW-151C-60	10/1/2013	491.14	--	9.09	482.05	Off-site	10-55		
MW-152A-15	10/1/2013	488.35	--	6.25	482.10	Off-site	Water Table		
MW-152B-25	10/1/2013	488.13	--	6.04	482.09	Off-site	10-55		
MW-152C-65	10/1/2013	488.17	--	6.16	482.01	Off-site	10-55		
MW-153A-15	10/1/2013	490.11	--	7.14	482.97	Off-site	Water Table		
MW-153B-55	10/1/2013	489.78	--	6.80	482.98	Off-site	10-55		
MW-154A-75	10/1/2013	498.04	--	13.93	484.11	On-site	55-90		

**Table 4-2
Groundwater Elevation and Depth to LNAPL**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Date Measured	Riser Elevation (MSL feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Proximity	Zone	Group	Notes
MW-155A-15	10/1/2013	488.19	--	7.41	480.78	Off-site	Water Table		
MW-156A-15	10/1/2013	485.80	--	6.02	479.78	Off-site	Water Table		
MW-156B-50	10/1/2013	489.36	--	9.97	479.39	Off-site	10-55		
MW-157A-15	10/1/2013	485.06	--	6.25	478.81	Off-site	Water Table		
MW-157B-30	10/1/2013	484.74	--	5.95	478.79	Off-site	10-55		
MW-158A-15	10/1/2013	488.07	--	6.80	481.27	Off-site	Water Table		
MW-158B-60	10/1/2013	487.46	--	6.71	480.75	Off-site	10-55		
MW-159A-15	10/1/2013	488.52	--	7.32	481.20	Off-site	Water Table		
MW-159B-45	10/1/2013	488.22	--	7.14	481.08	Off-site	10-55		
MW-159C-70	10/1/2013	488.70	--	7.44	481.26	Off-site	55-90		
MW-160B-90	10/1/2013	485.46	--	6.40	479.06	Off-site	55-90		
MW-161A-15	10/1/2013	479.51	--	6.18	473.33	Off-site	Water Table		
MW-161B-50	10/1/2013	479.60	--	6.37	473.23	Off-site	10-55		
MW-162A-15	10/1/2013	484.02	--	7.67	476.35	Off-site	Water Table		
MW-162B-65	10/1/2013	484.20	--	7.90	476.30	Off-site	10-55		
MW-163A-15	10/1/2013	485.02	--	8.79	476.23	Off-site	Water Table		
MW-163B-40	10/2/2013	484.80	--	9.14	475.66	Off-site	10-55		
MW-164A-15	10/1/2013	480.09	--	6.91	473.18	Off-site	Water Table		
MW-164B-50	10/1/2013	479.85	--	6.37	473.48	Off-site	10-55		
MW-164C-60	10/1/2013	479.90	--	6.34	473.56	Off-site	10-55		
MW-165A-15	10/1/2013	474.79	--	6.05	468.74	Off-site	Water Table		
MW-165B-50	10/1/2013	474.64	--	5.86	468.78	Off-site	10-55		
MW-166A-15	10/1/2013	475.08	--	8.60	466.48	Off-site	Water Table		
MW-166B-30	10/1/2013	475.51	--	8.83	466.68	Off-site	10-55		
MW-167A-15	10/1/2013	475.70	--	9.25	466.45	Off-site	Water Table		
MW-167B-35	10/1/2013	475.57	--	9.11	466.46	Off-site	10-55		
MW-168A-15	10/1/2013	478.25	--	8.93	469.32	Off-site	Water Table		
MW-168B-50	10/1/2013	478.34	--	9.01	469.33	Off-site	10-55		
MW-169A-15	10/1/2013	486.12	--	9.50	476.62	Off-site	Water Table		
MW-169B-50	10/1/2013	485.95	--	9.19	476.76	Off-site	10-55		
MW-169C-60	10/1/2013	482.52	--	6.02	476.50	Off-site	10-55		
MW-170A-15	10/1/2013	490.69	--	8.48	482.21	Off-site	Water Table		
MW-170B-75	10/1/2013	490.74	--	8.50	482.24	Off-site	55-90		
MW-170C-130	10/1/2013	490.84	--	8.65	482.19	Off-site	90-160		
MW-170D-50	10/1/2013	490.41	--	8.25	482.16	Off-site	10-55		
MW-171A-15	10/1/2013	484.89	--	8.74	476.15	Off-site	Water Table		
MW-171B-40	10/1/2013	484.83	--	8.77	476.06	Off-site	10-55		
MW-172A-15	10/1/2013	475.67	--	—	—	Off-site	Water Table		Well was frozen with a data logger suspended from well plug—the well could not be opened.

**Table 4-2
Groundwater Elevation and Depth to LNAPL**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Date Measured	Riser Elevation (MSL feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Proximity	Zone	Group	Notes
MW-172B-150	10/1/2013	475.78	--	—	—	Off-site	90-160		point.
MW-173A-15	10/1/2013	496.10	--	11.69	484.41	On-site	Water Table		
MW-173B-150	10/1/2013	496.41	--	11.96	484.45	On-site	90-160		
MW-174A-50	10/1/2013	494.40	--	9.53	484.87	On-site	10-55		
MW-174B-90	10/1/2013	493.53	--	8.74	484.79	On-site	55-90		
MW-175-90	9/30/2013	497.09	No LNAPL	12.26	484.83	On-site	55-90		
MW-176B-50	10/1/2013	496.93	No LNAPL	11.44	485.49	On-site	10-55		
MW-176C-90	10/1/2013	496.86	No LNAPL	11.33	485.53	On-site	55-90		
MW-177-90	10/1/2013	497.92	No LNAPL	11.15	486.77	On-site	55-90		
MW-178C-90	10/1/2013	497.27	No LNAPL	11.76	485.51	On-site	55-90		
MW-179A-15	10/1/2013	496.96	No LNAPL	11.38	485.58	On-site	Water Table	Vertical Gradient	
MW-179B-50	10/1/2013	496.75	No LNAPL	11.15	485.60	On-site	10-55	Vertical Gradient	
MW-179C-90	10/1/2013	497.26	No LNAPL	11.67	485.59	On-site	55-90	Vertical Gradient	
MW-179D-135	10/1/2013	497.06	No LNAPL	11.48	485.58	On-site	90-160	Vertical Gradient	
MW-180B-50	10/1/2013	496.87	No LNAPL	11.06	485.81	On-site	10-55		
MW-180C-90	10/1/2013	497.05	No LNAPL	11.23	485.82	On-site	55-90		
MW-181A-15	10/1/2013	475.92	--	9.20	466.72	Off-site	Water Table	Vertical Gradient	
MW-181B-50	10/1/2013	475.86	--	9.09	466.77	Off-site	10-55	Vertical Gradient	
MW-181C-150	10/1/2013	475.99	--	9.04	466.95	Off-site	90-160	Vertical Gradient	
MW-182A-15	10/1/2013	475.54	--	—	—	Off-site	Water Table		point
MW-182B-45	10/1/2013	475.40	--	6.10	469.30	Off-site	10-55		
MW-183A-15	10/1/2013	478.07	--	6.76	471.31	Off-site	Water Table		
MW-183B-60	10/1/2013	478.06	--	6.43	471.63	Off-site	10-55		
MW-184-45	10/1/2013	486.64	--	7.65	478.99	Off-site	10-55		
MW-185A-15	10/1/2013	478.06	--	7.12	470.94	Off-site	Water Table	Vertical Gradient	
MW-185B-50	10/1/2013	478.09	--	7.19	470.90	Off-site	10-55	Vertical Gradient	
MW-185C-120	10/1/2013	478.48	--	7.53	470.95	Off-site	90-160	Vertical Gradient	
MW-186A-15	9/30/2013	495.96	11.57	12.30	484.25	On-site	Water Table	Vertical Gradient	
MW-186B-60	9/30/2013	495.84	No LNAPL	11.42	484.42	On-site	10-55	Vertical Gradient	
MW-186C-100	9/30/2013	495.76	No LNAPL	11.24	484.52	On-site	90-160	Vertical Gradient	
MW-186D-135	9/30/2013	495.75	No LNAPL	11.18	484.57	On-site	90-160	Vertical Gradient	
MW-186E-75	9/30/2013	495.77	No LNAPL	11.31	484.46	On-site	55-90	Vertical Gradient	
MW-187-15	10/1/2013	485.24	--	12.35	472.89	Off-site	Water Table		
MW-188A-15	10/2/2013	461.84	--	4.13	457.71	Off-site	Water Table		
MW-188B-40	10/2/2013	461.53	--	5.15	456.38	Off-site	10-55		
MW-189A-15	10/1/2013	470.19	--	4.71	465.48	Off-site	Water Table		
MW-189B-60	10/1/2013	470.25	--	—	—	Off-site	10-55		point
MW-190A-15	10/1/2013	481.87	--	8.12	473.75	Off-site	Water Table		
MW-190BR-60	10/1/2013	481.91	--	8.42	473.49	Off-site	10-55		
MW-191A-15	10/1/2013	475.64	--	5.69	469.95	Off-site	Water Table		

**Table 4-2
Groundwater Elevation and Depth to LNAPL**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Date Measured	Riser Elevation (MSL feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Proximity	Zone	Group	Notes
MW-191B-60	10/1/2013	475.51	--	5.68	469.83	Off-site	10-55		
MW-192A-15	10/1/2013	495.90	--	9.80	486.10	On-site	Water Table		
MW-192B-55	10/1/2013	495.47	--	9.30	486.17	On-site	10-55		
MW-193A-15	10/1/2013	487.70	--	8.79	478.91	Off-site	Water Table		
MW-193B-60	10/1/2013	487.40	--	8.39	479.01	Off-site	10-55		
MW-194A-15	10/1/2013	475.58	--	9.11	466.47	Off-site	Water Table		
MW-194B-40	10/1/2013	475.58	--	8.87	466.71	Off-site	10-55		
MW-195A-15	10/1/2013	496.10	--	11.08	485.02	On-site	Water Table		
MW-195B-150	10/1/2013	496.12	--	11.00	485.12	On-site	90-160		
MW-197A-65	9/30/2013	495.27	No LNAPL	10.62	484.65	On-site	10-55		
MW-198-150	10/1/2013	493.32	No LNAPL	7.75	485.57	On-site	90-160		
MW-199-150	10/1/2013	495.90	--	11.45	484.45	On-site	90-160		
MW-300-150	10/1/2013	496.00	No LNAPL	10.36	485.64	On-site	90-160		
MW-301-60	10/1/2013	492.61	No LNAPL	8.75	483.86	On-site	10-55	Vertical Gradient	
MW-301-70	10/1/2013	492.65	No LNAPL	8.78	483.87	On-site	55-90	Vertical Gradient	
MW-301-CMT-10	10/1/2013	492.88	--	9.10	483.78	On-site	Water Table	Vertical Gradient	
MW-301-CMT-20	10/1/2013	492.88	--	9.11	483.77	On-site	10-55	Vertical Gradient	
MW-301-CMT-30	10/1/2013	492.88	--	9.12	483.76	On-site	10-55	Vertical Gradient	
MW-301-CMT-40	10/1/2013	492.88	--	9.12	483.76	On-site	10-55	Vertical Gradient	
MW-301-CMT-50	10/1/2013	492.88	--	9.13	483.75	On-site	10-55	Vertical Gradient	
MW-302-110	10/1/2013	493.65	No LNAPL	9.83	483.82	On-site	90-160	Vertical Gradient	
MW-302-70	10/1/2013	493.29	No LNAPL	9.43	483.86	On-site	55-90	Vertical Gradient	
MW-302-80	10/1/2013	493.49	No LNAPL	9.66	483.83	On-site	55-90	Vertical Gradient	
MW-302-95	10/1/2013	493.00	No LNAPL	9.15	483.85	On-site	55-90	Vertical Gradient	
MW-302-CMT-10	10/1/2013	494.32	--	10.42	483.90	On-site	Water Table	Vertical Gradient	
MW-302-CMT-20	10/1/2013	494.32	--	10.41	483.91	On-site	10-55	Vertical Gradient	
MW-302-CMT-30	10/1/2013	494.32	--	10.41	483.91	On-site	10-55	Vertical Gradient	
MW-302-CMT-40	10/1/2013	494.32	--	10.40	483.92	On-site	10-55	Vertical Gradient	
MW-302-CMT-50	10/1/2013	494.32	--	10.40	483.92	On-site	10-55	Vertical Gradient	
MW-303-130	10/1/2013	495.15	No LNAPL	11.25	483.90	On-site	90-160	Vertical Gradient	
MW-303-70	10/1/2013	495.06	No LNAPL	11.25	483.81	On-site	55-90	Vertical Gradient	
MW-303-80	10/1/2013	495.12	No LNAPL	11.30	483.82	On-site	55-90	Vertical Gradient	
MW-303-95	10/1/2013	495.12	No LNAPL	11.25	483.87	On-site	55-90	Vertical Gradient	
MW-303-CMT-9	10/1/2013	495.85	--	11.85	484.00	On-site	Water Table	Vertical Gradient	
MW-303-CMT-19	10/1/2013	495.85	--	11.86	483.99	On-site	10-55	Vertical Gradient	
MW-303-CMT-29	10/1/2013	495.85	--	11.86	483.99	On-site	10-55	Vertical Gradient	
MW-303-CMT-39	10/1/2013	495.85	--	11.86	483.99	On-site	10-55	Vertical Gradient	
MW-303-CMT-49	10/1/2013	495.85	--	11.86	483.99	On-site	10-55	Vertical Gradient	
MW-303-CMT-59	10/1/2013	495.85	--	11.88	483.97	On-site	10-55	Vertical Gradient	
MW-304-125	10/1/2013	497.31	No LNAPL	13.39	483.92	On-site	90-160	Vertical Gradient	

**Table 4-2
Groundwater Elevation and Depth to LNAPL**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Date Measured	Riser Elevation (MSL feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Proximity	Zone	Group	Notes
MW-304-15	10/1/2013	496.97	No LNAPL	13.07	483.90	On-site	Water Table	Vertical Gradient	
MW-304-150	10/1/2013	497.16	No LNAPL	13.24	483.92	On-site	90-160	Vertical Gradient	
MW-304-70	10/1/2013	496.99	No LNAPL	13.05	483.94	On-site	55-90	Vertical Gradient	
MW-304-80	10/1/2013	496.72	No LNAPL	12.82	483.90	On-site	55-90	Vertical Gradient	
MW-304-96	10/1/2013	496.95	No LNAPL	13.01	483.94	On-site	55-90	Vertical Gradient	
MW-304-CMT-10	10/1/2013	497.63	--	—	—	On-site	Water Table	Vertical Gradient	Well channel was dry.
MW-304-CMT-20	10/1/2013	497.63	--	13.67	483.96	On-site	10-55	Vertical Gradient	
MW-304-CMT-30	10/1/2013	497.63	--	13.67	483.96	On-site	10-55	Vertical Gradient	
MW-304-CMT-40	10/1/2013	497.63	--	13.67	483.96	On-site	10-55	Vertical Gradient	
MW-304-CMT-50	10/1/2013	497.63	--	13.66	483.97	On-site	10-55	Vertical Gradient	
MW-304-CMT-60	10/1/2013	497.63	--	13.66	483.97	On-site	10-55	Vertical Gradient	
MW-305-100	10/1/2013	495.71	No LNAPL	11.85	483.86	On-site	90-160	Vertical Gradient	
MW-305-70	10/1/2013	495.67	No LNAPL	11.93	483.74	On-site	55-90	Vertical Gradient	
MW-305-80	10/1/2013	495.38	No LNAPL	11.86	483.52	On-site	55-90	Vertical Gradient	
MW-305-CMT-8	10/1/2013	496.39	--	—	—	On-site	Water Table	Vertical Gradient	Well channel was dry.
MW-305-CMT-18	10/1/2013	496.39	--	12.47	483.92	On-site	10-55	Vertical Gradient	
MW-305-CMT-28	10/1/2013	496.39	--	12.48	483.91	On-site	10-55	Vertical Gradient	
MW-305-CMT-38	10/1/2013	496.39	--	12.45	483.94	On-site	10-55	Vertical Gradient	
MW-305-CMT-48	10/1/2013	496.39	--	12.47	483.92	On-site	10-55	Vertical Gradient	
MW-305-CMT-58	10/1/2013	496.39	--	12.47	483.92	On-site	10-55	Vertical Gradient	
MW-306-100	10/1/2013	495.55	No LNAPL	11.81	483.74	On-site	55-90	Vertical Gradient	
MW-306-15	10/1/2013	496.76	No LNAPL	12.97	483.79	On-site	Water Table	Vertical Gradient	
MW-306-150	10/1/2013	496.00	No LNAPL	12.29	483.71	On-site	90-160	Vertical Gradient	
MW-306-70	10/1/2013	496.70	No LNAPL	12.96	483.74	On-site	55-90	Vertical Gradient	
MW-306-80	10/1/2013	496.52	No LNAPL	12.80	483.72	On-site	55-90	Vertical Gradient	
MW-306-CMT-10	10/1/2013	496.95	--	13.09	483.86	On-site	Water Table	Vertical Gradient	
MW-306-CMT-20	10/1/2013	496.95	--	13.09	483.86	On-site	10-55	Vertical Gradient	
MW-306-CMT-30	10/1/2013	496.95	--	13.09	483.86	On-site	10-55	Vertical Gradient	
MW-306-CMT-40	10/1/2013	496.95	--	13.11	483.84	On-site	10-55	Vertical Gradient	
MW-306-CMT-50	10/1/2013	496.95	--	13.11	483.84	On-site	10-55	Vertical Gradient	
MW-306-CMT-60	10/1/2013	496.95	--	13.11	483.84	On-site	10-55	Vertical Gradient	
MW-307-150	9/30/2013	495.48	No LNAPL	10.68	484.80	On-site	90-160		
MW-309-15	10/1/2013	494.90	--	10.63	484.27	On-site	Water Table		
MW-309-66	10/1/2013	495.15	--	10.85	484.30	On-site	10-55		
MW-310-110	10/1/2013	494.28	--	9.75	484.53	On-site	90-160		
MW-310-15	10/1/2013	494.26	--	9.92	484.34	On-site	Water Table		
MW-310-65	10/1/2013	494.38	--	10.02	484.36	On-site	10-55		
MW-311-15	10/1/2013	466.78	--	3.60	463.18	Off-site	Water Table		
MW-311-46	10/1/2013	466.96	--	3.77	463.19	Off-site	10-55		
MW-312-15	10/2/2013	464.30	--	5.11	459.19	Off-site	Water Table		

**Table 4-2
Groundwater Elevation and Depth to LNAPL**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Date Measured	Riser Elevation (MSL feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Proximity	Zone	Group	Notes
MW-312-50	10/2/2013	464.25	--	5.08	459.17	Off-site	10-55		
MW-313-15	10/1/2013	465.79	--	4.41	461.38	Off-site	Water Table		
MW-315-15	10/2/2013	458.44	--	4.96	453.48	Off-site	Water Table		
MW-315-150	10/2/2013	458.96	--	5.47	453.49	Off-site	90-160		
MW-317-71	10/1/2013	488.79	--	6.80	481.99	Off-site	55-90		
MW-318-135	10/1/2013	493.10	--	11.75	481.35	Off-site	90-160		
MW-318-20	10/1/2013	493.05	--	11.60	481.45	Off-site	Water Table		
MW-319-15	10/2/2013	456.10	--	4.28	451.82	Off-site	Water Table		
MW-319-45	10/1/2013	455.96	--	4.08	451.88	Off-site	10-55		
MW-321-15	10/1/2013	495.59	--	10.68	484.91	On-site	Water Table		
MW-321-65	10/1/2013	495.26	--	10.40	484.86	On-site	10-55		
MW-322-15	10/1/2013	472.14	--	9.45	462.69	Off-site	Water Table		
MW-322-150	10/1/2013	472.04	--	9.38	462.66	Off-site	90-160		
MW-324-15	10/1/2013	463.41	--	6.85	456.56	Off-site	Water Table		
MW-324-151	10/1/2013	462.90	--	6.28	456.62	Off-site	90-160		
MW-326-20	10/1/2013	500.57	--	10.35	490.22	Off-site	Water Table		
MW-326-150	10/1/2013	500.48	--	10.06	490.42	Off-site	90-160		
MW-327-15	10/1/2013	467.82	--	7.12	460.70	Off-site	Water Table		
MW-327-150	10/1/2013	467.61	--	6.74	460.87	Off-site	90-160		
MW-328-15	10/1/2013	472.35	--	7.50	464.85	Off-site	Water Table		
MW-328-151	10/1/2013	472.67	--	7.83	464.84	Off-site	90-160		
MW-330-65	10/1/2013	499.83	--	14.90	484.93	On-site	10-55		
MW-332-15	10/1/2013	481.63	--	7.49	474.14	Off-site	Water Table		
MW-332-150	10/1/2013	481.14	--	7.08	474.06	Off-site	90-160		
MW-333-16	10/1/2013	497.23	--	9.01	488.22	Off-site	Water Table		
MW-333-150	10/1/2013	497.17	--	8.95	488.22	Off-site	90-160		
MW-334-65	9/30/2013	495.81	No LNAPL	11.33	484.48	On-site	10-55		
O-1	10/1/2013	497.14	No LNAPL	11.54	485.60	On-site	Water Table		
O-12	9/30/2013	496.28	No LNAPL	12.00	484.28	On-site	Water Table		
O-14	10/1/2013	494.90	No LNAPL	9.04	485.86	On-site	Water Table		
O-15	10/1/2013	498.70	No LNAPL	12.50	486.20	On-site	Water Table		
O-17	10/1/2013	493.26	No LNAPL	8.42	484.84	On-site	Water Table		
O-18	10/1/2013	492.70	No LNAPL	7.64	485.06	On-site	Water Table		
O-2	9/30/2013	496.89	12.65	12.93	484.19	On-site	Water Table		
O-22	10/1/2013	496.76	No LNAPL	11.77	484.99	On-site	Water Table		
O-23	10/1/2013	495.83	--	11.13	484.70	On-site	Water Table		
O-24	9/30/2013	496.89	No LNAPL	12.53	484.36	On-site	Water Table		
O-26	10/1/2013	496.82	No LNAPL	12.70	484.12	On-site	Water Table		
O-27	10/1/2013	496.86	12.67	12.72	484.18	On-site	Water Table		
O-28	10/1/2013	494.65	--	8.91	485.74	On-site	Water Table		

**Table 4-2
Groundwater Elevation and Depth to LNAPL**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Date Measured	Riser Elevation (MSL feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Proximity	Zone	Group	Notes
O-29	10/1/2013	498.61	No LNAPL	13.38	485.23	On-site	Water Table		
O-30	10/1/2013	497.97	No LNAPL	12.40	485.57	On-site	Water Table		
O-3	9/30/2013	497.83	No LNAPL	13.29	484.54	On-site	Water Table		
O-4	10/1/2013	496.53	--	12.34	484.19	On-site	Water Table		
O-5	10/1/2013	496.19	--	11.87	484.32	On-site	Water Table		
O-6	10/1/2013	495.02	--	10.42	484.60	On-site	Water Table		
O-8	10/1/2013	496.72	No LNAPL	11.14	485.58	On-site	Water Table		
R-14A	9/30/2013	494.13	9.87	10.03	484.23	On-site	Water Table		
R-21	10/1/2013	495.54	12.50	12.62	483.02	On-site	Water Table		
R-35R	10/1/2013	494.71	No LNAPL	16.65	478.06	On-site	Water Table		
R-39	9/30/2013	495.06	No LNAPL	10.46	484.60	On-site	Water Table		
R-40	9/30/2013	494.47	10.16	10.17	484.31	On-site	Water Table		
R-42	10/1/2013	493.29	--	10.27	483.02	On-site	Water Table		
S-32	9/30/2013	495.81	No LNAPL	11.10	484.71	On-site	Water Table		
S-39	10/1/2013	494.07	9.57	11.43	484.15	On-site	Water Table		
S-43	9/30/2013	496.29	sheen	11.57	484.72	On-site	Water Table		
S-44	9/30/2013	495.03	10.48	10.52	484.54	On-site	Water Table		
S-50	9/30/2013	496.70	12.00	12.17	484.67	On-site	Water Table		
S-54	10/1/2013	497.01	--	13.19	483.82	On-site	Water Table		
Surface Water									
South Gravel Pit**	10/1/2013	493.51	--	9.80	491.31	On-site			
North Gravel Pit	10/1/2013	492.81	--	8.51	484.30	On-site			
Culvert 1- Large	10/3/2013	--	--	--	452.49 / 452.42	Off-site			
Culvert 1- Small	10/3/2013	--	--	--	452.39 / 452.51	Off-site			
Culvert 2- Large	10/3/2013	--	--	--	456.87 / 456.77	Off-site			
Culvert 2- Small	10/3/2013	--	--	--	457.77 / 456.77	Off-site			
Culvert 3- Large	10/3/2013	--	--	--	463.22 / 463.30	Off-site			
Culvert 3- Small	10/3/2013	--	--	--	463.21 / 463.56	Off-site			
Culvert 4- Large	10/3/2013	--	--	--	470.29 / 470.36	Off-site			
Culvert 4- Small	10/3/2013	--	--	--	470.28 / 470.90	Off-site			
Culvert 5	10/3/2013	--	--	--	473.33 / 473.42	Off-site			
Culvert 6	10/3/2013	--	--	--	473.75 / 473.56	Off-site			
Culvert 7	10/3/2013	--	--	--	482.31 / 483.76	Off-site			
Culvert 8- South	10/3/2013	--	--	--	463.82 / 463.87	Off-site			
Culvert 8- North	10/3/2013	--	--	--	463.91 / 463.69	Off-site			
Culvert 9- West	10/3/2013	--	--	--	468.08 / 468.31	Off-site			
Culvert 9- East	10/3/2013	--	--	--	468.44 / 468.39	Off-site			

Acronyms and Abbreviations:

-- = A water sounder was used. The well was not checked with an interface probe for the presence of LNAPL

**Table 4-2
Groundwater Elevation and Depth to LNAPL**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Well ID	Date Measured	Riser Elevation (MSL feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Proximity	Zone	Group	Notes
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MSL = mean sea level

No LNAPL = an interface probe was used, but LNAPL was not measured or observed

sheen = an interface probe was used. A measurable thickness of LNAPL was not present, but LNAPL was observed visually

** = the South Gravel Pit measurement is taken from a 12 foot staff gauge in the pond. The 12 foot mark on the gauge is at an elevation of 493.51 MSL feet

Culvert measurements were collected in October and November, however, only October data were included in this table. Water elevations for Culverts 2 and 8 are reported as

"Water Elevation East / Water Elevation West" and Culverts 1, 3, 4, 5, 6, 7 and 9 are reported as "Water Elevation North / Water Elevation South."

**Table 4-3
North Gravel Pit Hydraulic Gradients - November and December 2013**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Location	Top of Riser Elevation (ft MSL)	Ground Surface Elevation (ft MSL)	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Screen Top (ft btoc)	Screen Bottom (ft btoc)	Groundwater Elevation 11/25/2013 (ft MSL)	Groundwater Elevation 12/19/2013 (ft MSL)
MW-146A-15	495.07	492.6	6.00	16.00	8.49	18.49	484.05	484.03
MW-146B-30	494.94	492.6	22.00	27.00	24.36	29.36	484.08	484.06
MW-147A-15	491.92	489.5	3.00	13.00	5.41	15.41	483.71	483.72
MW-147B-25	492.55	489.7	20.50	25.50	23.32	28.32	483.68	483.69
MW-301-60	492.60	489.6	55.61	60.26	58.65	63.30	483.97	483.97
MW-301-70	492.65	489.6	65.70	70.14	68.75	73.19	484.00	484.00
MW-309-15	494.91	492.0	4.92	14.72	7.81	17.61	484.45	484.32
MW-309-66	495.15	492.0	59.43	64.10	62.61	67.28	484.46	484.39
MW-310-15	494.26	491.3	4.58	14.38	7.56	17.36	484.41	484.65
MW-310-65	494.38	491.5	60.47	65.13	63.31	67.97	484.54	484.57
MW-310-110	494.13	491.1	105.28	109.94	108.31	112.97	484.57	484.26
MW-351-15	493.41	490.4	5.32	15.08	8.32	18.08	484.23	484.23
MW-351-55	493.56	490.4	50.60	55.12	53.76	58.28	484.32	484.31
MW-351-75	493.43	490.4	71.39	75.91	74.44	78.96	484.25	484.28
MW-351-150	493.74	490.6	145.74	150.25	148.91	153.42	483.20	483.26
PZ-1-15	497.98	495.2	0.10	9.60	2.92	12.42	484.88	484.85
PZ-1-20	500.58	497.7	15.50	20.00	18.34	22.84	484.74	484.73
PZ-1-45	500.34	497.6	35.30	39.80	38.06	42.56	484.71	484.70
PZ-1-65	500.36	497.6	60.60	65.10	63.33	67.83	484.72	484.71
PZ-4-13	489.71	486.8	0.00	9.70	2.91	12.61	484.28	484.32
PZ-4-20	489.64	486.8	15.50	19.90	18.33	22.73	484.27	484.32
PZ-4-45	489.73	487.0	40.30	44.90	43.05	47.65	484.26	484.27
PZ-4-65	489.57	486.8	61.50	66.10	64.23	68.83	484.30	484.27
PZ-5-13	491.86	488.9	1.00	10.70	3.98	13.68	484.01	484.06
PZ-5-20	492.00	489.1	15.20	19.70	18.14	22.64	484.03	484.08
PZ-5-45	491.74	488.7	40.30	44.70	43.39	47.79	483.94	483.98
PZ-5-65	491.93	488.8	60.30	64.80	63.40	67.90	483.91	483.91
North Gravel Pit†	492.81						484.39	484.51

Acronyms and Abbreviations:

bgs = below ground surface

btoc = below top of casing

ft = feet

MSL = mean sea level

† = The surface water gauging station at the north gravel pit was used as a benchmark for this survey. The benchmark elevation did not change between surveys performed in September 2009 and October 2013.

Table 4-4
LNAPL Thickness Check Results

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well ID	Top of Riser Elevation (MSL feet)	Frequency	October 2013					November 2013					December 2013				
			Date Measured	LNAPL Thickness (feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Date Measured	LNAPL Thickness (feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)	Date Measured	LNAPL Thickness (feet)	Depth to LNAPL (feet)	Depth to Water (feet)	Corrected Water Table Elevation (MSL feet)
MW-138-20	496.34	Monthly	10/29/2013	0.29	11.12	11.41	485.17	11/19/2013	0.01	10.55	10.56	485.79	12/20/2013	0.01	10.38	10.39	485.96
MW-176A-15	497.02	Quarterly	10/29/2013	3.12	11.80	14.92	484.64	Measured Quarterly					Measured Quarterly				
MW-186A-15	495.96	Monthly	10/22/2013	0.39	12.25	12.64	483.64	11/26/2013	0.54	11.33	11.87	484.53	12/18/2013	0.67	11.61	12.28	484.23
MW-334-15*	495.89	Monthly	10/22/2013	1.68	12.08	13.76	483.47	11/26/2013	1.25	12.11	13.36	483.53	12/18/2013	1.30	12.44	13.74	483.19
O-10	496.36	Monthly	10/29/2013	0.04	12.00	12.04	484.35	11/19/2013	sheen	sheen	11.36	485.00	12/20/2013	0.10	11.24	11.34	485.10
O-11	497.90	Monthly	10/22/2013	0.98	14.10	15.08	483.63	11/26/2013	0.68	13.36	14.04	484.42	12/18/2013	0.85	13.51	14.36	484.25
O-13	495.38	Monthly	10/22/2013	0.81	11.54	12.35	483.70	11/26/2013	0.18	10.92	11.10	484.43	12/18/2013	0.32	11.03	11.35	484.30
O-19	496.50	Monthly	10/22/2013	1.31	12.19	13.50	484.06	11/26/2013	0.08	11.65	11.73	484.83	12/18/2013	0.36	11.75	12.11	484.68
O-2	496.89	Monthly	10/22/2013	0.33	13.27	13.60	483.56	11/26/2013	0.46	12.29	12.75	484.51	12/18/2013	0.59	12.68	13.27	484.10
O-21	493.12	Monthly	10/29/2013	0.28	7.90	8.18	485.18	11/19/2013	0.05	7.20	7.25	485.91	12/20/2013	sheen	sheen	7.11	486.01
O-27	496.86	Monthly	10/29/2013	0.11	13.37	13.48	483.47	11/19/2013	sheen	sheen	12.73	484.13	12/20/2013	0.01	12.65	12.66	484.21
O-31*	496.11	Monthly	10/29/2013	0.68	12.43	13.11	483.54	11/25/2013	1.53	11.46	12.99	484.34	12/20/2013	1.24	11.63	12.87	484.23
O-32	496.36	Monthly	10/29/2013	0.00	No LNAPL	12.87	483.49	11/19/2013	0.00	No LNAPL	12.19	484.17	12/20/2013	0.00	No LNAPL	12.15	484.21
O-33*	496.53	Monthly	10/29/2013	0.34	12.41	12.75	484.05	11/19/2013	0.81	11.64	12.45	484.73	12/20/2013	0.77	11.56	12.33	484.82
O-34*	496.31	Monthly	10/29/2013	2.41	11.31	13.72	484.52	11/19/2013	0.45	10.97	11.42	485.25	12/20/2013	0.42	10.88	11.30	485.35
O-35*	496.88	Monthly	10/29/2013	0.01	12.11	12.12	484.77	11/19/2013	0.01	11.37	11.38	485.51	12/20/2013	0.02	11.29	11.31	485.59
O-36*	496.49	Monthly	10/29/2013	0.01	12.32	12.33	484.17	11/19/2013	1.03	11.51	12.54	484.77	12/20/2013	0.44	11.51	11.95	484.89
O-37*	496.42	Monthly	10/29/2013	0.20	12.00	12.20	484.38	11/19/2013	0.28	11.36	11.64	485.00	12/20/2013	0.28	11.27	11.55	485.09
O-38*	496.60	Monthly	10/29/2013	0.95	11.82	12.77	484.59	11/19/2013	1.62	11.10	12.72	485.18	12/20/2013	0.97	11.14	12.11	485.27
O-7	496.01	Monthly	10/29/2013	0.03	11.87	11.90	484.13	11/19/2013	0.47	11.22	11.69	484.69	12/20/2013	0.02	11.19	11.21	484.82
O-9	496.95	Monthly	10/29/2013	0.88	12.31	13.19	484.48	11/19/2013	1.01	11.69	12.70	485.08	12/20/2013	0.43	11.69	12.12	485.18
R-14A	494.13	Monthly	10/22/2013	0.40	10.44	10.84	483.61	11/26/2013	0.01	9.62	9.63	484.51	12/18/2013	0.71	9.76	10.47	484.24
R-18	499.83	Quarterly	10/22/2013	0.41	15.40	15.81	484.34	Measured Quarterly					Measured Quarterly				
R-20R	498.74	Monthly	10/29/2013	0.05	14.30	14.35	484.43	11/19/2013	0.09	13.57	13.66	485.15	12/20/2013	0.80	13.33	14.13	485.26
R-21	495.54	Monthly	10/29/2013	0.08	13.70	13.78	481.83	11/19/2013	0.95	12.60	13.55	482.77	12/20/2013	0.07	12.58	12.65	482.95
R-32	494.33	Monthly	10/29/2013	0.72	9.80	10.52	484.40	11/19/2013	0.92	9.12	10.04	485.04	12/20/2013	0.64	9.05	9.69	485.16
R-32R*	496.55	Monthly	10/29/2013	0.77	12.08	12.85	484.33	11/19/2013	0.47	11.45	11.92	485.01	12/20/2013	0.61	11.33	11.94	485.11
R-33	495.82	Monthly	10/29/2013	0.15	10.87	11.02	484.93	11/19/2013	0.25	10.02	10.27	485.76	12/20/2013	0.17	10.03	10.20	485.76
R-34	495.20	Quarterly	10/29/2013	0.49	10.80	11.29	484.31	Measured Quarterly					Measured Quarterly				
R-35R	494.71	Monthly	10/29/2013	0.00	No LNAPL	20.71	474.00	11/19/2013	0.00	No LNAPL	16.05	478.66	12/20/2013	0.00	No LNAPL	19.67	475.04
R-39	495.06	Monthly	10/22/2013	0.00	No LNAPL	11.36	483.70	11/26/2013	0.00	No LNAPL	10.80	484.26	12/18/2013	0.00	No LNAPL	10.87	484.19
R-40	494.47	Monthly	10/22/2013	0.06	10.78	10.84	483.68	11/26/2013	sheen	sheen	9.84	484.63	12/18/2013	0.01	10.09	10.10	484.38
R-44*	496.25	Monthly	10/29/2013	0.05	18.41	18.46	477.83	11/25/2013	sheen	sheen	11.76	484.49	12/20/2013	0.00	No LNAPL	19.10	477.15
R-45*	495.97	Monthly	10/29/2013	0.42	22.94	23.36	472.95	11/19/2013	0.01	20.89	20.90	475.08	12/20/2013	0.00	No LNAPL	18.35	477.62
S-21	497.19	Monthly	10/29/2013	1.29	12.91	14.20	484.01	11/19/2013	0.23	12.47	12.70	484.67	12/20/2013	0.28	12.34	12.62	484.79
S-22	496.70	Monthly	10/29/2013	1.78	11.95	13.73	484.43	11/19/2013	1.11	11.42	12.53	485.08	12/20/2013	1.06	11.31	12.37	485.20
S-32	495.81	Monthly	10/22/2013	0.00	No LNAPL	11.75	484.06	11/26/2013	0.00	No LNAPL	11.11	484.70	12/18/2013		No LNAPL	11.11	484.70
S-39	494.07	Monthly	10/29/2013	0.76	10.48	11.24	483.45	11/19/2013	0.05	9.96	10.01	484.10	12/20/2013	0.12	9.81	9.93	484.24
S-43	496.29	Monthly	10/22/2013	sheen	sheen	12.17	484.12	11/26/2013	sheen	sheen	11.69	484.60	12/18/2013	sheen	sheen	11.57	484.72
S-44	495.03	Monthly	10/22/2013	1.31	10.83	12.14	483.91	11/26/2013	0.14	10.27	10.41	484.73	12/18/2013	0.17	10.48	10.65	484.51
S-50	496.70	Monthly	10/22/2013	1.39	12.50	13.89	483.98	11/26/2013	0.01	11.90	11.91	484.80	12/18/2013	0.74	11.94	12.68	484.64
S-51	495.92	Monthly	10/22/2013	1.93	11.63	13.56	483.95	11/26/2013	0.14	11.12	11.26	484.78	12/18/2013	0.55	11.21	11.76	484.61

Acronyms and Abbreviations:

MSL = mean sea level

No LNAPL = an interface probe was used to measure depth to water. LNAPL was not observed

sheen = LNAPL thickness was less than 0.01' and was not detected with an air/product/water interface probe; product was detected visually

* = corrected water table elevation is an approximation based on a LNAPL specific gravity of 0.8

**Table 4-5
LNAPL Migration Check Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Location	Frequency	October 2013			November 2013			December 2013		
		Date Measured	LNAPL Present (yes/no)	Notes	Date Measured	LNAPL Present (yes/no)	Notes	Date Measured	LNAPL Present (yes/no)	Notes
MW-139-25	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
MW-140-25	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
MW-142-20	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
MW-144A-25	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
MW-145-20	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
MW-178A-15	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
MW-179A-15	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
MW-180A-15	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
MW-195A-15	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
MW-196-15	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
O-1	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-12	Monthly	10/22/2013	N		11/26/2013	N		12/18/2013	N	
O-14	Monthly	10/29/2013	N		11/25/2013	N		12/20/2013	N	
O-15	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-16	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-17	Monthly	10/29/2013	N		11/26/2013	N		12/20/2013	--	Well was inaccessible--buried in snow berm.
O-18	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-20	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-22	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-23	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-24	Monthly	10/22/2013	N		11/26/2013	N		12/18/2013	N	
O-25	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-26	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-28	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-29	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
O-3	Monthly	10/22/2013	N		11/26/2013	N		12/18/2013	N	
O-30	Quarterly	10/29/2013	N		--	--	measured quarterly	--	--	measured quarterly
O-4	Monthly	10/29/2013	N		11/26/2013	N		12/18/2013	N	
O-5	Monthly	10/22/2013	N		11/26/2013	N		12/18/2013	N	
O-6	Monthly	10/22/2013	N		11/26/2013	N		12/18/2013	N	
O-8	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
R-3	Quarterly	10/29/2013	N	Well dry at 7.32 feet below measuring point	--	--	measured quarterly	--	--	measured quarterly
R-42	Monthly	10/29/2013	N		11/19/2013	N		12/18/2013	N	
R-43	Monthly	10/29/2013	N		11/19/2013	N		12/18/2013	N	
R-46	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	
S-9	Monthly	10/29/2013	N		11/19/2013	N		12/20/2013	N	

Acronyms and Abbreviations:

--- = not measured

**Table 4-6
LNAPL Baildown Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLP
North Pole Refinery, North Pole, Alaska**

Well ID	Date	Drawdown Adjustment (feet)	Time Cut (minutes)	Initial LNAPL Thickness (feet)	Test Duration (minutes)	Final LNAPL Thickness (feet)	Percent Recovery	LNAPL Transmissivity (feet ² /day)			
								Bouwer & Rice	Cooper & Jacob / Jacob & Lohman	Cooper, Bredehoeft, & Papadopoulos	Geometric Average
MW-176A	5/10/2012	0.43	2	3.49	161	1.12	32	2.8	8.7	8.1	5.8
MW-176A	5/11/2012	0.09	1	1.31	587	0.85	65	NA	8.0	8.1	8.0
MW-176A	5/31/2012	NA	NA	0.65	1336	0.32	49	NA			--
MW-176A	10/26/2012	0.22	10	2.94	1453	2.18	74	1.7	--	--	--
MW-176A	10/29/2012	0.18	17	2.69	1404	1.86	69	1.4	--	--	--
MW-176A	3/6/2013	0.30	14	4.14	1493	1.82	44	0.20	--	--	--
MW-176A	10/18/2013	0	30	2.53	305	1.50	59	0.40	--	--	--
MW-186A	10/17/2012	0.01	6	0.52	1465	0.38	73	0.12	--	--	--
MW-186A	10/18/2012	NA	NA	0.38	293	0.28	74	0			--
O-9	5/15/2012	0.18	5	1.57	185	0.55	35	1.1	2.8	1.8	1.8
O-9	5/16/2012	0.09	4	0.79	266	0.24	30	0.44	1.1	1.0	0.8
O-10	5/11/2012	0.03	30	1.41	247	1.15	82	2.3	3.8	--	--
O-10	5/14/2012	0.04	10	1.3	206	0.94	72	2.0	2.3	--	--
O-10	10/22/2012	0.16	8	1.25	1248	0.76	61	--	2.4	--	--
O-10	10/24/2012	0.09	7	0.93	1437	0.69	74	--	2.7	--	--
O-10	3/6/2013	0.20	6	1.58	266	0.30	19	1.4	--	--	--
O-11	11/22/2011	NA	NA	0.63	35	0.12	19	NA	1.3	1.0	1.2
O-11	5/10/2012	0.11	4	1.03	453	0.38	37	NA	1.8	0.60	1.0
O-11	5/11/2012	0.09	4	0.72	456	0.33	46	NA	NA	NA	--
O-11	5/31/2012	NA	NA	0.63	1200	0.40	63	NA			--
O-11	10/23/2012	NA	NA	0.99	2809	0.21	21	NA			--
O-11	3/11/2013	0.07	7	0.76	1546	0.43	57	0.30	--	--	--
O-13	10/22/2011	0.20	3	1.56	138	0.88	56	9.4	11	6.8	8.9
O-13	5/10/2012	0.05	3	0.69	390	0.34	49	NA	4.7	3.9	4.3
O-13	10/23/2012	0.02	4	0.54	2783	0.59	109	--	2.0	--	--
O-13	10/29/2012	0.05	5	0.69	1404	1.86	270	1.3	--	--	--
O-19	10/26/2011	0.01	3	1.75	1880	1.77	101	15	18	10	14
O-19	5/8/2012	0.15	3	1.7	102	1.02	60	4.5	13	6.5	7.2
O-19	5/9/2012	0.13	4	1.34	165	0.69	51	NA	8.7	6.5	7.5
O-19	5/14/2012	0.16	2	1.49	163	0.60	40	1.4	4.5	3.3	2.7
O-19	10/22/2012	NA	NA	0.57	1379	0.38	67	NA			--
O-19	10/24/2012	0.04	4	0.47	1399	0.42	89	0			--
O-27	10/17/2012	0.12	8	0.99	1494	0.37	37	--	1.1	--	--
O-27	10/29/2012	0.10	15	0.68	1435	0.12	18	--	1.4	--	--
O-27	3/7/2013	0.06	3	0.56	1547	0.24	43	2.6	--	--	--
O-27	10/18/2013	NA	NA	0.6	405	0.06	10	NA			--
O-31	10/17/2013	0	43	0.69	1730	0.50	72	0.05	--	--	--
O-33	10/17/2013	NA	NA	0.59	4407	0.21	36	NA			--
O-34	10/16/2013	0	32	1.85	1185	1.68	91	0.50	--	--	--
O-34	10/17/2013	0	32	1.68	1840	1.76	105	0.60	--	--	--
R-14A	10/23/2012	0.09	2	0.78	2900	0.24	31	0.26	--	--	--
R-14A	3/11/2013	0.02	8	0.75	251	0.25	33	0.10	--	--	--
S-20	10/3/2011	0.34	4	2.45	1454	1.82	74	2.6	2.3	3.2	2.7
S-21	5/8/2012	0	2	0.64	71	0.63	98	NA	6.8	5.0	5.8

**Table 4-6
LNAPL Baildown Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLP
North Pole Refinery, North Pole, Alaska**

Well ID	Date	Drawdown Adjustment (feet)	Time Cut (minutes)	Initial LNAPL Thickness (feet)	Test Duration (minutes)	Final LNAPL Thickness (feet)	Percent Recovery	LNAPL Transmissivity (feet ² /day)			
								Bouwer & Rice	Cooper & Jacob / Jacob & Lohman	Cooper, Bredehoeft, & Papadopoulos	Geometric Average
S-21	5/10/2012	0	2	0.7	79	0.70	100	11	13	9.3	11
S-21	10/16/2013	0	35	0.5	140	0.43	86	1.0	--	--	--
S-21	10/16/2013	0	50	0.43	90	0.37	86	1.6	--	--	--
S-22	9/29/2011	0.21	7	1.88	382	0.76	40	1.4	1.8	2.9	1.9
S-22	10/26/2012	0.20	4	1.49	1493	0.36	24	0.21	--	--	--
S-22	3/6/2013	0.07	4	0.9	300	0.15	17	--	0.20	--	--
S-39	10/26/2012	NA	NA	0.64	1321.0	0.07	11	NA			
S-39	10/18/2013	0	19	1.94	135.0	0.06	3	0.02	--	--	--
S-44	3/6/2013	0.20	22	1.19	367	0.08	7	0.10	--	--	--
S-50	10/1/2011	NA	NA	2.03	12.7	1.06	52	NA			
S-50	10/2/2011	0.05	10	1.67	527	1.68	101	1.4	2.3	2.1	1.9
S-50	5/7/2012	0.04	2	1.21	136	0.96	79	NA	5.9	5.2	5.5
S-50	5/9/2012	0.04	8	1.34	521	1.16	87	6.2	4.3	2.8	4.2
S-50	10/19/2012	0.10	50	1.72	4265	1.73	101	2.3	--	--	--
S-50	10/22/2012	0.10	52	1.73	1447	1.49	86	1.8	--	--	--
S-50	3/7/2013	0.15	10	1.3	235	0.30	23	1.7	--	--	--
S-51	10/3/2011	0.02	10	1.88	122	1.70	90	4.0	8.1	2.8	4.5
S-51	10/3/2011	0.05	8	1.81	148	1.60	88	7.3	11	5.9	7.8
S-51	5/7/2012	0.02	2	1.5	229	1.42	95	2.9	8.4	6.7	5.4
S-51	5/9/2012	0.02	19	1.59	404	1.50	94	1.3	3.6	2.3	2.2
S-51	10/18/2012	0	27	1.27	1229	1.29	102	0.70	--	--	--
S-51	10/19/2012	0	19	1.29	230	1.05	81	0.58	--	--	--
S-51	3/7/2013	0	10	1.06	312	0.88	83	0.36	--	--	--
MW-334-15*	10/19/2012	NA	NA	1.42	28.5	1.40	99	NA			
MW-334-15*	3/7/2013	NA	NA	1.46	30	1.43	98	NA			

General Notes:

Bold Exceeds 0.1 to 0.8 feet²/day upper criterion range to produce sufficient LNAPL recoverability (ITRC 2009a).

* LNAPL manual skimming test was completed at MW-334-15 due to apparent high transmissivity.

Acronyms and Abbreviations:

-- = method of analysis not used

0 = LNAPL transmissivity is assumed to be zero due to negligible LNAPL thickness in well at test commencement

LNAPL = light nonaqueous phase liquid

NA = not analyzed. Test was not analyzed using analysis method

**Table 4-7
LNAPL Manual Skimming Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Test Well ID	Date	Initial LNAPL Thickness (feet)	Test Duration (hours)	LNAPL Volume Recovered (gallons)	LNAPL Transmissivity¹ (feet²/day)
MW-334-15	10/15/2013	1.61	3	48	141

General Notes:

Bold Exceeds 0.1 to 0.8 foot²/day lower criterion range to produce sufficient LNAPL recoverability (ITRC 2009).

¹Transmissivity was the overall result for all LNAPL removal events during manual skimming test.

Acronyms and Abbreviations:

LNAPL = light nonaqueous phase liquid

**Table 4-8
LNAPL Pneumatic Skimming Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Test Well ID	Date	Static LNAPL Thickness (feet)	Volume of LNAPL Removed During Period (gallons)	LNAPL Transmissivity ¹ (feet ² /day)
R-20R	9/14/2011	0.02	14	3.3
	12/19/2011	0.98	10	0.45
	1/5/2012	0.73	11	0.41
	2/28/2012	1.24	12	0.09
	3/5/2012	0.07	8	9.2
	4/9/2012	1.23	22	0.25
	4/16/2012	0.01	5.0	34
	6/19/2012	0.24	10	0.31
	7/2/2012	0.10	2.0	1.6
	8/23/2012	0.12	10	0.77
	11/13/2012	0.06	1.5	0.25
	12/31/2012	0.10	1.0	0.10
	3/26/2013	0.11	6.0	0.31
	4/25/2013	0.12	11	1.5
	6/6/2013	0.03	10	3.8
	7/18/2013	0.50	0.6	0.01
	9/9/2013	0.09	20	2.0
	10/25/2013	0.35	18	0.55
	12/30/2013	0.10	20.0	1.6
MW-138-20	1/28/2010	0.10	10	6.6
	2/12/2010	0.10	17	1.7
	3/5/2010	0.10	48	11.8
	3/16/2010	0.10	40	18.7
	3/18/2010	0.10	14	2.1
	3/25/2010	0.10	29	21.3
	2/9/2011	0.35	14	0.06
	2/24/2011	0.10	44	15.2
	4/28/2011	0.10	29	2.4
	9/14/2011	0.15	1.7	0.04
	10/19/2011	0.84	14	0.5
	10/21/2011	0.93	16	4.4
	12/8/2011	0.10	31	3.3
	12/19/2011	0.10	10	4.7
	1/31/2012	1.45	20	0.17

**Table 4-8
LNAPL Pneumatic Skimming Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Test Well ID	Date	Static LNAPL Thickness (feet)	Volume of LNAPL Removed During Period (gallons)	LNAPL Transmissivity ¹ (feet ² /day)
MW-138-20	2/17/2012	<i>0.10</i>	35	10.6
	2/22/2012	<i>0.10</i>	30	30.9
	2/27/2012	<i>0.10</i>	31	31.9
	3/7/2012	<i>0.10</i>	35	20.0
	3/26/2012	1.09	43	1.1
	3/30/2012	<i>0.10</i>	1.53	2.0
	4/9/2012	0.70	55	4.0
	4/16/2012	0.16	20	9.2
	4/24/2012	<i>0.10</i>	17	10.9
	4/11/2013	<i>0.10</i>	10	6.4

General Notes:

Italicized LNAPL thickness was assumed to be 0.1 feet. Skimmers were not operating unless greater than 0.1 feet.

Bold Exceeds 0.1 to 0.8 feet²/day upper criterion range to produce sufficient LNAPL recoverability (ITRC 2009a).

¹ LNAPL transmissivity calculated for entire skimming duration.

Acronyms and Abbreviations:

LNAPL = light nonaqueous phase liquid

**Table 4-9a
R-21 Water-Enhanced Recovery Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Test Well ID	Date	Static LNAPL Thickness (feet)	LNAPL Recovery Rate (gallons per day)	Groundwater Recovery Rate (gallons per day)	LNAPL Transmissivity (feet ² /day)	
					Small Relative LNAPL Drawdown ¹	Large Relative LNAPL Drawdown ²
R-21	1/7/2010	0.43	0.24	57,600	0.05	---
	1/28/2010	0.48	0.22	67,156	0.04	---
	2/3/2010	0.66	0.82	59,040	---	0.17
	2/12/2010	0.43	0.20	57,600	0.04	---
	2/17/2010	0.22	0.26	54,720	0.05	---
	3/4/2010	0.56	0.33	63,900	0.06	---
	3/22/2010	1.04	0.27	61,844	---	0.06
	3/25/2010	1.06	4.60	66,240	---	0.92
	4/6/2010	0.84	0.03	66,240	---	0.01
	4/8/2010	0.43	1.55	60,480	0.28	---
	4/23/2010	0.95	0.58	54,000	---	0.14
	5/3/2010	0.86	3.41	38,880	---	1.13
	5/23/2010	0.38	2.49	41,760	0.66	---
	5/28/2010	4.0	2.98	36,000	---	1.6
	6/11/2010	3.67	1.50	53,280	---	0.52
	6/18/2010	0.32	1.29	50,400	0.28	---
	6/30/2010	1.08	0.47	59,151	---	0.11
	7/9/2010	1.03	1.00	50,400	---	0.26
	7/19/2010	1.35	0.78	41,760	---	0.26
	7/19/2010	0.33	2.85	56,160	0.56	---
	7/28/2010	0.41	0.28	50,400	0.06	---
	8/6/2010	0.63	0.40	59,040	0.08	---
	8/23/2010	0.97	0.43	48,960	---	0.12
	8/30/2010	0.61	0.50	60,480	0.09	---
	9/3/2010	0.55	0.80	57,600	0.15	---
	9/23/2010	1.46	0.42	51,840	---	0.11
	10/1/2010	0.43	0.31	47,520	0.07	---
	10/20/2010	1.66	0.60	67,680	---	0.13
	10/25/2010	4.82	5.53	54,720	---	2.1
	11/3/2010	3.9	2.49	54,720	---	0.87
	11/5/2010	3.85	11.05	82,080	---	2.6
	11/8/2010	4.4	8.42	79,200	---	2.1
	11/9/2010	2.65	15.20	97,920	---	2.6
	11/11/2010	4.27	12.25	93,600	---	2.6
	11/12/2010	1.7	9.80	93,600	---	1.5
	11/15/2010	4.31	8.25	90,720	---	1.8
11/17/2010	1.76	5.05	93,600	---	0.79	
11/18/2010	1.49	8.55	90,720	---	1.3	
11/24/2010	4.2	4.02	92,160	---	0.86	
11/29/2010	1.67	1.92	90,720	---	0.31	
12/8/2010	2.34	1.50	86,400	---	0.28	

Table 4-9a
R-21 Water-Enhanced Recovery Test Results

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Test Well ID	Date	Static LNAPL Thickness (feet)	LNAPL Recovery Rate (gallons per day)	Groundwater Recovery Rate (gallons per day)	LNAPL Transmissivity (feet ² /day)	
					Small Relative LNAPL Drawdown ¹	Large Relative LNAPL Drawdown ²
R-21	12/22/2010	2.99	1.23	79,200	---	0.27
	12/27/2010	1.81	2.08	77,760	---	0.40
	12/30/2010	0.65	1.23	74,880	---	0.20
	1/3/2011	1.97	2.83	86,400	---	0.49
	1/6/2011	0.94	1.80	122,400	---	0.19
	1/20/2011	1.24	0.51	144,000	---	0.05
	1/27/2011	2.02	1.66	136,800	---	0.18
	1/31/2011	0.7	1.00	144,000	---	0.09
	2/3/2011	1.94	3.73	160,200	---	0.35
	2/9/2011	3.1	2.97	120,960	---	0.43
	2/14/2011	2.36	2.72	113,760	---	0.38
	2/15/2011	0.64	3.70	133,920	---	0.34
	2/24/2011	6.56	4.19	120,960	---	0.85
	2/28/2011	6.12	8.78	116,640	---	1.8
	3/1/2011	1.5	8.60	116,640	---	1.0
	3/3/2011	1.87	5.35	135,360	---	0.59
	3/4/2011	1.72	9.90	120,960	---	1.2
	3/7/2011	4.46	8.53	97,920	---	1.8
	3/9/2011	2.48	7.10	113,760	---	1.0
	3/15/2011	6.24	5.97	116,640	---	1.2
	3/16/2011	1.2	6.90	116,640	---	0.80
	3/18/2011	2.67	7.66	116,640	---	1.1
	3/21/2011	4.02	7.70	116,640	---	1.3
	3/24/2011	2.11	4.04	106,560	---	0.58
	3/28/2011	4.73	6.78	115,200	---	1.2
	3/31/2011	3.6	6.90	110,880	---	1.1
	4/1/2011	0.95	5.50	118,080	---	0.61
	4/4/2011	3.28	6.27	139,680	---	0.80
	4/6/2011	2.26	6.50	139,680	---	0.73
	4/7/2011	1.44	8.30	138,240	---	0.84
	4/11/2011	4.05	5.80	132,480	---	0.85
	4/15/2011	4	5.75	129,600	---	0.85
	4/18/2011	3.03	5.80	119,520	---	0.84
	4/20/2011	1.18	3.39	123,840	---	0.37
4/21/2011	0.97	5.57	123,840	---	0.59	
4/26/2011	3.36	3.86	125,280	---	0.55	
4/28/2011	0.84	2.41	125,280	---	0.25	
5/3/2011	1.25	1.44	123,840	---	0.16	
5/4/2011	0.19	1.09	123,840	0.10	---	
5/10/2011	0.5	0.48	128,160	0.04	---	
5/14/2011	1.32	1.90	122,400	---	0.21	

**Table 4-9a
R-21 Water-Enhanced Recovery Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Test Well ID	Date	Static LNAPL Thickness (feet)	LNAPL Recovery Rate (gallons per day)	Groundwater Recovery Rate (gallons per day)	LNAPL Transmissivity (feet ² /day)	
					Small Relative LNAPL Drawdown ¹	Large Relative LNAPL Drawdown ²
R-21	5/17/2011	2.36	4.51	119,520	---	0.60
	5/22/2011	5.47	6.28	119,520	---	1.2
	5/27/2011	0.44	0.51	142,080	0.04	---
	5/28/2011	0.41	2.35	116,640	0.22	---
	5/31/2011	1.63	3.12	110,880	---	0.41
	6/5/2011	1.27	1.46	115,200	---	0.17
	6/9/2011	0.95	1.36	115,200	---	0.15
	6/16/2011	1.7	1.39	125,280	---	0.16
	6/24/2011	2.21	1.59	116,640	---	0.21
	6/29/2011	1.26	1.45	112,320	---	0.18
	7/1/2011	0.19	0.55	131,040	0.05	---
	7/8/2011	1.7	1.39	125,280	---	0.16
	7/18/2011	2.47	1.42	110,880	---	0.21
	7/22/2011	0.55	0.79	129,600	0.07	---
	8/9/2011	1.14	0.36	110,880	---	0.04
	10/7/2011	0.48	1.41	97,104	0.16	---
	10/10/2011	0.5	15.00	136,800	1.2	---
	10/11/2011	0.1	34.00	164,160	2.3	---
	10/14/2011	0.7	18.00	164,160	1.2	---
	10/19/2011	1.6	16.40	140,160	---	1.6
	10/25/2011	8.85	16.67	95,657	---	4.2
	10/27/2011	6	91.00	77,760	---	23
	10/31/2011	3.9	50.00	78,912	---	11
	11/23/2011	1.65	3.57	14,976	---	3.2
	11/28/2011	5.4	2.00	74,880	---	0.50
	12/5/2011	5	6.71	82,620	---	1.5
	12/8/2011	0.02	24.00	72,000	3.7	---
	12/12/2011	0.02	8.75	72,000	1.3	---
	12/15/2011	1.4	16.50	72,000	---	3.0
	12/19/2011	0.4	12.38	72,000	1.9	---
	12/22/2011	0.01	8.67	108,000	0.89	---
	12/27/2011	0.05	6.20	70,560	0.97	---
	1/5/2012	0.27	4.67	84,096	0.62	---
1/9/2012	0.01	13.25	82,944	1.8	---	
1/19/2012	0.83	5.50	84,436	---	0.87	
1/23/2012	0.01	6.50	64,800	1.1	---	
2/3/2012	0.01	3.64	90,600	0.45	---	
2/13/2012	0.01	1.00	80,771	0.14	---	
2/17/2012	0.34	3.00	107,136	0.31	---	
2/21/2012	0.4	3.75	73,440	0.57	---	
2/22/2012	0.75	17.00	57,600	---	3.9	

**Table 4-9a
R-21 Water-Enhanced Recovery Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Test Well ID	Date	Static LNAPL Thickness (feet)	LNAPL Recovery Rate (gallons per day)	Groundwater Recovery Rate (gallons per day)	LNAPL Transmissivity (feet ² /day)	
					Small Relative LNAPL Drawdown ¹	Large Relative LNAPL Drawdown ²
R-21	2/28/2012	0.01	6.67	67,474	1.1	---
	3/7/2012	0.02	5.00	87,840	0.63	---
	3/15/2012	0	3.25	77,120	0.47	---
	3/26/2012	0.09	3.64	67,920	0.59	---
	4/9/2012	1.1	3.93	73,248	---	0.78
	4/16/2012	0.04	5.71	68,040	0.93	---
	4/30/2012	0.5	0.36	75,936	---	0.06
	5/14/2012	1.29	0.57	70,176	---	0.12
	5/16/2012	0.81	2.50	84,000	---	0.41
	5/31/2012	0.4	2.00	74,250	0.30	---
	6/19/2012	0.11	1.00	84,240	0.13	---
	8/23/2012	0.07	0.60	82,189	0.08	---
	9/25/2012	0.29	0.08	76,998	0.01	---
	10/29/2012	0.65	0.25	80,023	---	0.04
	11/13/2012	0.06	0.47	70,740	0.07	---
	12/31/2012	0.1	0.24	75,203	0.04	---
	1/31/2013	0.23	0.47	88,245	0.06	---
	3/26/2013	0.1	0.47	77,236	0.07	---
	4/8/2013	1.11	0.50	78,069	---	0.08
	4/22/2013	0.09	0.55	90,624	0.07	---
	4/30/2013	0.85	0.45	71,360	---	0.08
	5/13/2013	0.1	1.05	97,320	0.12	---
	5/20/2013	0.35	0.17	71,460	0.03	---
	6/10/2013	0.19	0.13	60,807	0.02	---
	7/18/2013	0.27	0.05	68,714	0.01	---
	7/29/2013	0.25	0.06	78,120	0.01	---
	8/14/2013	0.08	0.09	86,231	0.01	---
	9/9/2013	0.2	0.12	54,240	0.02	---
	10/23/2013	0.27	0.11	17376	0.07	---
	11/4/2013	1.96	0.58	46342	---	0.2
11/11/2013	2.47	0.86	72443	---	0.2	
11/19/2013	0.97	4.63	115740	---	0.5	
12/30/2013	0.09	0.39	35246	0.12	---	

General Notes:

Bold Exceeds 0.1 to 0.8 feet²/day upper criterion range to produce sufficient LNAPL recoverability (ITRC 2009a).

¹ LNAPL to Groundwater Drawdown ratio was less than 10 percent; small relative LNAPL drawdown method was used to calculate

² LNAPL to Groundwater Drawdown ratio was greater than 10 percent; small relative LNAPL drawdown method was used to

Acronyms and Abbreviations:

--- = no data or not calculated

LNAPL = light nonaqueous phase liquid

**Table 4-9b
R-40 Water Enhanced LNAPL Recovery Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Test Well ID	Date	Static LNAPL Thickness (feet)	LNAPL Recovery Rate (gallons per day)	Groundwater Recovery Rate (gallons per day)	LNAPL Transmissivity (feet ² /day)	
					Small Relative LNAPL Drawdown ¹	Large Relative LNAPL Drawdown ²
R-40	1/7/2010	0.18	1.57	57,600	0.18	---
	1/13/2010	0.08	1.83	54,720	0.22	---
	1/20/2010	0.21	1.57	66,240	0.16	---
	5/28/2010	1.72	0.53	68,565	0.05	---
	2/9/2011	0.02	0.01	146,813	5.5E-04	---
	2/14/2011	0.10	0.63	50,400	0.08	---
	2/24/2011	0.33	0.31	43,200	0.05	---
	2/28/2011	0.13	0.79	41,760	0.12	---
	3/4/2011	0.08	0.79	46,080	0.11	---
	3/9/2011	0.09	0.63	50,400	0.08	---
	3/16/2011	0.44	0.67	28,800	0.15	---
	3/24/2011	0.30	1.08	36,000	0.20	---
	3/28/2011	0.22	2.36	46,080	0.34	---
	3/31/2011	0.12	3.14	44,640	0.46	---
	4/6/2011	0.22	1.57	47,520	0.22	---
	4/7/2011	0.01	11.00	46,080	1.57	---
	4/15/2011	0.46	1.38	44,640	0.20	---
	4/26/2011	0.32	1.43	68,480	0.14	---
	4/28/2011	0.45	7.86	38,880	1.33	---
	5/4/2011	0.22	1.31	44,640	0.19	---
	5/10/2011	0.03	1.83	50,400	0.24	---
	7/8/2011	1.17	0.08	204,624	2.7E-03	---
	7/18/2011	0.46	0.47	47,520	0.07	---
	7/22/2011	0.07	1.18	53,280	0.15	---
	9/13/2011	7.50	0.57	71,867	---	0.06
	9/14/2011	2.00	15.00	120,240	0.82	---
	10/4/2011	6.05	2.70	107,794	---	0.21
	10/11/2011	0.95	9.86	92,340	0.70	---
	11/12/2011	0.40	0.97	61,920	0.10	---
	11/23/2011	0.75	1.27	19,872	0.42	---
	12/5/2011	1.35	1.17	59,262	0.13	---
	12/12/2011	0.20	1.18	74,880	0.10	---
	12/15/2011	0.77	3.00	73,440	0.27	---
1/5/2012	0.55	1.17	699,251	0.01	---	
1/9/2012	0.10	2.75	109,152	0.17	---	
1/19/2012	0.05	1.63	95,956	0.11	---	
1/25/2012	0.14	1.67	179,040	0.06	---	
2/3/2012	0.67	2.78	94,752	0.19	---	
2/17/2012	0.15	2.86	101,376	0.19	---	
2/22/2012	0.22	2.40	87,600	0.18	---	
2/28/2012	0.05	4.17	82,286	0.33	---	

**Table 4-9b
R-40 Water Enhanced LNAPL Recovery Test Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Test Well ID	Date	Static LNAPL Thickness (feet)	LNAPL Recovery Rate (gallons per day)	Groundwater Recovery Rate (gallons per day)	LNAPL Transmissivity (feet ² /day)	
					Small Relative LNAPL Drawdown ¹	Large Relative LNAPL Drawdown ²
R-40	3/7/2012	0.14	4.63	126,240	0.24	---
	3/15/2012	0.13	3.13	93,280	0.22	---
	3/26/2012	0.26	3.64	82,680	0.29	---
	4/9/2012	0.63	3.93	91,584	0.28	---
	4/16/2012	0.03	5.00	74,880	0.44	---
	4/23/2012	0.13	3.71	85,320	0.29	---
	5/7/2012	0.10	1.46	94,560	0.10	---
	5/17/2012	0.16	1.00	100,145	0.07	---
	6/6/2012	0.10	1.25	86,949	0.09	---
	6/18/2012	1.26	0.83	66,462	0.08	---
	7/2/2012	0.52	0.64	1,328,448	3.2E-03	---
	8/23/2012	0.14	0.28	102,485	0.02	---
	11/13/2012	2.12	0.49	78,176	0.04	---
	12/31/2012	0.18	0.22	87,458	0.02	---
	1/31/2013	0.10	0.04	307,156	7.7E-04	---
	3/26/2013	0.10	0.31	85,012	0.02	---
4/22/2013	0.09	0.46	69,120	0.04	---	

General Notes:

Bold Exceeds 0.1 to 0.8 feet²/day upper criterion range to produce sufficient LNAPL recoverability (ITRC 2009a).

¹ LNAPL to Groundwater Drawdown ratio was less than 10 percent; small relative LNAPL drawdown method was used to

² LNAPL to Groundwater Drawdown ratio was greater than 10 percent; small relative LNAPL drawdown method was used to calculate LNAPL transmissivity.

Accronyms and Abbreviations:

--- = No data or not calculated

LNAPL = light nonaqueous phase liquid

**Table 4-10
BTEX Analytical Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Proximity	Zone	Location	Comments	Sample Name	Dup	Work Order	Sample Date	Benzene	Toluene	Ethylbenzene	o-Xylene	p & m -Xylenes	Total Xylenes
								µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
On-site	Water Table	MW-106-25		MW-106-25		1138578	10/03/13	<0.240 ^d	<0.620 ^d	<0.620 ^d	<0.620 ^d	<1.24 ^d	<2.00 ^d
On-site	Water Table	MW-109-15		MW-109-15		1138670	11/01/13	<0.240	<0.620	<0.620	<0.620	<2.00B*	<1.88
On-site	Water Table	MW-110-20		MW-110-20		1138616	10/15/13	97.6	<0.620	1.17	0.730J	73.0	73.7
On-site	Water Table	MW-113-15		MW-113-15		1138643	10/22/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-113-15		MW-213-15	DUP	1138643	10/22/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-115-15		MW-115-15		1138731	11/17/13	1600	0.490J	18.0	0.440J	849	856
On-site	Water Table	MW-116-15		MW-116-15		1138731	11/17/13	7240	1.37	302	145	4780	4930
On-site	Water Table	MW-116-15		MW-216-15	DUP	1138731	11/17/13	7390	1.36	346	154	4680	4840
On-site	Water Table	MW-124-25		MW-124-25		1138670	11/01/13	<0.240	0.460J	0.320J	0.650J	<2.00B*	2.20J
On-site	Water Table	MW-125-25		MW-125-25		1138670	11/01/13	2.79	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-126-25		MW-126-25		1138731	11/16/13	<0.200	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	Water Table	MW-126-25		MW-226-25	DUP	1138731	11/16/13	<0.200	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	Water Table	MW-127-25		MW-127-25		1138634	10/19/13	54.6	<0.620	<0.620	<0.620	5.07	5.07
On-site	Water Table	MW-130-25		MW-130-25		1138716	11/11/13	60.0	145	55.4	155	259	414
On-site	Water Table	MW-132-20		MW-132-20		1138695	11/07/13	<0.240	<0.620	1.02J*	2.68J*	13.7J*	16.4J*
On-site	Water Table	MW-132-20		MW-232-20	DUP	1138695	11/07/13	<0.240	<0.620	0.640J*	1.36J*	6.38J*	7.74J*
On-site	Water Table	MW-133-20		MW-133-20		1138695	11/07/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-134-20		MW-134-20		1138731	11/16/13	<0.200	<0.500	<0.500	<0.500	<2.00B*	<3.00B*
On-site	Water Table	MW-135-20		MW-135-20		1138695	11/07/13	704	9370	376	599	1350	1950
On-site	Water Table	MW-136-20		MW-136-20		1138670	11/01/13	1770	1820	312	507	1240	1750
On-site	Water Table	MW-137-20		MW-137-20		1138731	11/16/13	<0.200	<0.500	3.73	<1.00B*	19.0	19.4
On-site	Water Table	MW-139-25		MW-139-25		1138628	10/16/13	36.8	0.410J	23.5	0.550J	392	413
On-site	Water Table	MW-140-25		MW-140-25		1138670	10/31/13	<0.240	<0.620	<0.620	0.360J	0.720J	1.08J
On-site	Water Table	MW-141-20		MW-141-20		1138578	10/03/13	<0.240 ^d	<0.620 ^d	<0.620 ^d	<0.620 ^d	<1.24 ^d	<2.00 ^d
On-site	Water Table	MW-142-20		MW-142-20		1138616	10/15/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-143-20		MW-143-20		1138616	10/15/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-144A-25		MW-144A-25		1138670	10/30/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-145-20		MW-145-20		1138634	10/19/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-149A-15		MW-149A-15		1138594	10/09/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-174-15		MW-174-15		1138668	10/23/13	<0.240	<0.620	<0.620	<0.620	0.650J	<1.88
On-site	Water Table	MW-176A-15		MW-176A-15		1138716	11/11/13	76.8	78.6	150	279	861	1140
On-site	Water Table	MW-179A-15		MW-179A-15		1138716	11/12/13	<0.200	0.320J	<0.500	0.330J	0.710J	1.04J
On-site	Water Table	MW-180A-15		MW-180A-15		1138716	11/11/13	0.930	1.96	34.4J*	7.90J*	49.7J*	57.6J*
On-site	Water Table	MW-180A-15		MW-280A-15	DUP	1138716	11/11/13	0.690	1.50	18.8J*	4.71J*	27.5J*	32.2J*
On-site	Water Table	MW-186A-15		MW-186A-15		1138695	11/05/13	2.19	<0.620	17.4	24.5	92.5	117
On-site	Water Table	MW-309-15		MW-309-15		1138643	10/22/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-321-15		MW-321-15		1138668	10/25/13	53.4	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-334-15		MW-334-15		1138695	11/07/13	649	1580	326	560	1260	1820
On-site	Water Table	MW-336-15	P8 Well Initial Sample	MW-336-15		1138593	10/09/13	14900	3360	700J	2620	5730	8350
On-site	Water Table	MW-344-15		MW-344-15		1138643	10/22/13	2.45	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	MW-345-15		MW-345-15		1138643	10/22/13	10.9	<0.620	0.780J	<0.620	1.55J	1.55J
On-site	Water Table	MW-355-15		MW-355-15		1138757	11/25/13	<0.200	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	Water Table	MW-355-15	P8 Well Initial Sample	MW-355-15		1138603	10/10/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	O-12		O-12		1138634	10/19/13	<0.240	<0.620	<0.620	<0.620	1.41J	1.41J
On-site	Water Table	O-14		O-14		1138757	11/25/13	<0.200	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	Water Table	O-16		O-16		1138731	11/15/13	2.88	<0.500	<0.500	<0.500	0.650J	<1.50
On-site	Water Table	O-17		O-17		1138731	11/15/13	<0.200	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	Water Table	O-18		O-18		1138731	11/15/13	<0.200	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	Water Table	O-19		O-19		1138695	11/07/13	12.8	45.5	59.4	191	551	742
On-site	Water Table	O-2		O-2		1138731	11/16/13	275J*	5.64J*	354	335	1600	1940
On-site	Water Table	O-2		O-200	DUP	1138731	11/16/13	160J*	3.30J*	376	323	1460	1780
On-site	Water Table	O-24		O-24		1138731	11/16/13	20.4	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	Water Table	O-26		O-26		1138731	11/16/13	1.31	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	Water Table	O-26		O-260	DUP	1138731	11/16/13	<0.200	<0.500	<0.500	<0.500	12.3	12.3
On-site	Water Table	O-27		O-27		1138670	10/30/13	19.9	0.390J	42.0	20.2	163	183

**Table 4-10
BTEX Analytical Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Proximity	Zone	Location	Comments	Sample Name	Dup	Work Order	Sample Date	Benzene	Toluene	Ethylbenzene	o-Xylene	p & m -Xylenes	Total Xylenes
								µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
On-site	Water Table	O-27		O-270	DUP	1138670	10/30/13	19.6	<0.620	39.6	16.2	148	164
On-site	Water Table	O-3		O-3		1138731	11/16/13	1.47	<0.500	<0.500	<0.500	4.35	4.35
On-site	Water Table	O-3		O-300	DUP	1138731	11/16/13	<0.200	<0.500	<0.500	<0.500	4.15	4.15
On-site	Water Table	O-32	P8 Well Initial Sample	O-32		1138557	10/01/13	<0.240	<0.620	0.380J	0.520J	2.25	2.77J
On-site	Water Table	O-4		O-4		1138628	10/16/13	<0.240	<0.620	1.38	0.400J	2.32	2.72J
On-site	Water Table	O-5		O-5		1138628	10/16/13	<0.240	<0.620	6.89	0.380J	10.5	10.9
On-site	Water Table	O-6		O-6		1138643	10/22/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	Water Table	S-43		S-43		1138695	11/04/13	954	18.0J	76.0	51.0	676	727
On-site	Water Table	S-44		S-44		1138695	11/04/13	1420	780	532	562	1910	2470
On-site	Water Table	S-50	FROZEN	—		—	11/07/13	—	—	—	—	—	—
On-site	Water Table	S-9		S-9		1138634	10/19/13	36.8	<0.620	<0.620	<0.620	3.67	3.67
On-site	90-160	MW-199-150		MW-199-150		1138670	10/30/13	<0.240	<0.620	<0.620	<0.620	0.730J	<1.88
On-site	55-90	MW-154A-75		MW-154A-75		1138628	10/17/13	<0.240	0.390J	<0.620	<0.620	0.730J	<1.88
On-site	55-90	MW-154B-95		MW-154B-95		1138628	10/17/13	<0.240	0.310J	<0.620	<0.620	0.720J	<1.88
On-site	55-90	MW-175-90		MW-175-90		1138695	11/04/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	55-90	MW-186E-75		MW-186E-75		1138695	11/05/13	0.720	0.440J	0.530J	0.420J	1.63J	2.05J
On-site	10-55	MW-129-40		MW-129-40		1138634	10/19/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	MW-149B-20		MW-149B-20		1138594	10/09/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	MW-186B-60		MW-186B-60		1138695	11/05/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	MW-309-66		MW-309-66		1138643	10/22/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	MW-334-65		MW-334-65		1138695	11/06/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	MW-336-20	P8 Well Initial Sample	MW-336-20		1138593	10/09/13	15300	<620	<620	1300	3420	4720
On-site	10-55	MW-336-35	P8 Well Initial Sample	MW-336-35		1138593	10/09/13	28.1	1.15	<0.620	1.62	3.47	5.09
On-site	10-55	MW-336-55	P8 Well Initial Sample	MW-336-55		1138593	10/09/13	1.09	<0.620	<0.620	0.320J	<1.24	<1.88
On-site	10-55	MW-354-35	P8 Well Initial Sample	MW-354-35		1138603	10/11/13	<0.240	<0.620	4.04	4.60	19.4	24.0
On-site	10-55	MW-354-60	P8 Well Initial Sample	MW-354-60		1138603	10/11/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	MW-355-55		MW-355-55		1138757	11/25/13	<0.200	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	10-55	MW-355-55	P8 Well Initial Sample	MW-355-55		1138603	10/10/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	O-12-65		O-12-65		1138634	10/19/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	O-12-65	P8 Well Initial Sample	O-12-65		1138603	10/11/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	O-24-65	P8 Well Initial Sample	O-24-65		1138603	10/11/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
On-site	10-55	O-27-65	P8 Well Initial Sample	O-27-65		1138773	12/04/13	<0.200	<0.500	<0.500	<0.500	<1.00	<1.50
On-site	10-55	O-5-65		O-5-65		1138628	10/16/13	<0.240	<0.620	<0.620	<0.620	0.720J	<1.88
Off-site	Water Table	MW-148A-15		MW-148A-15		1138604	10/11/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
Off-site	Water Table	MW-153A-15		MW-153A-15		1138604	10/11/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
Off-site	10-55	MW-148B-30		MW-148B-30		1138604	10/11/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88
Off-site	10-55	MW-153B-55		MW-153B-55		1138604	10/11/13	<0.240	<0.620	<0.620	<0.620	<1.24	<1.88

Acronyms and Abbreviations:

For frozen wells, the date listed is the date of the most recent sampling attempt

– = NA, no sample collected

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

α = samples analyzed by EPA Method 624 as part of semi-annual groundwater treatment compliance monitoring; method is equivalent to EPA Method SW8260B

BTEX = benzene, toluene, ethylbenzene and total xylenes

DUP = field-duplicate sample

B* = result is considered not detected at the limit of quantitation (LOQ) or reported concentration (higher value), due to contamination identified in a method blank, trip blank, or equipment blank

J = estimated concentration, detected above the detection limit (DL) and below the limit of quantitation (LOQ)

J* = result is considered estimated (no direction of bias), due to QC failures or sample-handling anomalies

µg/L = micrograms per liter

Table 4-11
Sulfolane Analytical Results

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Proximity	Zone	Location	Comments	Sample Name	Dup	Work Order	Sample Date	Sulfolane
								µg/L
On-site	Water Table	AS-MW-1		AS-MW-1		1138556	10/02/13	16.3
On-site	Water Table	AS-MW-2		AS-MW-2		1138556	10/02/13	<6.20
On-site	Water Table	AS-MW-3		AS-MW-3		1138556	10/02/13	11.7
On-site	Water Table	AS-MW-4		AS-MW-4		1138556	10/02/13	<6.20
On-site	Water Table	AS-MW-5		AS-MW-5		1138556	10/02/13	<6.20
On-site	Water Table	AS-MW-7		AS-MW-7		1138556	10/02/13	<6.20
On-site	Water Table	AS-MW-8		AS-MW-8		1138556	10/02/13	43.3
On-site	Water Table	AS-MW-8		AS-MW-908	DUP	1138556	10/02/13	40.3
On-site	Water Table	MW-101A-25		MW-101A-25		1138616	10/14/13	49.2
On-site	Water Table	MW-101A-25		MW-201A-25	DUP	1138616	10/14/13	48.4
On-site	Water Table	MW-106-25		MW-106-25		1138578	10/03/13	<6.40
On-site	Water Table	MW-109-15		MW-109-15		1138670	11/01/13	<6.46
On-site	Water Table	MW-110-20		MW-110-20		1138616	10/15/13	448
On-site	Water Table	MW-113-15		MW-113-15		1138643	10/22/13	61.6
On-site	Water Table	MW-115-15		MW-115-15		1138731	11/17/13	13.7
On-site	Water Table	MW-116-15		MW-116-15		1138731	11/17/13	45.5
On-site	Water Table	MW-125-25		MW-125-25		1138670	11/01/13	<6.20
On-site	Water Table	MW-127-25		MW-127-25		1138634	10/19/13	18.7
On-site	Water Table	MW-130-25		MW-130-25		1138716	11/11/13	750
On-site	Water Table	MW-131-25		MW-131-25		1138643	10/22/13	6.47J
On-site	Water Table	MW-132-20		MW-132-20		1138695	11/07/13	<6.20
On-site	Water Table	MW-133-20		MW-133-20		1138695	11/07/13	<6.32
On-site	Water Table	MW-134-20		MW-134-20		1138731	11/16/13	<5.10
On-site	Water Table	MW-135-20		MW-135-20		1138695	11/07/13	<6.20
On-site	Water Table	MW-138-20		MW-138-20		1138724	11/14/13	1250
On-site	Water Table	MW-139-25		MW-139-25		1138628	10/16/13	160
On-site	Water Table	MW-139-25		MW-239-25	DUP	1138628	10/16/13	154
On-site	Water Table	MW-141-20		MW-141-20		1138578	10/03/13	<6.20
On-site	Water Table	MW-142-20		MW-142-20		1138616	10/15/13	192
On-site	Water Table	MW-142-20		MW-242-20	DUP	1138616	10/15/13	191
On-site	Water Table	MW-143-20		MW-143-20		1138616	10/15/13	15.7
On-site	Water Table	MW-143-20		MW-243-20	DUP	1138616	10/15/13	12.1
On-site	Water Table	MW-144A-25		MW-144A-25		1138668	10/30/13	<6.20
On-site	Water Table	MW-145-20		MW-145-20		1138634	10/19/13	<6.46
On-site	Water Table	MW-146A-15		MW-146A-15		1138716	11/12/13	<5.25
On-site	Water Table	MW-147A-15		MW-147A-15		1138716	11/12/13	<5.45
On-site	Water Table	MW-149A-15		MW-149A-15		1138594	10/09/13	<6.46
On-site	Water Table	MW-173A-15		MW-173A-15		1138668	10/29/13	<6.20
On-site	Water Table	MW-174-15		MW-174-15		1138643	10/23/13	55.4
On-site	Water Table	MW-176A-15		MW-176A-15		1138716	11/11/13	1510JL*
On-site	Water Table	MW-178A-15		MW-178A-15		1138695	11/07/13	25.0
On-site	Water Table	MW-178A-15		MW-278A-15	DUP	1138695	11/07/13	24.7
On-site	Water Table	MW-179A-15		MW-179A-15		1138716	11/12/13	5.37J
On-site	Water Table	MW-180A-15		MW-180A-15		1138716	11/11/13	<5.10
On-site	Water Table	MW-186A-15		MW-186A-15		1138695	11/05/13	163
On-site	Water Table	MW-195A-15		MW-195A-15		1138643	10/23/13	213
On-site	Water Table	MW-195A-15		MW-295A-15	DUP	1138643	10/23/13	209
On-site	Water Table	MW-196-15		MW-196-15		1138616	10/15/13	<6.96
On-site	Water Table	MW-301-CMT-10		MW-301-CMT-10		1138628	10/16/13	<6.20
On-site	Water Table	MW-302-CMT-10		MW-302-CMT-10		1138616	10/14/13	37.2
On-site	Water Table	MW-303-CMT-9		MW-303-CMT-9		1138616	10/15/13	<6.32
On-site	Water Table	MW-304-15		MW-304-15		1135693	11/18/13	351
On-site	Water Table	MW-304-15		MW-404-15	DUP	1135693	11/18/13	352
On-site	Water Table	MW-306-15		MW-306-15		1138628	10/17/13	<6.20
On-site	Water Table	MW-309-15		MW-309-15		1138643	10/22/13	19.5
On-site	Water Table	MW-309-15		MW-409-15	DUP	1138643	10/22/13	21.6
On-site	Water Table	MW-310-15		MW-310-15		1138628	10/16/13	201
On-site	Water Table	MW-310-15		MW-410-15	DUP	1138628	10/16/13	192
On-site	Water Table	MW-321-15		MW-321-15		1138648	10/25/13	124
On-site	Water Table	MW-321-15		MW-421-15	DUP	1138648	10/25/13	126
On-site	Water Table	MW-330-20		MW-330-20		1138643	10/23/13	282
On-site	Water Table	MW-330-20		MW-430-20	DUP	1138643	10/23/13	300
On-site	Water Table	MW-334-15		MW-334-15		1138695	11/07/13	30.9
On-site	Water Table	MW-336-15	P8 Well Initial Sample	MW-336-15		1138593	10/09/13	17600
On-site	Water Table	MW-344-15		MW-344-15		1138643	10/22/13	51.6
On-site	Water Table	MW-345-15		MW-345-15		1138643	10/22/13	98.8
On-site	Water Table	MW-348-15		MW-348-15		1138731	11/15/13	1280
On-site	Water Table	MW-354-15	P8 Well Initial Sample	MW-354-15		1138603	10/11/13	1060
On-site	Water Table	MW-355-15	P8 Well Initial Sample	MW-355-15		1138757	11/25/13	5.69J
On-site	Water Table	MW-355-15	P8 Well Initial Sample	MW-355-15		1138603	10/10/13	4.60J
On-site	Water Table	MW-358-15	P8 Well Initial Sample	MW-358-15		1138681	11/05/13	<6.70
On-site	Water Table	MW-360-15	P8 Well Initial Sample	MW-360-15		1138718	11/13/13	21.7
On-site	Water Table	MW-362-15	P8 Well Initial Sample	MW-362-15		1138793	12/10/13	<5.40
On-site	Water Table	MW-363-15	P8 Well Initial Sample	MW-363-15		1138714	11/12/13	<6.74
On-site	Water Table	O-1		O-1		1138716	11/11/13	5080JL*
On-site	Water Table	O-12		O-12		1138634	10/19/13	40.4
On-site	Water Table	O-14		O-14		1138757	11/25/13	<5.00
On-site	Water Table	O-19		O-19		1138695	11/07/13	745
On-site	Water Table	O-2		O-2		1138731	11/16/13	95.6
On-site	Water Table	O-24		O-24		1138731	11/16/13	3.43J
On-site	Water Table	O-26		O-26		1138731	11/16/13	218
On-site	Water Table	O-3		O-3		1138731	11/16/13	<5.00
On-site	Water Table	O-31	P8 Well Initial Sample	O-31		1138557	10/01/13	R*
On-site	Water Table	O-32	P8 Well Initial Sample	O-32		1138557	10/01/13	376
On-site	Water Table	O-33	P8 Well Initial Sample	O-33		1138592	10/07/13	61.3
On-site	Water Table	O-34	P8 Well Initial Sample	O-34		1138595	10/10/13	1700JL*
On-site	Water Table	O-35	P8 Well Initial Sample	O-135	DUP	1138595	10/10/13	8.99J
On-site	Water Table	O-35	P8 Well Initial Sample	O-35		1138595	10/10/13	11.3
On-site	Water Table	O-36	P8 Well Initial Sample	O-36		1138592	10/07/13	<6.20J*
On-site	Water Table	O-37	P8 Well Initial Sample	O-37		1138592	10/07/13	7.71JL*
On-site	Water Table	O-38	P8 Well Initial Sample	O-38		1138592	10/08/13	260
On-site	Water Table	O-4		O-4		1138628	10/16/13	172
On-site	Water Table	O-5		O-5		1138628	10/16/13	130
On-site	Water Table	O-6		O-6		1138643	10/22/13	13.1
On-site	Water Table	R-32R	P8 Well Initial Sample	R-32R		1138592	10/08/13	1100
On-site	Water Table	S-21		S-21		1138674	11/04/13	4.45J
On-site	Water Table	S-43		S-43		1138674	11/04/13	4.94J
On-site	Water Table	S-44		S-44		1138674	11/04/13	<7.30
On-site	Water Table	S-51		S-51		1138695	11/06/13	770
On-site	90-160	MW-142-150	P8 Well Initial Sample	MW-142-150		1138788	12/06/13	<5.00
On-site	90-160	MW-173B-150		MW-173B-150		1138668	10/29/13	<6.32
On-site	90-160	MW-179D-135		MW-179D-135		1138716	11/12/13	<5.00
On-site	90-160	MW-186C-100		MW-186C-100		1138695	11/05/13	<6.32
On-site	90-160	MW-186D-135		MW-186D-135		1138695	11/05/13	<6.32
On-site	90-160	MW-195B-150		MW-195B-150		1138643	10/23/13	<6.20
On-site	90-160	MW-197B-150		MW-197B-150		1138674	11/04/13	<6.20
On-site	90-160	MW-198-150		MW-198-150		1138731	11/15/13	<5.00

Table 4-11
Sulfolane Analytical Results

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Proximity	Zone	Location	Comments	Sample Name	Dup	Work Order	Sample Date	Sulfolane
								µg/L
On-site	90-160	MW-199-150		MW-199-150		1138668	10/30/13	<6.32
On-site	90-160	MW-300-150		MW-300-150		1138695	11/06/13	<6.20
On-site	90-160	MW-302-110		MW-302-110		1138616	10/14/13	<6.20
On-site	90-160	MW-303-130		MW-303-130		1138616	10/15/13	<6.20
On-site	90-160	MW-304-125		MW-304-125		1138628	10/16/13	<6.32
On-site	90-160	MW-304-150		MW-304-150		1135693	11/18/13	<5.00
On-site	90-160	MW-305-100		MW-305-100		1135693	11/18/13	<5.00
On-site	90-160	MW-306-150		MW-306-150		1138628	10/17/13	<6.20
On-site	90-160	MW-307-150		MW-307-150		1138670	11/01/13	<6.20
On-site	90-160	MW-309-150		MW-309-150		1138643	10/22/13	<6.36
On-site	90-160	MW-310-110		MW-310-110		1138668	10/28/13	<6.20
On-site	90-160	MW-321-151		MW-321-150		1138648	10/25/13	<7.04
On-site	90-160	MW-330-150		MW-330-150		1138643	10/23/13	<6.60
On-site	90-160	MW-331-150		MW-331-150		1138668	10/30/13	<6.20
On-site	90-160	MW-358-150	P8 Well Initial Sample	MW-358-150		1138675	11/04/13	<6.40
On-site	90-160	MW-359-150	P8 Well Initial Sample	MW-359-150		1138681	11/05/13	<6.60
On-site	90-160	MW-360-150	P8 Well Initial Sample	MW-360-150		1138721	11/14/13	<6.52
On-site	90-160	MW-362-150	P8 Well Initial Sample	MW-362-150		1138721	11/14/13	<6.36
On-site	90-160	MW-364-150	P8 Well Initial Sample	MW-364-150		1138744	11/22/13	<5.00
On-site	90-160	O-27-150	P8 Well Initial Sample	O-27-150		1138769	12/03/13	<5.00
On-site	55-90	MW-144BR-90		MW-144BR-90		1138668	10/30/13	<6.32
On-site	55-90	MW-154A-75		MW-154A-75		1138628	10/17/13	3.93J
On-site	55-90	MW-154B-95		MW-154B-95		1138628	10/17/13	26.2
On-site	55-90	MW-154B-95		MW-254B-95	DUP	1138628	10/17/13	26.8
On-site	55-90	MW-174B-90		MW-174B-90		1138643	10/23/13	<6.20
On-site	55-90	MW-175-90		MW-175-90		1138674	11/04/13	<6.20
On-site	55-90	MW-176C-90		MW-176C-90		1138760	11/27/13	<5.00
On-site	55-90	MW-177-90		MW-177-90		1138670	10/31/13	<6.20
On-site	55-90	MW-178C-90		MW-178C-90		1138731	11/15/13	<5.00
On-site	55-90	MW-179C-90		MW-179C-90		1138731	11/15/13	<5.10
On-site	55-90	MW-180C-90		MW-180C-90		1138716	11/11/13	<5.00
On-site	55-90	MW-186E-75		MW-186E-75		1138695	11/05/13	8.30J
On-site	55-90	MW-301-70		MW-301-70		1138628	10/16/13	5.63J
On-site	55-90	MW-302-70		MW-302-70		1138616	10/14/13	16.4
On-site	55-90	MW-302-80		MW-302-80		1138616	10/14/13	14.7
On-site	55-90	MW-302-95		MW-302-95		1138616	10/14/13	<6.20
On-site	55-90	MW-303-70		MW-303-70		1138616	10/15/13	5.95J
On-site	55-90	MW-303-80		MW-303-80		1138616	10/15/13	<6.20
On-site	55-90	MW-303-95		MW-303-95		1138616	10/15/13	<6.20
On-site	55-90	MW-304-70		MW-304-70		1135693	11/18/13	<5.00
On-site	55-90	MW-304-80		MW-304-80		1138616	10/15/13	<6.20
On-site	55-90	MW-304-96		MW-304-95		1138616	10/15/13	<6.20
On-site	55-90	MW-305-70		MW-305-70		1135693	11/18/13	<5.00
On-site	55-90	MW-305-80		MW-305-80		1135693	11/18/13	<5.10
On-site	55-90	MW-306-100		MW-306-100		1138628	10/17/13	<6.20
On-site	55-90	MW-306-70		MW-306-70		1138628	10/17/13	<6.20
On-site	55-90	MW-306-80		MW-306-80		1138628	10/17/13	<6.20
On-site	55-90	MW-334-85	P8 Well Initial Sample	MW-334-85		1138672	11/01/13	<6.40
On-site	55-90	MW-344-75	P8 Well Initial Sample	MW-344-75		1138671	11/01/13	<6.46
On-site	55-90	MW-345-75	P8 Well Initial Sample	MW-345-75		1138671	11/01/13	7.03J
On-site	55-90	MW-360-80	P8 Well Initial Sample	MW-360-80		1138727	11/15/13	6.52J
On-site	55-90	MW-362-80	P8 Well Initial Sample	MW-362-80		1138793	12/10/13	3.85J
On-site	10-55	MW-101-60		MW-101-60		1138616	10/14/13	19.4
On-site	10-55	MW-104-65		MW-104-65		1138670	10/31/13	<6.20
On-site	10-55	MW-105-65		MW-105-65		1138668	10/28/13	<6.20
On-site	10-55	MW-110-65		MW-110-65		1138648	10/25/13	<6.52
On-site	10-55	MW-129-40		MW-129-40		1138634	10/19/13	<6.20
On-site	10-55	MW-142-65	P8 Well Initial Sample	MW-142-65		1138788	12/06/13	6.63J
On-site	10-55	MW-146B-30		MW-146B-30		1138716	11/12/13	<5.30
On-site	10-55	MW-147B-25		MW-147B-25		1138668	10/28/13	<6.20
On-site	10-55	MW-149B-20		MW-149B-20		1138594	10/09/13	<6.20
On-site	10-55	MW-174A-50		MW-174A-50		1138643	10/23/13	9.30J
On-site	10-55	MW-176B-50		MW-176B-50		1138716	11/11/13	3.61J
On-site	10-55	MW-178B-50		MW-178B-50		1138716	11/11/13	211
On-site	10-55	MW-178B-50		MW-278B-50	DUP	1138716	11/11/13	210
On-site	10-55	MW-179B-50		MW-179B-50		1138716	11/12/13	6.08J
On-site	10-55	MW-180B-50		MW-180B-50		1138716	11/11/13	<5.00
On-site	10-55	MW-186B-60		MW-186B-60		1138695	11/05/13	23.2
On-site	10-55	MW-197A-65		MW-197A-65		1138674	11/04/13	<6.20
On-site	10-55	MW-301-60		MW-301-60		1138628	10/16/13	3.73J
On-site	10-55	MW-301-CMT-20		MW-301-CMT-20		1138628	10/16/13	<6.20
On-site	10-55	MW-301-CMT-30		MW-301-CMT-30		1138628	10/16/13	<6.20
On-site	10-55	MW-301-CMT-40		MW-301-CMT-40		1138628	10/16/13	<6.20
On-site	10-55	MW-301-CMT-50		MW-301-CMT-50		1138628	10/16/13	<6.20
On-site	10-55	MW-302-CMT-20		MW-302-CMT-20		1138616	10/14/13	52.7
On-site	10-55	MW-302-CMT-20		MW-402-CMT-20	DUP	1138616	10/14/13	51.7
On-site	10-55	MW-302-CMT-30		MW-302-CMT-30		1138616	10/14/13	43.4
On-site	10-55	MW-302-CMT-40		MW-302-CMT-40		1138616	10/14/13	14.9
On-site	10-55	MW-302-CMT-50		MW-302-CMT-50		1138616	10/14/13	17.9
On-site	10-55	MW-303-CMT-19		MW-303-CMT-19		1138616	10/15/13	44.4
On-site	10-55	MW-303-CMT-19		MW-403-CMT-19	DUP	1138616	10/15/13	42.6
On-site	10-55	MW-303-CMT-29		MW-303-CMT-29		1138616	10/15/13	51.2
On-site	10-55	MW-303-CMT-39		MW-303-CMT-39		1138616	10/15/13	13.4
On-site	10-55	MW-303-CMT-49		MW-303-CMT-49		1138616	10/15/13	11.8
On-site	10-55	MW-303-CMT-59		MW-303-CMT-59		1138616	10/15/13	9.56J
On-site	10-55	MW-304-CMT-20		MW-304-CMT-20		1135693	11/19/13	46.4
On-site	10-55	MW-304-CMT-30		MW-304-CMT-30		1135693	11/19/13	41.6
On-site	10-55	MW-304-CMT-40		MW-304-CMT-40		1135693	11/19/13	25.4
On-site	10-55	MW-304-CMT-50		MW-304-CMT-50		1135693	11/19/13	<5.00
On-site	10-55	MW-304-CMT-60		MW-304-CMT-60		1135693	11/19/13	<5.10
On-site	10-55	MW-305-CMT-18		MW-305-CMT-18		1135693	11/18/13	3.80J
On-site	10-55	MW-305-CMT-28		MW-305-CMT-28		1135693	11/18/13	6.71J
On-site	10-55	MW-305-CMT-38		MW-305-CMT-38		1135693	11/18/13	<5.10
On-site	10-55	MW-305-CMT-48		MW-305-CMT-48		1135693	11/18/13	<5.00
On-site	10-55	MW-305-CMT-58		MW-305-CMT-58		1135693	11/18/13	<5.00
On-site	10-55	MW-306-CMT-20		MW-306-CMT-20		1138628	10/17/13	<6.20
On-site	10-55	MW-306-CMT-30		MW-306-CMT-30		1138628	10/17/13	<6.20
On-site	10-55	MW-306-CMT-40		MW-306-CMT-40		1138628	10/17/13	<6.20
On-site	10-55	MW-306-CMT-50		MW-306-CMT-50		1138628	10/17/13	<6.20
On-site	10-55	MW-306-CMT-60		MW-306-CMT-60		1138628	10/17/13	<6.20
On-site	10-55	MW-309-66		MW-309-66		1138643	10/22/13	10.3
On-site	10-55	MW-310-65		MW-310-65		1138628	10/16/13	<6.40
On-site	10-55	MW-321-65		MW-321-65		1138648	10/25/13	<6.46
On-site	10-55	MW-330-65		MW-330-65		1138643	10/23/13	<6.20
On-site	10-55	MW-334-65		MW-334-65		1138695	11/06/13	<6.40
On-site	10-55	MW-336-20	P8 Well Initial Sample	MW-336-20		1138593	10/09/13	34800
On-site	10-55	MW-336-35	P8 Well Initial Sample	MW-336-35		1138593	10/09/13	377

Table 4-11
Sulfolane Analytical Results

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Proximity	Zone	Location	Comments	Sample Name	Dup	Work Order	Sample Date	Sulfolane
								µg/L
On-site	10-55	MW-336-55	P8 Well Initial Sample	MW-336-55		1138593	10/09/13	4.32J
On-site	10-55	MW-348-65		MW-348-65		1138731	11/15/13	8.25J
On-site	10-55	MW-354-35	P8 Well Initial Sample	MW-354-35		1138603	10/11/13	849
On-site	10-55	MW-354-60	P8 Well Initial Sample	MW-354-60		1138603	10/11/13	<6.74
On-site	10-55	MW-355-55	P8 Well Initial Sample	MW-355-55		1138757	11/25/13	<5.00
On-site	10-55	MW-355-55	P8 Well Initial Sample	MW-355-55		1138603	10/10/13	<6.40
On-site	10-55	MW-358-20	P8 Well Initial Sample	MW-358-20		1138681	11/05/13	24.7
On-site	10-55	MW-358-40	P8 Well Initial Sample	MW-358-40		1138681	11/05/13	39.0
On-site	10-55	MW-358-60	P8 Well Initial Sample	MW-358-60		1138675	11/04/13	25.2
On-site	10-55	MW-359-60	P8 Well Initial Sample	MW-359-60		1138681	11/05/13	16.9
On-site	10-55	MW-360-35	P8 Well Initial Sample	MW-360-35		1138718	11/13/13	82.6
On-site	10-55	MW-360-50	P8 Well Initial Sample	MW-360-50		1138707	11/11/13	92.7
On-site	10-55	MW-362-25	P8 Well Initial Sample	MW-362-25		1138793	12/10/13	<5.50
On-site	10-55	MW-362-35	P8 Well Initial Sample	MW-362-35		1138793	12/10/13	<5.00
On-site	10-55	MW-362-50	P8 Well Initial Sample	MW-362-50		1138793	12/10/13	<5.00
On-site	10-55	MW-364-65	P8 Well Initial Sample	MW-364-65		1138744	11/22/13	9.77J
On-site	10-55	MW-364-65	P8 Well Initial Sample	MW-364-65		1138735	11/18/13	9.60J
On-site	10-55	MW-364-65	P8 Well Initial Sample	MW-464-65	DUP	1138735	11/18/13	9.54J
On-site	10-55	MW-364-65	P8 Well Initial Sample	MW-464-65	DUP	1138744	11/22/13	10.1J
On-site	10-55	O-12-65	P8 Well Initial Sample	O-12-65		1138634	10/19/13	<6.20
On-site	10-55	O-12-65	P8 Well Initial Sample	O-12-65		1138603	10/11/13	<6.56
On-site	10-55	O-24-65	P8 Well Initial Sample	O-24-65		1138603	10/11/13	<6.60
On-site	10-55	O-27-65	P8 Well Initial Sample	O-27-65		1138773	12/04/13	5.94J
On-site	10-55	O-5-65		O-5-65		1138628	10/16/13	<6.32
Off-site	Water Table	MW-148A-15		MW-148A-15		1138604	10/11/13	32.8
Off-site	Water Table	MW-150A-10		MW-150A-10		1138591	10/08/13	49.8
Off-site	Water Table	MW-151A-15		MW-151A-15		1138580	10/07/13	57.0
Off-site	Water Table	MW-152A-15		MW-152A-15		1138591	10/08/13	70.0
Off-site	Water Table	MW-152A-15		MW-252A-15	DUP	1138591	10/08/13	69.1
Off-site	Water Table	MW-153A-15		MW-153A-15		1138604	10/11/13	37.0
Off-site	Water Table	MW-155A-15		MW-155A-15		1138594	10/09/13	11.3
Off-site	Water Table	MW-156A-15		MW-156A-15		1138580	10/07/13	36.6
Off-site	Water Table	MW-157A-15		MW-157A-15		1138591	10/08/13	66.5
Off-site	Water Table	MW-157A-15		MW-257A-15	DUP	1138591	10/08/13	65.1
Off-site	Water Table	MW-158A-15		MW-158A-15		1138591	10/08/13	70.3
Off-site	Water Table	MW-159A-15		MW-159A-15		1138594	10/09/13	11.8
Off-site	Water Table	MW-159A-15		MW-259A-15	DUP	1138594	10/09/13	13.2
Off-site	Water Table	MW-160AR-15		MW-160AR-15		1138591	10/08/13	<6.20
Off-site	Water Table	MW-161A-15		MW-161A-15		1138616	10/15/13	132
Off-site	Water Table	MW-161A-15		MW-261A-15	DUP	1138616	10/15/13	137
Off-site	Water Table	MW-162A-15		MW-162A-15		1138594	10/09/13	28.1
Off-site	Water Table	MW-162A-15		MW-262A-15	DUP	1138594	10/09/13	28.8
Off-site	Water Table	MW-163A-15		MW-163A-15		1138594	10/09/13	33.6
Off-site	Water Table	MW-163A-15		MW-263A-15	DUP	1138594	10/09/13	32.2
Off-site	Water Table	MW-164A-15		MW-164A-15		1138604	10/12/13	68.3
Off-site	Water Table	MW-165A-15		MW-165A-15		1138561	10/02/13	<6.32
Off-site	Water Table	MW-166A-15		MW-166A-15		1138561	10/02/13	34.1
Off-site	Water Table	MW-167A-15		MW-167A-15		1138572	10/04/13	3.97J
Off-site	Water Table	MW-168A-15		MW-168A-15		1138572	10/05/13	14.3
Off-site	Water Table	MW-169A-15		MW-169A-15		1138567	10/03/13	<6.32
Off-site	Water Table	MW-170A-15		MW-170A-15		1138594	10/09/13	<6.20
Off-site	Water Table	MW-171A-15		MW-171A-15		1138604	10/11/13	<6.36
Off-site	Water Table	MW-172A-15	FROZEN	—		—	10/05/13	—
Off-site	Water Table	MW-181A-15		MW-181A-15		1138572	10/04/13	<6.20
Off-site	Water Table	MW-182A-15	FROZEN	—		—	10/05/13	—
Off-site	Water Table	MW-183A-15		MW-183A-15		1138567	10/03/13	75.2
Off-site	Water Table	MW-183A-15		MW-283A-15	DUP	1138567	10/03/13	68.7
Off-site	Water Table	MW-185A-15		MW-185A-15		1138572	10/05/13	<6.20
Off-site	Water Table	MW-187-15		MW-187-15		1138572	10/04/13	4.54J
Off-site	Water Table	MW-189A-15	FROZEN	—		—	10/03/13	—
Off-site	Water Table	MW-190A-15		MW-190A-15		1138572	10/05/13	<6.20
Off-site	Water Table	MW-191A-15		MW-191A-15		1138561	10/02/13	<6.20
Off-site	Water Table	MW-193A-15		MW-193A-15		1138572	10/04/13	<6.40
Off-site	Water Table	MW-194A-15		MW-194A-15		1138561	10/02/13	38.3
Off-site	Water Table	MW-194A-15		MW-294A-15	DUP	1138561	10/02/13	36.2
Off-site	Water Table	MW-308-15		MW-308-15		1138561	10/02/13	9.86J
Off-site	Water Table	MW-311-15		MW-311-15		1138561	10/02/13	<6.20
Off-site	Water Table	MW-314-15		MW-314-15		1138567	10/03/13	<6.20
Off-site	Water Table	MW-316-15		MW-316-15		1138580	10/07/13	3.38J
Off-site	Water Table	MW-317-15		MW-317-15		1138604	10/11/13	4.84J
Off-site	Water Table	MW-318-20		MW-318-20		1138567	10/03/13	<6.20
Off-site	Water Table	MW-322-15		MW-322-15		1138567	10/03/13	<6.32
Off-site	Water Table	MW-323-15		MW-323-15		1138572	10/04/13	<6.46
Off-site	Water Table	MW-325-18		MW-325-18		1138604	10/12/13	<6.36
Off-site	Water Table	MW-326-20		MW-326-20		1138716	11/12/13	<5.50
Off-site	Water Table	MW-328-15		MW-328-15		1138567	10/03/13	<6.20
Off-site	Water Table	MW-329-15		MW-329-15		1138572	10/04/13	75.3
Off-site	Water Table	MW-332-15		MW-332-15		1138572	10/04/13	<6.20
Off-site	Water Table	MW-338-15		MW-338-15		1138580	10/07/13	31.2
Off-site	Water Table	MW-339-15		MW-339-15		1138572	10/05/13	44.2
Off-site	Water Table	MW-340-18		MW-340-18		1138572	10/05/13	<6.32
Off-site	Water Table	MW-341-15		MW-341-15		1138572	10/04/13	96.7
Off-site	Water Table	MW-341-15		MW-441-15	DUP	1138572	10/04/13	91.5
Off-site	Water Table	MW-342-15		MW-342-15		1138572	10/04/13	100
Off-site	Water Table	MW-343-15	P8 Well Initial Sample	MW-343-15		1138524	09/26/13	<6.32
Off-site	Water Table	MW-346-15	P8 Well Initial Sample	MW-346-15		1138524	09/26/13	7.19J
Off-site	Water Table	MW-347-20	P8 Well Initial Sample	MW-347-20		1138545	09/27/13	12.9
Off-site	Water Table	MW-349-15		MW-349-15		1138604	10/11/13	55.0
Off-site	Water Table	MW-350-15	P8 Well Initial Sample	MW-350-15		1138545	09/27/13	30.3
Off-site	Water Table	MW-352-15	P8 Well Initial Sample	MW-352-15		1138559	09/30/13	5.10J
Off-site	Water Table	MW-353-15	P8 Well Initial Sample	MW-353-15		1138524	09/25/13	157
Off-site	Water Table	MW-356-15	P8 Well Initial Sample	MW-356-15		1138635	10/21/13	<6.20
Off-site	Water Table	MW-357-15	P8 Well Initial Sample	MW-357-15		1138669	10/31/13	<6.74
Off-site	90-160	MW-148D-150		MW-148D-150		1138604	10/11/13	<6.20
Off-site	90-160	MW-170C-130		MW-170C-130		1138594	10/09/13	<6.32
Off-site	90-160	MW-172B-150	FROZEN	—		—	10/05/13	—
Off-site	90-160	MW-181C-150		MW-181C-150		1138567	10/03/13	<6.20
Off-site	90-160	MW-185C-120		MW-185C-120		1138572	10/05/13	3.57J
Off-site	90-160	MW-190-150		MW-190-150		1138572	10/05/13	<6.20
Off-site	90-160	MW-314-150		MW-314-150		1138567	10/03/13	<6.20
Off-site	90-160	MW-318-135		MW-318-135		1138567	10/03/13	<6.32
Off-site	90-160	MW-322-150		MW-322-150		1138567	10/03/13	<6.32
Off-site	90-160	MW-325-150		MW-325-150		1138604	10/12/13	<6.36
Off-site	90-160	MW-326-150		MW-326-150		1138716	11/12/13	<5.80
Off-site	90-160	MW-328-151		MW-328-151		1138567	10/03/13	<6.20
Off-site	90-160	MW-332-110		MW-332-110		1138591	10/08/13	25.7
Off-site	90-160	MW-332-150		MW-332-150		1138572	10/04/13	230

Table 4-11
Sulfolane Analytical Results

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Proximity	Zone	Location	Comments	Sample Name	Dup	Work Order	Sample Date	Sulfolane
								µg/L
Off-site	90-160	MW-340-150		MW-340-150		1138572	10/05/13	<6.46
Off-Site	90-160	MW-346-150	P8 Well Initial Sample	MW-346-150		1138524	09/26/13	<6.20
Off-site	90-160	MW-347-150	P8 Well Initial Sample	MW-347-150		1138545	09/27/13	9.57J
Off-site	90-160	MW-353-100	P8 Well Initial Sample	MW-353-100		1138524	09/25/13	198
Off-site	90-160	MW-357-150	P8 Well Initial Sample	MW-357-150		1138669	10/31/13	<6.66
Off-site	55-90	MW-148-100	P8 Well Initial Sample	MW-148-100		1138669	10/31/13	<6.66
Off-site	55-90	MW-148-80	P8 Well Initial Sample	MW-148-80		1138669	10/31/13	13.6
Off-site	55-90	MW-159C-70		MW-159C-70		1138594	10/09/13	51.9
Off-site	55-90	MW-160B-90		MW-160B-90		1138591	10/08/13	62.9
Off-site	55-90	MW-170B-75		MW-170B-75		1138594	10/09/13	<6.36
Off-site	55-90	MW-317-71		MW-317-71		1138594	10/09/13	8.99J
Off-site	55-90	MW-332-75		MW-332-75		1138591	10/08/13	<6.20
Off-site	55-90	MW-356-90	P8 Well Initial Sample	MW-356-90		1138635	10/21/13	<6.82
Off-site	55-90	MW-356-90	P8 Well Initial Sample	MW-456-90	DUP	1138635	10/21/13	<6.88
Off-site	10-55	MW-148B-30		MW-148B-30		1138604	10/11/13	112
Off-site	10-55	MW-148C-55		MW-148C-55		1138604	10/11/13	63.8
Off-site	10-55	MW-148C-55		MW-248C-55	DUP	1138604	10/11/13	62.7
Off-site	10-55	MW-150B-25		MW-150B-25		1138591	10/08/13	41.0
Off-site	10-55	MW-150C-60		MW-150C-60		1138591	10/08/13	11.8
Off-site	10-55	MW-150C-60		MW-250C-60	DUP	1138591	10/08/13	12.7
Off-site	10-55	MW-151B-25		MW-151B-25		1138591	10/08/13	34.4
Off-site	10-55	MW-151C-60		MW-151C-60		1138580	10/07/13	21.3
Off-site	10-55	MW-152B-25		MW-152B-25		1138591	10/08/13	71.2
Off-site	10-55	MW-152C-65		MW-152C-65		1138591	10/08/13	21.7
Off-site	10-55	MW-153B-55		MW-153B-55		1138604	10/11/13	23.0
Off-site	10-55	MW-153B-55		MW-253B-55	DUP	1138604	10/11/13	24.5
Off-site	10-55	MW-155B-65		MW-155B-65		1138594	10/09/13	<6.20
Off-site	10-55	MW-156B-50		MW-156B-50		1138580	10/07/13	25.1
Off-site	10-55	MW-157B-30		MW-157B-30		1138591	10/08/13	74.0
Off-site	10-55	MW-158B-60		MW-158B-50		1138591	10/08/13	68.1
Off-site	10-55	MW-159B-45		MW-159B-45		1138594	10/09/13	61.8
Off-site	10-55	MW-161-30		MW-161-30		1138616	10/15/13	161
Off-site	10-55	MW-161-30		MW-161-30		1138604	10/15/13	170
Off-site	10-55	MW-161B-50		MW-161B-50		1138616	10/15/13	230
Off-site	10-55	MW-162B-65		MW-162B-65		1138594	10/09/13	63.9
Off-site	10-55	MW-163B-40		MW-163B-40		1138594	10/09/13	25.6
Off-site	10-55	MW-164B-50		MW-164B-50		1138636	10/21/13	85.2
Off-site	10-55	MW-164C-60		MW-164C-60		1138636	10/21/13	83.7
Off-site	10-55	MW-165B-50		MW-165B-50		1138561	10/02/13	<6.46
Off-site	10-55	MW-166B-30		MW-166B-30		1138561	10/02/13	61.6
Off-site	10-55	MW-167B-35		MW-167B-35		1138572	10/04/13	12.3
Off-site	10-55	MW-168B-50		MW-168B-50		1138572	10/05/13	19.5
Off-site	10-55	MW-169C-60		MW-169C-60		1138567	10/03/13	<6.20
Off-site	10-55	MW-170D-50		MW-170D-50		1138594	10/09/13	<6.20
Off-site	10-55	MW-171B-40		MW-171B-40		1138604	10/11/13	<6.40
Off-site	10-55	MW-181B-50		MW-181B-50		1138572	10/04/13	<6.20
Off-site	10-55	MW-182B-45		MW-182B-45		1138572	10/05/13	23.3
Off-site	10-55	MW-183B-60		MW-183B-60		1138567	10/03/13	129
Off-site	10-55	MW-184-45		MW-184-45		1138604	10/11/13	<6.32
Off-site	10-55	MW-185B-50		MW-185B-50		1138572	10/05/13	6.69J
Off-site	10-55	MW-189B-60	FROZEN	—	—	—	10/03/13	—
Off-site	10-55	MW-190BR-60		MW-190BR-60		1138591	10/08/13	<6.20
Off-site	10-55	MW-191B-60		MW-191B-60		1138561	10/02/13	<6.40
Off-site	10-55	MW-193B-60		MW-193B-60		1138572	10/04/13	<6.32
Off-site	10-55	MW-194B-40		MW-194B-40		1138561	10/02/13	59.1
Off-site	10-55	MW-308-30	FROZEN	—	—	—	10/02/13	—
Off-site	10-55	MW-311-46		MW-311-46		1138561	10/02/13	<6.32
Off-site	10-55	MW-316-56		MW-316-56		1138580	10/07/13	<6.20
Off-site	10-55	MW-323-50		MW-323-50		1138572	10/04/13	<6.46
Off-site	10-55	MW-329-66		MW-329-66		1138572	10/04/13	89.8
Off-site	10-55	MW-329-66		MW-429-66	DUP	1138572	10/04/13	86.8
Off-site	10-55	MW-332-41		MW-332-41		1138591	10/08/13	<6.20
Off-site	10-55	MW-335-41	FROZEN	—	—	—	10/03/13	—
Off-site	10-55	MW-338-50		MW-338-50		1138580	10/07/13	46.0
Off-site	10-55	MW-339-50		MW-339-50		1138572	10/05/13	39.5
Off-site	10-55	MW-340-65		MW-340-65		1138572	10/05/13	<6.20
Off-site	10-55	MW-341-40		MW-341-40		1138572	10/04/13	87.1
Off-site	10-55	MW-342-65		MW-342-65		1138572	10/04/13	169
Off-site	10-55	MW-343-50		MW-343-50		1138591	10/08/13	<6.20
Off-Site	10-55	MW-346-65	P8 Well Initial Sample	MW-346-65		1138524	09/26/13	22.7
Off-Site	10-55	MW-346-65	P8 Well Initial Sample	MW-446-65	DUP	1138524	09/26/13	21.6
Off-Site	10-55	MW-347-65	P8 Well Initial Sample	MW-347-65		1138545	09/27/13	27.4
Off-site	10-55	MW-349-45		MW-349-45		1138604	10/11/13	56.8
Off-site	10-55	MW-350-50	P8 Well Initial Sample	MW-350-50		1138545	09/27/13	47.7
Off-site	10-55	MW-352-40	P8 Well Initial Sample	MW-352-40		1138559	09/30/13	8.73J
Off-site	10-55	MW-353-65	P8 Well Initial Sample	MW-353-65		1138524	09/25/13	204
Off-site	10-55	MW-356-65	P8 Well Initial Sample	MW-356-65		1138635	10/21/13	<6.66
Off-site	10-55	MW-357-65	P8 Well Initial Sample	MW-357-65		1138669	10/31/13	<6.74

General Notes:

For frozen wells, the date listed is the date of the most recent sampling attempt.

Acronyms and Abbreviations:

- = N/A; no sample collected
- < = not detected; limit of detection (LOD) listed
- DUP = field-duplicate sample
- J = estimated concentration, detected above the detection limit (DL) and below the limit of quantitation (LOQ)
- JL* = result is considered estimated (biased low), due to QC failures (flag applied by SWI)
- P8 = Phase 8
- µg/L = micrograms per liter

Table 4-12
Sulfolane Analytical Results - Vertical Profiling Transect

Fourth Quarter Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Analysis Method					Sulfolane-USEPA1625B with Isotope Dilution
Location	Sample	Dup	Work Order	Collect Date	Sulfolane Result µg/L
MW-301-CMT-10	MW-301-CMT-10		1138628	10/16/13	<6.20
MW-301-CMT-20	MW-301-CMT-20		1138628	10/16/13	<6.20
MW-301-CMT-30	MW-301-CMT-30		1138628	10/16/13	<6.20
MW-301-CMT-40	MW-301-CMT-40		1138628	10/16/13	<6.20
MW-301-CMT-50	MW-301-CMT-50		1138628	10/16/13	<6.20
MW-301-60	MW-301-60		1138628	10/16/13	3.73J
MW-301-70	MW-301-70		1138628	10/16/13	5.63J
MW-302-CMT-10	MW-302-CMT-10		1138616	10/14/13	37.2
MW-302-CMT-20	MW-302-CMT-20		1138616	10/14/13	52.7
MW-302-CMT-20	MW-402-CMT-20	DUP	1138616	10/14/13	51.7
MW-302-CMT-30	MW-302-CMT-30		1138616	10/14/13	43.4
MW-302-CMT-40	MW-302-CMT-40		1138616	10/14/13	14.9
MW-302-CMT-50	MW-302-CMT-50		1138616	10/14/13	17.9
MW-302-70	MW-302-70		1138616	10/14/13	16.4
MW-302-80	MW-302-80		1138616	10/14/13	14.7
MW-302-95	MW-302-95		1138616	10/14/13	<6.20
MW-302-110	MW-302-110		1138616	10/14/13	<6.20
MW-303-CMT-9	MW-303-CMT-9		1138616	10/15/13	<6.32
MW-303-CMT-19	MW-303-CMT-19		1138616	10/15/13	44.4
MW-303-CMT-19	MW-403-CMT-19	DUP	1138616	10/15/13	42.6
MW-303-CMT-29	MW-303-CMT-29		1138616	10/15/13	51.2
MW-303-CMT-39	MW-303-CMT-39		1138616	10/15/13	13.4
MW-303-CMT-49	MW-303-CMT-49		1138616	10/15/13	11.8
MW-303-CMT-59	MW-303-CMT-59		1138616	10/15/13	9.56J
MW-303-70	MW-303-70		1138616	10/15/13	5.95J
MW-303-80	MW-303-80		1138616	10/15/13	<6.20
MW-303-95	MW-303-95		1138616	10/15/13	<6.20
MW-303-130	MW-303-130		1138616	10/15/13	<6.20
MW-304-15	MW-304-15		1135693	11/18/13	351
MW-304-15	MW-404-15	DUP	1135693	11/18/13	352
MW-304-CMT-20	MW-304-CMT-20		1135693	11/19/13	46.4
MW-304-CMT-30	MW-304-CMT-30		1135693	11/19/13	41.6
MW-304-CMT-40	MW-304-CMT-40		1135693	11/19/13	25.4
MW-304-CMT-50	MW-304-CMT-50		1135693	11/19/13	<5.00
MW-304-CMT-60	MW-304-CMT-60		1135693	11/19/13	<5.10
MW-304-70	MW-304-70		1135693	11/18/13	<5.00
MW-304-80	MW-304-80		1138616	10/15/13	<6.20
MW-304-96	MW-304-95		1138616	10/15/13	<6.20
MW-304-125	MW-304-125		1138628	10/16/13	<6.32
MW-304-150	MW-304-150		1135693	11/18/13	<5.00
MW-305-CMT-8	No sample		—	--	—
MW-305-CMT-18	MW-305-CMT-18		1135693	11/18/13	3.80J

Table 4-12
Sulfolane Analytical Results - Vertical Profiling Transect

Fourth Quarter Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Analysis Method					Sulfolane-USEPA1625B with Isotope Dilution
Location	Sample	Dup	Work Order	Collect Date	Sulfolane Result µg/L
MW-305-CMT-28	MW-305-CMT-28		1135693	11/18/13	6.71J
MW-305-CMT-38	MW-305-CMT-38		1135693	11/18/13	<5.10
MW-305-CMT-48	MW-305-CMT-48		1135693	11/18/13	<5.00
MW-305-CMT-58	MW-305-CMT-58		1135693	11/18/13	<5.00
MW-305-70	MW-305-70		1135693	11/18/13	<5.00
MW-305-80	MW-305-80		1135693	11/18/13	<5.10
MW-305-100	MW-305-100		1135693	11/18/13	<5.00
MW-306-15	MW-306-15		1138628	10/17/13	<6.20
MW-306-CMT-20	MW-306-CMT-20		1138628	10/17/13	<6.20
MW-306-CMT-30	MW-306-CMT-30		1138628	10/17/13	<6.20
MW-306-CMT-40	MW-306-CMT-40		1138628	10/17/13	<6.20
MW-306-CMT-50	MW-306-CMT-50		1138628	10/17/13	<6.20
MW-306-CMT-60	MW-306-CMT-60		1138628	10/17/13	<6.20
MW-306-70	MW-306-70		1138628	10/17/13	<6.20
MW-306-80	MW-306-80		1138628	10/17/13	<6.20
MW-306-100	MW-306-100		1138628	10/17/13	<6.20
MW-306-150	MW-306-150		1138628	10/17/13	<6.20

Acronyms and Abbreviations:

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

DUP = field-duplicate sample

J = estimated concentration, detected above the detection limit (DL) and below the limit of quantitation (LOQ)

µg/L = micrograms per liter

USEPA = United States Environmental Protection Agency

**Table 4-13
Sulfolane Mass Flux Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

VPT Well Cluster	Approximate Depth (feet BGS / feet BWT)	Mass Flux (g/day)	Approximate Percent of Total Mass Flux
November 2011 Total Mass Flux = 86 g/day			
MW-302	8 (Water table) to 60 / 0 to 52	16.8	20%
MW-303	22 to 35 / 13 to 26	7.39	9%
MW-304	11 (Water table) to 60 / 0 to 49	40.63	47%
MW-305	9 (Water table) to 34 / 0 to 25	9.30	11%
First Quarter 2012 Total Mass Flux = 62 g/day			
MW-302	11 (Water table) to 90 / 0 to 79	22.54	36%
MW-303	22 to 35 / 13 to 26	5.29	9%
MW-304	14 (Water table) to 35 / 0 to 11	18.17	29%
MW-305	13 (Water table) to 34 / 0 to 21	5.48	9%
Second Quarter 2012 Total Mass Flux = 83 g/day			
MW-302	10 (Water table) to 90 / 0 to 80	16.36	20%
MW-303	22 to 35 / 13 to 26	5.34	6%
MW-304	13 (Water table) to 60 / 0 to 47	46.99	57%
MW-305	12 (Water table) to 22 / 0 to 10	4.63	6%
Third Quarter 2012 Total Mass Flux = 73 g/day			
MW-302	9 (Water table) to 90 / 0 to 81	22.11	30%
MW-303	22 to 35 / 13 to 26	3.55	5%
MW-304	12 (Water table) to 60 / 0 to 48	37.21	51%
MW-305	11 (Water table) to 34 / 0 to 23	3.75	5%
First Quarter 2013 Total Mass Flux = 43 g/day			
MW-302	10 (Water table) to 90 / 0 to 80	16.70	39%
MW-303	18 to 42 / 7 to 31	4.53	11%
MW-304	13 (Water table) to 42 / 0 to 29	14.32	33%
Second Quarter 2013 Total Mass Flux = 34 g/day			
MW-302	10 (Water table) to 90 / 0 to 80	13.08	38%
MW-303	18 to 42 / 7 to 31	3.98	12%
MW-304	13 (Water table) to 42 / 0 to 29	10.79	32%
Third Quarter 2013 Total Mass Flux = 35 g/day			
MW-302	10 (Water table) to 90 / 0 to 80	13.93	40%
MW-303	18 to 42 / 7 to 31	3.46	10%
MW-304	13 (Water table) to 42 / 0 to 29	11.97	34%
Fourth Quarter 2013 Total Mass Flux = 43 g/day			
MW-302	9 (Water table) to 90 / 0 to 79	13.72	32%
MW-303	9 to 70 / 0 to 61	4.91	11%
MW-304	9 (Water table) to 42 / 0 to 33	22.43	52%

Acronyms and Abbreviations:

BGS = below ground surface

BWT = below water table

g/day = grams per day

VPT = Vertical Profiling Transect

Table 4-14
Private Well Sulfolane Results - Initial Sampling Event

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Lat Long	PW_ID	Well Depth (feet)	Zone	Sample Type	Sample Date	Sulfolane
						µg/L
64.794651920, -147.405495323	PW-0239	42	10-55	DUP	12/6/2013	<5.00
					12/6/2013	<5.25
64.779216293, -147.336369999	PW-0342	80	55-90		11/11/2013	<6.32
64.776441022, -147.340406802	PW-0669	35.5	10-55		11/5/2013	<6.32
64.793293409, -147.379811328	PW-0690	30	10-55		10/5/2013	<6.20
64.726571728, -147.311858630	PW-0828	35	10-55	DUP	10/9/2013	<6.32
					10/9/2013	<6.40
64.771218154, -147.335381764	PW-1038	100	90-160		11/8/2013	<6.32
64.774647141, -147.323422995	PW-1340	108	90-160		11/12/2013	<6.20
64.778280106, -147.397944765	PW-1493	180	>160		9/24/2013	12.8
64.765101684, -147.401164423	PW-1494	--	--		10/2/2013	100
64.789862996, -147.378641757	PW-1891	--	--		11/9/2013	<6.46
64.763815359, -147.340718198	PW-1892	--	--		11/11/2013	<6.46
64.774886656, -147.256758921	PW-1893	--	--		11/15/2013	<6.46
64.813507582, -147.394410698	PW-1894	--	--		12/5/2013	<5.00

Acronyms and Abbreviations:

DUP = field-duplicate sample

PW_ID = private well identification number

µg/L = micrograms per liter

-- = information not available

**Table 4-15
Private Well Sulfolane Results - Resampling Event**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Lat Long	PW_ID	Well Depth (feet)	Zone	Sample Date	Sulfolane
					µg/L
64.783012730, -147.353661310	PW-0528	40	10-55	11/12/2013	<6.56
64.759271425, -147.348174681	PW-1031	36	10-55	11/8/2013	<6.36
64.787344754, -147.405221541	PW-1181	--	--	11/9/2013	<6.46
64.758106203, -147.347544913	PW-1272	--	--	11/8/2013	<6.36
64.755132666, -147.351600925	PW-1491	145	90-160	9/24/2013	4.66J
64.747786196, -147.349810353	PW-1492	176	>160	9/24/2013	<6.20

Acronyms and Abbreviations:

J = estimated concentration detected below the laboratory limit of quantitation (LOQ)

PW_ID = private well identification number

µg/L = micrograms per liter

-- = information not available

Table 4-16
2013 Deep Private Well Analytical Results

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

PW ID	Well Depth (feet)	Zone	Sample Type	Sample Date	Sulfolane	Alkalinity	Ammonia as N	Calcium	Chloride	CO3 Alkalinity	HCO3 Alkalinity	Dissolved Iron	Magnesium	Manganese	Methane	Nitrate/Nitrite Total ^a	Nitrate	Nitrite	OH Alkalinity	Potassium	Sodium	Sulfate	Total Iron	Total Manganese	Total Organic Carbon
					µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PW-0217	238	>160	PS	03/11/2013	173	157	<0.0620	46.5	11.0	<6.20	157	4.96	11.0	0.830	0.11	--	<0.0620	0.0930J	<6.20	4.10	10.2	23.7	12.7	0.862	2.65
PW-0217	238	>160	PS	06/05/2013	163	152	0.0830J	46.8	10.7	<6.20	152	12.9	10.9	0.891	0.0830	--	0.0490J	<0.0620	<6.20	4.16	9.97	23.3	13.5	0.886	2.49
PW-0217	238	>160	PS	09/05/2013	152	148	0.0859J	45.8	10.0	<6.20	148	12.8	10.7	0.833	0.0990	--	<0.0620	<0.0620	<6.20	4.09	9.49	21.7	14.1	0.842	2.58
PW-0217	238	>160	PS	11/19/2013	153	149	0.0775J	47.2	10.5	<5.00	149	10.9	10.7	0.882	0.074	--	<0.0500	0.176	<5.00	4.02	9.48	24.7	12.6	0.872	2.7
PW-0259	287	>160	PS	04/04/2013	<6.74	132	0.245	37.2	1.47	<6.20	132	5.41	8.86	0.815	0.025	--	0.0620JL*	0.0595JL*	<6.20	2.90	4.18	16.9	5.57	0.849	2.33
PW-0259	287	>160	PS	06/19/2013	<6.20	134	0.152	37.7	1.63	<6.20	134	4.55	8.81	0.845	0.0210	--	0.0600J	<0.0620	<6.20	2.91	4.11	16.6	5.76	0.870	2.40
PW-0296	220	>160	PS	03/21/2013	11.9	155	0.0951J	44.8	3.12	<6.20	155	6.44	9.95	0.624	0.059	--	0.0590J	<0.0620	<6.20	3.08	4.17	22.2	6.59	0.620	2.39
PW-0296	220	>160	PS	06/13/2013	12.6	140	0.119	51.1	3.20	<6.20	140	6.85	11.1	0.659	0.0390	--	0.0600J	<0.0620	<6.20	3.51	4.65	22.8	7.17	0.667	2.48
PW-0296	220	>160	DUP	06/13/2013	12.5	150	0.120	52.2	3.19	<6.20	150	6.91	11.2	0.673	0.0430	--	0.0590J	<0.0620	<6.20	3.54	4.71	22.9	7.13	0.669	2.48
PW-0296	220	>160	PS	09/12/2013	11.2	147	0.109	48.3	3.05	<6.20	147	6.47	10.6	0.645	0.0560	--	<0.0620	<0.0620	<6.20	3.33	4.57	22.2	6.60	0.643	2.29
PW-0296	220	>160	PS	12/4/2013	11.5	148	0.158	50.4	2.94	<5.00	148	6.03	11.3	0.686	0.046	--	0.0400J	<0.0500	<5.00	3.36	4.83	21.7	6.1	0.682	2.73
PW-0297 ^b	24	10-55	PS	12/4/2013	11.1	166	0.187	57.3	8.81	<5.00	166	2.68	14	1.56	0.066	--	0.0410J	<0.0500	<5.00	4.18	8.74	23.4	2.81	1.54	3.95
PW-0297 ^b	24	10-55	PS	03/21/2013	9.12J	172	0.217	52.3	7.20	<6.20	172	2.52	12.7	1.47	0.069	--	0.0620J	<0.0620	<6.20	3.95	7.77	24.3	2.46	1.43	3.41
PW-0297 ^b	24	10-55	PS	06/13/2013	10.5	170	0.197	55.4	7.92	<6.20	170	2.08	13.0	1.44	0.0230	--	0.0590J	<0.0620	<6.20	4.09	8.74	25.7	3.02	1.45	3.83
PW-0297 ^b	24	10-55	PS	09/12/2013	10.0J	172	0.166	53.5	8.61	<6.20	172	1.96	12.9	1.40	0.0180	--	<0.0620	<0.0620	<6.20	4.08	8.11	24.1	2.09	1.43	3.33
PW-0332	266	>160	PS	04/19/2013	<6.66J§	150J§	0.0994J§	<0.300J§	1.05J§	<6.20J§	150J§	<0.156J§	<0.0300J§	0.000477J§	0.080§	--	<0.0620J§	0.0645J§	<6.20J§	<0.300J§	77.7J§	15.8J§	0.192J§	0.000949J§	1.18J§
PW-0332	266	>160	PS	06/20/2013	<6.20	143	0.103	43.8	0.958	<6.20	143	2.16	8.87	0.368	0.00860	--	0.0590J	<0.0620	<6.20	3.14	4.63	15.6	2.16	0.378	1.13
PW-0332	266	>160	PS	09/24/2013	<6.20	143	0.0956J	44.2	0.944	<6.20	143	2.47	9.13	0.351	0.00940	--	0.0440J	0.0310J	<6.20	3.25	4.62	15.3	2.94	0.365	<1.69B*
PW-0332	266	>160	PS	12/16/2013	<5.00	144	0.105	44.2	1.03	<5.00	144	3.39	9.12	0.371	0.0099	--	<0.0500	<0.0500	<5.00	3.22	4.62	14.5	3.7	0.37	<1.47B*
PW-0358	105	90-160	PS	03/25/2013	73.8	113	0.181	39.5	3.90	<6.20	113	4.22	8.88	0.433	0.019	--	0.0570J	0.0530J	<6.20	3.05	4.17	23.3	8.00	0.610	3.70
PW-0358	105	90-160	PS	06/12/2013	80.2	116	0.0848J	44.1	2.53	<6.20	116	3.73	9.09	0.599	0.0180	--	0.0600J	<0.0620	<6.20	3.26	4.20	32.5	4.42	0.603	1.25
PW-0358	105	90-160	PS	09/10/2013	88.7	120	0.0331J	39.5	2.62	<6.20	120	4.67	8.88	0.582	0.0290	--	<0.0620	<0.0620	<6.20	3.11	4.24	24.5	5.93	0.570	<1.75B*
PW-0358	105	90-160	PS	12/9/2013	86.7	120	0.0916J*	36.6	2.87	<5.00	120	2.09	8.71	0.384	0.024	--	0.0450J	<0.0500	<5.00	3.1	5.26	18.4	6.44	0.43	2.4
PW-0463	89	55-90	PS	04/04/2013	27.9	124	0.207	41.6	3.57	<6.20	124	1.70	9.09	0.647	0.020	--	<0.0620	0.0510J	<6.20	3.09	4.52	29.4	1.77	0.638	1.41
PW-0463	89	55-90	PS	06/27/2013	33.2	124	0.0999J	43.5	3.68	<6.20	124	2.21	9.27	0.667	0.00910	<0.0620J*	--	--	<6.20	3.16	4.56	28.4	2.94	0.684	1.29
PW-0463	89	55-90	PS	09/12/2013	34.7	122	0.0656J	42.7	3.82	<6.20	122	2.08	9.07	0.670	0.0280	--	<0.0620	<0.0620	<6.20	3.06	4.39	28.5	2.17	0.676	<1.39B*
PW-0463	89	55-90	PS	11/25/2013	39.4	123	0.0986J	43.7	4.19	<5.00	123	1.88	9.52	0.646	0.011	--	<0.0500	0.127	<5.00	3.05	4.7	28.7	2	0.659	<1.59B*
PW-0464	98	55-90	PS	03/28/2013	40.3	126	0.0459J	41.4	4.07	<6.20	126	1.16	9.17	0.581	0.031	--	0.0560J	0.0520J	<6.20	3.02	4.41	28.5	2.17	0.592	1.57
PW-0464	98	55-90	PS	06/27/2013	44.2	126	0.0967J	43.2	4.01	<6.20	126	1.68	9.22	0.624	0.0260	<0.0620J*	--	--	<6.20	3.09	4.45	29.7	1.74	0.639	1.43
PW-0464	98	55-90	PS	09/25/2013	45.3	127	0.0688J	45.1	4.01JH*	<6.20	127	1.35	9.70	0.620	0.0350	--	<0.0620	<0.0620	<6.20	3.17	4.60	28.8	1.62	0.619	1.88
PW-0464	98	90-160	PS	12/3/2013	46.5	126	0.0879J	45.9	4.19	<5.00	126	1.24	9.43	0.647	0.023	--	0.0410J	<0.0500	<5.00	2.96	4.39	27.5	1.79	0.59	<2.14B*
PW-0466	122	90-160	DUP	04/18/2013	23.9	162	0.176	51.6	6.13	<6.20	162	2.86	11.5	0.749	0.061	--	<0.0620	<0.0620	<6.20	3.41	4.69	26	2.97	0.765	2.85
PW-0466	122	90-160	PS	04/18/2013	23.1	159	0.186	51.0	6.28	<6.20	159	2.84	11.0	0.738	0.078	--	0.0440J	<0.0620	<6.20	3.34	4.43	26.4	3.00	0.753	2.95
PW-0466	122	90-160	PS	06/12/2013	26.8	157	0.0895J	55.5	6.36	<6.20	157	3.17	12.0	0.762	0.0580	--	0.0600J	<0.0620	<6.20	3.60	4.77	25.9	3.14	0.754	2.90
PW-0466	122	90-160	PS	09/09/2013	29.5	164	0.111	52.6	6.54	<6.20	164	3.06	12.0	0.741	0.0970	--	<0.0620	<0.0620	<6.20	3.53	4.76	25.6	3.19	0.759	3.89
PW-0466	122	90-160	DUP	09/09/2013	29.0	164	0.0923J	54.0	6.51	<6.20	164	3.10	12.3	0.749	0.0810	--	<0.0620	<0.0620	<6.20	3.57	4.85	25.4	3.20	0.770	3.92
PW-0466	122	90-160	PS	12/16/2013	31.4	163	0.113	53.9	6.76	<5.00	163	3.36	11.8	0.792	0.084	--	0.0450J	<0.0500	<5.00	3.56	4.89	26.2	3.33	0.764	3.49
PW-0658	196	>160	PS	03/18/2013	48.4	169	0.139	48.4	7.40	<6.20	169	6.92	12.1	0.673	0.089	--	0.0610J	<0.0620	<6.20	3.65	4.49	15.2	9.25	0.693	3.43
PW-0658	196	>160	PS	06/12/2013	51.1	164	0.0646J	53.5	7.41	<6.20	164	7.00	12.3	0.691	0.0860	--	0.0580J	<0.0620	<6.20	3.94	4.62	14.6	7.92	0.672	3.63
PW-0658	196	>160	PS	09/11/2013	63.7	173	0.0597J	52.9	7.59	<6.20	173	7.24	12.3	0.748	0.120	--	<0.0620	<0.0620	<6.20	3.73	4.49	15.3	7.50	0.735	4.37
PW-0658	196	>160	PS	12/3/2013	57	171	0.122	52.8	7.26	<5.00	171	6.85	12.9	0.761	0.1	--	0.0450J	<0.0500	<5.00	3.79	4.67	15.4	8.43	0.819	3.76
PW-0932	255	>160	PS	03/20/2013	5.09J	139	<0.124B*	46.1	2.93	<6.20	139	5.54	9.95	0.543	0.044	--	0.0560J	<0.0620	<6.20	3.37	4.48	23	7.01	0.554	1.90
PW-0932	255	>160	PS	06/19/2013	5.04J	138	0.0921J	42.4	2.95	<6.20	138	4.24	9.08	0.527	0.0270	--	0.0940J	<0.0620	<6.20	3.13	4.23	24.6	4.40	0.509	1.84
PW-0932	255	>160	PS	09/16/2013	8.05J	135	0.0845J	44.2	3.19	<6.20	135	3.45	9.90	0.536	0.0290	--	<0.100B*	0.0590J	<6.20	3.36	4.42	24.9	3.66	0.534	2.05
PW-0932	316	>160	PS	11/26/2013	8.80J	137	0.196J*	46.7	3.17	<5.00	137	4.85	10.1	0.511	0.055	--	<0.0500	0.0415J	<5.00	3.35	4.59	22.5	6.48	0.53	2.17
PW-0932	316	>160	DUP	11/26/2013	9.00J	137	0.120J*	46.5	3.18	<5.00	137	4.71	10	0.501	0.052	--	<0.0500	0.0475J	<5.00	3.32	4.56	22.6	6		

**Table 4-16
2013 Deep Private Well Analytical Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

PW ID	Well Depth (feet)	Zone	Sample Type	Sample Date	Sulfolane	Alkalinity	Ammonia as N	Calcium	Chloride	CO3 Alkalinity	HCO3 Alkalinity	Dissolved Iron	Magnesium	Manganese	Methane	Nitrate/Nitrite Total ^a	Nitrate	Nitrite	OH Alkalinity	Potassium	Sodium	Sulfate	Total Iron	Total Manganese	Total Organic Carbon
					µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PW-1155	215	>160	PS	03/18/2013	162	155	0.144	48.0	6.89	<6.20	155	8.27	11.4	0.651	0.15	--	0.0610J	<0.0620	<6.20	3.66	6.18	28.7	8.74	0.660	2.68
PW-1155	215	>160	PS	06/05/2013	166	155	0.0855J	49.0	6.44	<6.20	155	11.9	11.3	0.705	0.0970	--	0.0490J	<0.0620	<6.20	3.80	6.19	24.7	13.0	0.713	2.65
PW-1155	215	>160	PS	09/11/2013	172	148	0.0604J	43.1	7.20	<6.20	148	11.1	10.1	0.652	0.0650	--	0.0580J	<0.0620	<6.20	3.37	5.54	26.3	9.96	0.588	3.08
PW-1155	215	>160	PS	11/25/2013	173	147	0.0953J	50.1	7.37	<5.00	147	7.82	11.3	0.604	0.044	--	<0.0500	0.0875J	<5.00	3.67	6.25	28.4	8.2	0.606	2.83
PW-1230	231	>160	PS	03/11/2013	558	134	0.289	41.8	12.4	<6.20	134	3.88	11.8	0.862	1.4	--	<0.0620	0.122	<6.20	3.10	4.73	18.2	37.2	1.06	1.81
PW-1230	231	>160	PS	06/27/2013	603	113	0.615	36.6	17.3	<6.20	113	5.29	11.7	0.556	0.00930	<0.0620J*	--	--	<6.20	3.20	4.76	17.5	122	1.10	3.28
PW-1230	231	>160	PS	09/12/2013	652	101	<0.0620	35.8	16.5	<6.20	101	4.52	11.5	0.474	0.0710	--	<0.0620	<0.0620	<6.20	3.37	5.01	16.6	78.9	0.915	2.93
PW-1230	231	>160	PS	12/2/2013	639	128	0.157	36.6	15	<5.00	128	2.57	10.5	0.655	0.3	--	<0.0500J*	<0.0500J*	<5.00	3.22	4.5	15.4	84.4	1.08	4.27J*
PW-1230	231	>160	DUP	12/2/2013	657	132	0.142	37.9	14.9	<5.00	132	2.19	10.8	0.69	0.26	--	<0.0500J*	<0.0500J*	<5.00	3.33	4.52	15	81.9	1.12	3.83
PW-1230 ^c	231	>160	DUP	03/28/2013	497	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PW-1230 ^c	231	>160	PS	03/28/2013	517	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PW-1343	94	55-90	PS	03/20/2013	<6.66	202	<0.100B*	66.3	23.7	<6.20	202	1.62	14.9	0.272	0.049	--	<0.100J*	0.0890J*	<6.20	3.94	10.6	17.7	2.08	0.301	2.51
PW-1343	94	55-90	PS	06/13/2013	<6.20	196	<0.0620	<0.300	25.2	<6.20	196	<0.156	<0.0300	0.000395J	0.0460	--	0.0660J	<0.0620	<6.20	0.177J	129	17.9	<0.156	0.000467J	2.06
PW-1343	94	55-90	PS	09/10/2013	<6.40	205	<0.0620	64.4	25.0	<6.20	205	1.35	15.0	0.297	0.0320	--	<0.0620	<0.0620	<6.20	3.91	10.8	17.3	1.42	0.301	2.54
PW-1343	94	90-160	PS	11/21/2013	<5.00J*	204JL*	<0.0500J*	63.9JL*	2.82JL*	<5.00J*	204JL*	1.52JL*	14.1JL*	0.303JL*	0.0260JL*	--	0.0700JL*	<0.0500J*	<5.00J*	3.95JL*	10.9JL*	31.7JL*	1.63JL*	0.295JL*	2.25JL*
PW-1458 ^b	30	10-55	PS	06/20/2013	<6.66	170	0.118	50.5	14.7	<6.20	170	0.787	13.6	1.75	0.0470	--	0.0670J	<0.0620	<6.20	3.68	8.10	26.4	0.849	1.77	2.31
PW-1458 ^b	30	10-55	PS	09/05/2013	<6.40	163	0.0557J	52.4	12.7	<6.20	163	0.646	14.5	1.65	0.0290	--	<0.0620	<0.0620	<6.20	4.15	8.56	27.3	0.687	1.73	1.59
PW-1626	305	>160	PS	10/16/2013	307	122	0.0651J	43.1	5.17	<6.20	122	2.77	10.8	0.480	0.0130	--	<0.0620	0.0320J	<6.20	3.74	6.02	32.5	16.3	0.543	<1.51B*

General Notes:

- a. Laboratory performed total analysis for samples received outside of hold time due to delivery truck delay.
- b. Garden well location.
- c. Location was resampled to verify sulfolane results from the sample collected on 3/11/2013.

Acronyms and Abbreviations:

- < = analyte not detected; limit of detection listed
- § = result biased. Sample location was downstream of a water-treatment system. The sample was collected from the appropriate spigot during the second and third quarter sampling events.
- B* = result is considered non-detect; flag applied by SWI based on analytical QC issues, see data-review checklist for details
- DUP = duplicate sample
- J = result is estimated; analyte was detected below the limit of quantitation (LOQ).
- J* = result is estimated; flag applied by SWI based on sample-handling or analytical QC issues, see data-review checklist for details
- JL* = results is considered an estimate, biased low; flag applied by SWI based on sample-handling or analytical QC issues, see data-review checklist for details
- JH* = results is considered an estimate, biased high; flag applied by SWI based on sample-handling or analytical QC issues, see data-review checklist for details
- mg/L = milligrams per liter
- PF = project sample
- PW ID = Private Well Identification Number
- µg/L = micrograms per liter

Table 4-17
Analytical Data and Field Data Summary – Air Sparge Pilot System

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Monitoring Well	Time Period	Date	Lab Data						Field Data					
			Sulfolane (µg/L)	Fe (µg/L)	Mn (µg/L)	TOC (mg/L)	TKN (mg/L)	Total Phosphorus (mg/L)	DO (mg/L)	Temp. (°C)	ORP (mV)	pH	Conductivity (µS/cm)	Water Elevation (ft)
AS-MW-1	Week 46	1/24/2013	<6.20 J*	<156 J*	0.995 J*	2.18 J*	<0.620	0.455	6.62	3.6	186.4	6.77	234.4	485.12
AS-MW-1	Week 61	5/8/2013	--	--	--	--	--	--	0.49	--	--	--	--	--
AS-MW-1	Week 62	5/15/2013	--	--	--	--	--	--	0.26	--	--	--	--	--
AS-MW-1	Week 63	5/23/2013	--	--	--	--	--	--	10.79	--	--	--	--	--
AS-MW-1	Week 70 Pre-shut down	7/10/2013	14.3	<156	979	2.10	<0.620	<0.00620	1.17	1.8	129.9	6.80	235.0	488.45
AS-MW-1	(Week 71) Week 1 Post-shut down	7/17/2013	9.89 J	<156	1060	2.19	<0.620	<0.00620	0.59	2.3	125.0	7.12	211.9	488.57
AS-MW-1	(Week 72) Week 2 Post-shut down	7/24/2013	12.0	<156	1030	1.95	0.321 J	<0.0124	0.29	2.6	270.7	7.36	209.3	489.28
AS-MW-1	(Week 74) Week 4 Post-shut down	8/7/2013	17.8	<156	1200	2.25	<0.620	0.00440 J	0.12	2.66	36.9	6.72	235	492.02
AS-MW-1	(Week 76) Week 6 Post-shut down	08/21/2013 - 08/22/2013	20.0	<156	1380	2.05	<0.620	<0.0100 B*	0.10	1.5	141.8	6.70	225.4	490.09
AS-MW-1	(Week 78) Week 8 Post-shut down	9/4/2013	19.5	<156	1560	2.22	<0.620	<0.0124	0.25	1.6	156.5	6.74	234.9	488.48
AS-MW-1	(Week 80) Week 10 Post-shut down	9/18/2013	17.6	<156	1830	2.18	<0.620	<0.0132 B*	0.26	2.6	114.4	6.91	254.3	488.49
AS-MW-1	(Week 82) Week 12 Post-shut down	10/2/2013	16.3	<156	1990	1.91	<0.620	<0.0100 B*	0.37	2.8	134.9	7.04	245.8	487.81
AS-MW-1	(Week 84) Week 14 Post-shut down	10/17/2013	18.9	<156	1850	2.16	<0.620	0.0125	0.22	1.8	202.7	6.65	224.5	487.32
AS-MW-1	(Week 86) Week 16 Post-shut down	10/30/2013	20.1	<156	1620	2.40	<0.620	0.00340 J	1.54	3.06	43.9	7.09	276	487.15
AS-MW-1	(Week 88) Week 18 Post-shut down	11/15/2013	20.0	<125	1900	2.30	<0.500	<0.0108 B*	0.76	2.98	128.2	5.94	244	--
AS-MW-1	(Week 90) Week 20 Post-shut down	11/26/2013	21.7	94.6 J	1930	2.42	<0.500 J*	<0.00500	0.22	2.0	59.2	6.72	228.5	--
AS-MW-2	Week 46	1/24/2013	<6.60	289	2.55	3.06	0.492 J	<0.0100 B*	9.97	3.9	190.4	7.21	272.5	484.63
AS-MW-2	Week 61	5/8/2013	--	--	--	--	--	--	7.40	--	--	--	--	--
AS-MW-2	Week 62	5/15/2013	--	--	--	--	--	--	5.91	--	--	--	--	--
AS-MW-2	Week 63	5/23/2013	--	--	--	--	--	--	7.03	--	--	--	--	--
AS-MW-2	Week 70 Pre-shut down	7/10/2013	<6.20	<156	7.17	2.16	<0.620	<0.00620	8.32	2.0	132.4	7.00	265.2	487.83
AS-MW-2	Week 70 Pre-shut down	7/10/2013	--	--	--	--	--	--	6.43	--	--	--	--	--
AS-MW-2	Week 70	7/11/2013	--	--	--	--	--	--	5.53	--	--	--	--	--
AS-MW-2	Week 70	7/12/2013	--	--	--	--	--	--	4.35	--	--	--	--	--
AS-MW-2	Week 70	7/13/2013	--	--	--	--	--	--	3.94	--	--	--	--	--
AS-MW-2	(Week 71) Week 1 Post-shut down	7/17/2013	<6.20	<156	1.47	1.95	<0.620	<0.00620	4.10	2.73	204.4	6.17	258	488.08
AS-MW-2	(Week 72) Week 2 Post-shut down	7/24/2013	<6.20	<156	14.8	1.91	<0.620	<0.00620	3.58	2.6	273.4	7.41	227.7	488.51
AS-MW-2	(Week 74) Week 4 Post-shut down	8/7/2013	<6.20	<156	25.4	2.03	<0.620	<0.00620	2.49	3.04	4.0	7.89	250	488.6
AS-MW-2	(Week 76) Week 6 Post-shut down	08/21/2013 - 08/22/2013	<6.20	<156	32.2	1.98	<0.620	<0.0100 B*	2.64	1.9	131.3	6.91	248.2	488.67
AS-MW-2	(Week 78) Week 8 Post-shut down	9/4/2013	<6.20	<156	17.0	2.02	<0.620	0.00554 J	3.47	3.3	149.6	6.90	271.6	488
AS-MW-2	(Week 80) Week 10 Post-shut down	9/18/2013	<6.40	<156	44.0	2.82	<0.620	<0.0159 B*	2.89	4.0	108.9	6.97	288.4	487.99
AS-MW-2	(Week 82) Week 12 Post-shut down	10/2/2013	<6.20	<156	65.6	2.07	<0.620	<0.0114 B*	2.80	4.5	131.9	7.06	286.9	487.33
AS-MW-2	(Week 84) Week 14 Post-shut down	10/17/2013	<6.40	<156	58.3	2.35	<0.620	<0.00620	1.88	4.66	-28.2	7.18	283	486.96
AS-MW-2	(Week 86) Week 16 Post-shut down	10/30/2013	<6.32	<156	77.8	2.65	<0.620	0.00590 J	2.13	4.58	52.2	7.16	313	486.84
AS-MW-2	(Week 88) Week 18 Post-shut down	11/15/2013	<5.15	<125	106	2.20	<0.500	<0.0100 B*	0.89	4.4	139.7	6.92	256.9	--
AS-MW-2	(Week 90) Week 20 Post-shut down	11/26/2013	3.75 J	<125	125	2.02	<0.500 J*	<0.0100 B*	0.40	3.0	78.2	6.90	244.5	--
AS-MW-2	(Week 92) Week 22 Post-shut down	12/11/2013	12.7	<307 B*	227	--	--	--	0.17	4.0	165.0	7.06	257.8	--
AS-MW-2	(Week 94) Week 24 Post-shut down	12/30/2013	12.4	<125	258	--	--	--	0.27	3.8	73.5	7.09	245.9	--
AS-MW-3	Week 46	1/24/2013	<6.20	305 J*	490 J*	2.85	0.428 J	0.0355	0.78	3.1	95.2	6.61	431.0	484.76
AS-MW-3	Week 61	5/8/2013	--	--	--	--	--	--	0.56	--	--	--	--	--
AS-MW-3	Week 62	5/15/2013	--	--	--	--	--	--	0.07	--	--	--	--	--
AS-MW-3	Week 63	5/23/2013	--	--	--	--	--	--	0.01	--	--	--	--	--
AS-MW-3	Week 70 Pre-shut down	7/10/2013	<6.20	<156	1690	4.25	0.322 J	0.00780 J	3.63	1.4	158.1	6.34	338.4	487.68
AS-MW-3	(Week 71) Week 1 Post-shut down	7/17/2013	7.76 J	108 J	3520	3.78	<0.620	<0.00620	1.6	2.1	151.9	6.62	418.2	488.23
AS-MW-3	(Week 72) Week 2 Post-shut down	7/24/2013	8.07 J	1040	5070	3.96	0.354 J	<0.0310	2.27	2.25	45.6	6.76	474	488.57
AS-MW-3	(Week 74) Week 4 Post-shut down	8/7/2013	5.95 J	1980	5610	4.06	0.311 J	0.0674	1.41	2.37	19.2	7.64	483	488.66
AS-MW-3	(Week 76) Week 6 Post-shut down	08/21/2013 - 08/22/2013	8.80 J	2640	5330	3.62	0.422 J	<0.0100 B*	0.44	1.7	29.6	6.19	446.8	488.79
AS-MW-3	(Week 78) Week 8 Post-shut down	9/4/2013	6.21 J	1710	3820	3.49	<0.620	<0.0248	0.50	3.30	85.5	6.61	425.0	488.18
AS-MW-3	(Week 80) Week 10 Post-shut down	9/18/2013	13.4	2770	4960	3.74	0.351 J	<0.00620	0.22	3.6	124.6	6.02	479.8	488.08
AS-MW-3	(Week 82) Week 12 Post-shut down	10/2/2013	11.7	1840	4000	3.41	0.375 J	<0.0100 B*	0.47	4.0	137.1	6.25	500	487.44

Table 4-17
Analytical Data and Field Data Summary – Air Sparge Pilot System

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Monitoring Well	Time Period	Date	Lab Data						Field Data					
			Sulfolane (µg/L)	Fe (µg/L)	Mn (µg/L)	TOC (mg/L)	TKN (mg/L)	Total Phosphorus (mg/L)	DO (mg/L)	Temp. (°C)	ORP (mV)	pH	Conductivity (µS/cm)	Water Elevation (ft)
AS-MW-3	(Week 84) Week 14 Post-shut down	10/17/2013	35.6	3590	5000	3.86	0.538 J	<0.00620	0.64	3.1	10.2	6.02	457.1	486.42
AS-MW-3	(Week 86) Week 16 Post-shut down	10/30/2013	54.5	5130 JH*	5820	4.42	0.362 J	0.0106	0.89	4.16	23.1	6.32	568	486.81
AS-MW-3	(Week 88) Week 18 Post-shut down	11/15/2013	92.1	8040	6080	3.71	0.559 J	<0.0100 B*	0.75	2.72	56.1	6.62	422	--
AS-MW-3	(Week 90) Week 20 Post-shut down	11/26/2013	80.8	9040	6730	4.05	0.363 JL*	<0.00500	0.21	2.5	23.5	6.22	421.0	--
AS-MW-4	Week 46	1/24/2013	<6.20J*	<156	31.5	4.40	0.405 J	<0.00620	5.76	3.8	206.7	6.76	366.8	485
AS-MW-4	Week 61	5/8/2013	--	--	--	--	--	--	0.69	--	--	--	--	--
AS-MW-4	Week 62	5/15/2013	--	--	--	--	--	--	0.01	--	--	--	--	--
AS-MW-4	Week 63	5/23/2013	--	--	--	--	--	--	0.50	--	--	--	--	--
AS-MW-4	Week 70 Pre-shut down	7/10/2013	<6.20	<156	61.2	3.42	<0.620	0.014	6.71	1.5	150.3	6.73	336.7	487.89
AS-MW-4	(Week 71) Week 1 Post-shut down	7/17/2013	<6.46	130 J	184	3.76	<0.620	<0.00620	3.60	1.9	153.3	6.89	359.9	488.44
AS-MW-4	(Week 72) Week 2 Post-shut down	7/24/2013	<6.50	<156	360	4.00	<0.620	<0.0124	2.50	2.0	271.0	6.87	369.1	488.81
AS-MW-4	(Week 74) Week 4 Post-shut down	8/7/2013	<6.20	<156	563	3.94	<0.620	0.00340 J	2.02	2.22	9.4	7.42	403	488.86
AS-MW-4	(Week 76) Week 6 Post-shut down	08/21/2013 - 08/22/2013	5.40 J	<156	657	3.95	<0.620	<0.0147 B*	1.50	1.2	166.8	6.48	391.2	488.93
AS-MW-4	(Week 78) Week 8 Post-shut down	9/4/2013	<6.20	<156	167	3.82	<0.620	0.0145 J*	1.91	2.70	76.1	7.07	367.0	488.34
AS-MW-4	(Week 80) Week 10 Post-shut down	9/18/2013	6.14 J	<156	471	5.18	<0.620	<0.0166 B*	1.40	3.0	99.9	6.36	419.7	488.33
AS-MW-4	(Week 82) Week 12 Post-shut down	10/2/2013	<6.20	<156	58.4	3.48	0.454 J	<0.0138 B*	1.30	3.4	128.3	6.58	380.9	487.62
AS-MW-4	(Week 84) Week 14 Post-shut down	10/17/2013	6.56 J	129 J	55.7	3.69	<0.620	<0.00620	1.18	3.59	-5.4	6.65	377	487.29
AS-MW-4	(Week 86) Week 16 Post-shut down	10/30/2013	21.5	<156	225	4.35	<0.620	0.00450 J	1.31	3.54	73.1	6.63	435	487.01
AS-MW-4	(Week 88) Week 18 Post-shut down	11/15/2013	29.3	<125	552	3.81	<0.500	<0.0169 B*	0.89	3.4	143.4	6.50	374.2	--
AS-MW-4	(Week 90) Week 20 Post-shut down	11/26/2013	46.0	<125	844	3.37	<0.500 J*	<0.00500	0.53	2.0	121.0	6.50	362.0	--
AS-MW-4	(Week 92) Week 22 Post-shut down	12/11/2013	37.6	<250 B*	1280	--	--	--	0.42	3.3	190.7	6.57	355.7	--
AS-MW-4	(Week 94) Week 24 Post-shut down	12/30/2013	49.0	<125	1740	--	--	--	0.38	3.1	82.1	6.62	346.9	--
AS-MW-5	Week 46	1/24/2013	<6.74	156	0.848 J	2.76	0.340 J	<0.00620	13.56	4.2	233.7	7.42	319.4	485.07
AS-MW-5	Week 61	5/8/2013	--	--	--	--	--	--	7.33	--	--	--	--	--
AS-MW-5	Week 62	5/15/2013	--	--	--	--	--	--	11.82	--	--	--	--	--
AS-MW-5	Week 63	5/23/2013	--	--	--	--	--	--	6.23	--	--	--	--	--
AS-MW-5	Week 70 Pre-shut down	7/10/2013	<6.20	<156	0.769 J	4.49	0.339 J	0.00820 J	17.56	3.03	261.6	7.11	277.0	488.12
AS-MW-5	Week 70 Pre-shut down	7/10/2013	--	--	--	--	--	--	15.06	--	--	--	--	--
AS-MW-5	Week 70	7/11/2013	--	--	--	--	--	--	14.95	--	--	--	--	--
AS-MW-5	Week 70	7/12/2013	--	--	--	--	--	--	14.37	--	--	--	--	--
AS-MW-5	Week 70	7/13/2013	--	--	--	--	--	--	14.19	--	--	--	--	--
AS-MW-5	(Week 71) Week 1 Post-shut down	7/17/2013	<6.20	<156	1.66	2.72	<0.620	<0.00620	13.69	3.06	190.6	6.41	242	488.46
AS-MW-5	(Week 72) Week 2 Post-shut down	7/24/2013	<6.20	293	14.9	2.27	<0.620	0.0419	13.63	3.64	25.1	7.63	240	488.84
AS-MW-5	(Week 74) Week 4 Post-shut down	8/7/2013	<6.20	<156	1.25	2.12	<0.620	0.00360 J	11.64	3.78	47.2	8.05	241	488.86
AS-MW-5	(Week 76) Week 6 Post-shut down	08/21/2013 - 08/22/2013	<6.32	<156	1.79	2.21	<0.620	<0.0274 B*	10.10	3.6	102.2	7.07	238.4	489
AS-MW-5	(Week 78) Week 8 Post-shut down	9/4/2013	<6.32	<156	1.23	2.43	<0.620	<0.00620	9.13	5.05	76.6	7.56	252.0	488.34
AS-MW-5	(Week 80) Week 10 Post-shut down	9/18/2013	<6.40	<156	0.672 J	2.55	<0.620	<0.0133 B*	8.71	5.6	284.0	7.07	283.3	488.33
AS-MW-5	(Week 82) Week 12 Post-shut down	10/2/2013	<6.20	<156	1.10	3.06	<0.620	0.0289	7.31	5.9	227.8	7.25	269.8	487.66
AS-MW-5	(Week 84) Week 14 Post-shut down	10/17/2013	<6.50	<156	0.752 J	2.32	<0.620	0.0181	12.47	5.0	58.1	7.06	10.1	487.31
AS-MW-5	(Week 86) Week 16 Post-shut down	10/30/2013	<6.20	<156	0.820 J	2.73	<0.620	0.0142	6.65	5.70	51.1	7.29	310	487.05
AS-MW-5	(Week 88) Week 18 Post-shut down	11/15/2013	<5.00	<125	<0.500	2.19	<0.500	<0.0188 B*	5.97	5.32	41.4	6.57	270	--
AS-MW-5	(Week 90) Week 20 Post-shut down	11/26/2013	<5.80	<125	0.966 J	2.12	<0.500 J*	<0.00500	6.25	3.9	89.9	7.07	252.3	--
AS-MW-5	(Week 92) Week 22 Post-shut down	12/11/2013	<5.00	<250 B*	<1.49 B*	--	--	--	6.06	5.0	191.7	7.04	268.5	--
AS-MW-5	(Week 94) Week 24 Post-shut down	12/30/2013	<5.00	112 J	<0.281 B*	--	--	--	5.03	4.5	112.6	7.05	197.9	--
AS-MW-6	Week 46	1/24/2013	<6.20	<156	0.676 J	3.37	0.530 J	0.337	13.84	4.0	85.1	7.74	318.0	485.15
AS-MW-7	Week 46	1/24/2013	--	--	--	--	--	--	12.73	3.8	249.9	7.79	230.0	484.95
AS-MW-7	Week 61	5/8/2013	--	--	--	--	--	--	12.68	--	--	--	--	--
AS-MW-7	Week 62	5/15/2013	--	--	--	--	--	--	13.76	--	--	--	--	--
AS-MW-7	Week 63	5/23/2013	--	--	--	--	--	--	13.67	--	--	--	--	--
AS-MW-7	Week 70 Pre-shut down	7/10/2013	<6.20	<156	0.870 J	2.61	<0.620	0.0191	15.75	2.2	129.1	7.55	297.7	488.01
AS-MW-7	Week 70 Pre-shut down	7/10/2013	--	--	--	--	--	--	12.64	--	--	--	--	--

Table 4-17
Analytical Data and Field Data Summary – Air Sparge Pilot System

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Monitoring Well	Time Period	Date	Lab Data						Field Data					
			Sulfolane (µg/L)	Fe (µg/L)	Mn (µg/L)	TOC (mg/L)	TKN (mg/L)	Total Phosphorus (mg/L)	DO (mg/L)	Temp. (°C)	ORP (mV)	pH	Conductivity (µS/cm)	Water Elevation (ft)
AS-MW-7	Week 70	7/11/2013	--	--	--	--	--	--	12.68	--	--	--	--	--
AS-MW-7	Week 70	7/12/2013	--	--	--	--	--	--	11.93	--	--	--	--	--
AS-MW-7	Week 70	7/13/2013	--	--	--	--	--	--	11.90	--	--	--	--	--
AS-MW-7	(Week 71) Week 1 Post-shut down	7/17/2013	<6.20	<156	0.492 J	2.61	<0.620	<0.00620	12.28	3.27	183.1	7.20	291	488.28
AS-MW-7	(Week 72) Week 2 Post-shut down	7/24/2013	<6.50	<156	1.11	2.70	<0.620	0.0298	11.89	4.09	7.1	7.71	289	488.6
AS-MW-7	(Week 74) Week 4 Post-shut down	8/7/2013	<6.20	<156	1.12	2.67	<0.620	<0.00620	7.94	4.63	99.8	7.71	289	488.64
AS-MW-7	(Week 76) Week 6 Post-shut down	08/21/2013 - 08/22/2013	<6.20	<156	2.53	2.72	<0.620	<0.0100 B*	4.70	4.3	120.7	7.01	228.5	488.75
AS-MW-7	(Week 78) Week 8 Post-shut down	9/4/2013	<6.36	<156	3.72	2.82	<0.620	0.0122	3.60	5.79	51.2	7.51	300.0	488.15
AS-MW-7	(Week 80) Week 10 Post-shut down	9/18/2013	<6.32	<156	5.71	2.78	<0.620	<0.0121 B*	2.99	6.2	267.6	6.90	343.5	488.09
AS-MW-7	(Week 82) Week 12 Post-shut down	10/2/2013	<6.20	<156	13.7	3.25	<0.620	<0.0100 B*	2.56	6.4	226.4	6.92	327.3	487.41
AS-MW-7	(Week 84) Week 14 Post-shut down	10/17/2013	<6.60	<156	27.5	3.23	<0.620	<0.00620	1.55	6.11	16.2	7.11	339	487.14
AS-MW-7	(Week 86) Week 16 Post-shut down	10/30/2013	<6.20	<156	44.6	3.29	0.356 J	<0.00620	1.84	5.88	31.3	7.04	384	486.8
AS-MW-7	(Week 88) Week 18 Post-shut down	11/15/2013	<5.20	<125	68.5	3.08	<0.500	<0.0125 B*	0.83	5.3	140.8	6.96	338.6	--
AS-MW-7	(Week 90) Week 20 Post-shut down	11/26/2013	11.1	<125	137	2.99	<0.500 J*	<0.0131 B*	0.70	3.6	150.6	6.90	308.6	--
AS-MW-7	(Week 92) Week 22 Post-shut down	12/11/2013	17.9	<250 B*	199	--	--	--	0.52	4.6	207.2	6.80	314.5	--
AS-MW-7	(Week 94) Week 24 Post-shut down	12/30/2013	22.1	<125	392	--	--	--	0.5	0	84.8	6.93	263.8	--
AS-MW-8	Week 46	1/24/2013	26.4	<156	395	2.36	0.333 J	<0.00620	0.57	3.7	274.1	7.07	273.2	a
AS-MW-8	Week 46 - Duplicate	1/24/2013	28.4	<156	369	2.34	<0.620	<0.00620	0.57	3.7	274.1	7.07	273.2	a
AS-MW-8	Week 61	5/8/2013	--	--	--	--	--	--	0.90	--	--	--	--	--
AS-MW-8	Week 62	5/15/2013	--	--	--	--	--	--	0.31	--	--	--	--	--
AS-MW-8	Week 63	5/23/2013	--	--	--	--	--	--	0.46	--	--	--	--	--
AS-MW-8	Week 70 Pre-shut down	7/10/2013	37.1	279	2890	2.31	<0.620	<0.00620	0.57	1.8	26.3	6.92	243.5	488.59
AS-MW-8	Week 70 Pre-shut down - Duplicate	7/10/2013	37.0	250	2830	2.29	<0.620	<0.00620	0.57	1.8	26.3	6.92	243.5	488.59
AS-MW-8	(Week 71) Week 1 Post-shut down	7/17/2013	41.9	389	3910	2.38	<0.620	<0.00620	0.21	0.21	81.0	7.30	218.6	488.21
AS-MW-8	(Week 71) Week 1 Post-shut down - Duplicate	7/17/2013	39.8	392	3970	2.37	<0.620	<0.00620	0.21	0.21	81.0	7.30	218.6	488.21
AS-MW-8	(Week 72) Week 2 Post-shut down	7/24/2013	39.7	283	4300	2.32	<0.620	<0.0620	0.14	3.0	108.1	7.35	215.0	489.14
AS-MW-8	(Week 72) Week 2 Post-shut down - Duplicate	7/24/2013	39.6	317	4540	2.90	<0.620	<0.0124	0.14	3.0	108.1	7.35	215.0	489.14
AS-MW-8	(Week 74) Week 4 Post-shut down	8/7/2013	45.5	427	4720	2.29	<0.620	<0.00620	0.07	2.74	33.5	6.88	237	489.11
AS-MW-8	(Week 74) Week 4 Post-shut down - Duplicate	8/7/2013	44.9	453	4740	2.26	<0.620	<0.00620	--	--	--	--	--	--
AS-MW-8	(Week 76) Week 6 Post-shut down	08/21/2013 - 08/22/2013	44.8	432	4790	2.47	<0.620	<0.0148 B*	0.16	2.2	-22.4	6.86	230.9	489.26
AS-MW-8	(Week 76) Week 6 Post-shut down - Duplicate	08/21/2013 - 08/22/2013	44.0	413	4860	2.42	<0.620	<0.0100 B*	--	--	--	--	--	--
AS-MW-8	(Week 78) Week 8 Post-shut down	9/4/2013	38.0	97.8 J	4250	2.66	<0.620	<0.00620	0.19	4.30	16.3	6.81	274.6	488.48
AS-MW-8	(Week 78) Week 8 Post-shut down - Duplicate	9/4/2013	34.7	110 J	4540	2.78	<0.620	<0.00620	--	--	--	--	--	--
AS-MW-8	(Week 80) Week 10 Post-shut down	9/18/2013	33.3	405	2780	3.73	<0.620	<0.0100 B*	0.01	3.9	110.5	6.40	421.6	488.57
AS-MW-8	(Week 80) Week 10 Post-shut down - Duplicate	9/18/2013	31.9	493	2830	3.61	<0.620	<0.0218 B*	--	--	--	--	--	--
AS-MW-8	(Week 82) Week 12 Post-shut down	10/2/2013	43.3	262	3720	2.60	<0.620	<0.00620	0.12	4.1	96.0	6.85	280.3	487.97
AS-MW-8	(Week 82) Week 12 Post-shut down - Duplicate	10/2/2013	40.3	340	3780	2.46	0.500 J	<0.00620	--	--	--	--	--	--
AS-MW-8	(Week 84) Week 14 Post-shut down	10/17/2013	39.9	372	5100	2.40	<0.620	0.0205	0.15	4.28	-4.6	7.07	269	487.58
AS-MW-8	(Week 84) Week 14 Post-shut down - Duplicate	10/17/2013	41.2	232 J	4830	2.32	<0.620	<0.00620	--	--	--	--	--	--
AS-MW-8	(Week 86) Week 16 Post-shut down	10/30/2013	40.7	411 JH*	3960	2.48	<0.620	0.0157	0.67	4.22	21.6	7.07	295	487.31
AS-MW-8	(Week 86) Week 16 Post-shut down - Duplicate	10/30/2013	44.7	546 JH*	3850	2.42	<0.620	<0.00620	--	--	--	--	--	487.31
AS-MW-8	(Week 88) Week 18 Post-shut down	11/15/2013	38.4	475	4760	2.10	<0.500	<0.0100 B*	0.15	4.1	82.6	6.93	236.0	--

**Table 4-17
Analytical Data and Field Data Summary – Air Sparge Pilot System**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Monitoring Well	Time Period	Date	Lab Data						Field Data					
			Sulfolane (µg/L)	Fe (µg/L)	Mn (µg/L)	TOC (mg/L)	TKN (mg/L)	Total Phosphorus (mg/L)	DO (mg/L)	Temp. (°C)	ORP (mV)	pH	Conductivity (µS/cm)	Water Elevation (ft)
AS-MW-8	(Week 88) Week 18 Post-shut down - Duplicate	11/15/2013	40.7	492	4730	2.34	<0.500	<0.00500	--	--	--	--	--	--
AS-MW-8	(Week 90) Week 20 Post-shut down	11/26/2013	39.8	555	4940	2.33	<0.500 J*	<0.0100 B*	0.15	2.7	-3.20	6.83	223.2	--
AS-MW-8	(Week 90) Week 20 Post-shut down - Duplicate	11/26/2013	39.6	591	5040	2.31	<0.500 J*	<0.00500	--	--	--	--	--	--
AS-MW-8	(Week 92) Week 22 Post-shut down	12/11/2013	34.5	663	5050				0.09	3.9	-27.6	6.95	245.7	--
AS-MW-8	(Week 92) Week 22 Post-shut down - Duplicate	12/11/2013	36.1	681	5230	--	--	--	--	--	--	--	--	--
AS-MW-8	(Week 94) Week 24 Post-shut down	12/30/2013	32.6	465	5190	--	--	--	0.11	3.5	58.2	6.86	232.6	--
AS-MW-8	(Week 94) Week 24 Post-shut down - Duplicate	12/30/2013	33.5	519	5370	--	--	--	--	--	--	--	--	--

General Notes:

^a Depth to water measurement could not be taken due to an ice ring at approximately 6 feet below TOC.

Acronyms and Abbreviations:

Fe = Iron
Mn = Manganese
TOC = Total Organic Carbon
TKN = Total Kjeldahl Nitrogen
DO = dissolved Oxygen
ORP = Oxidation-Reduction Potential
µS/cm = microSiemens per centimeter
mV = millivolts
°C = degrees Celsius
mg/L = milligrams per liter
µg/L = micrograms per liter

ft. = feet
SWI = Shannon and Wilson, Inc.
Temp = temperature
LOD = Limit of Detection
J = Estimated concentration below the limit of quantitation.
J* = Estimated concentration or LOD due to QC failures or sample-handling anomalies; flag applied by SWI.
B* = Estimated concentration due to method blank detection.
-- = Not analyzed or sampled.
< = analyte not detected; detection limit listed

**Table 4-18
Soil Analytical Results**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Location Name	Sample Name	Sample Date	Dup	Work Order	Depth	Sulfolane	Benzene	Total Xylenes*
					ft bgs	µg/kg	µg/kg	µg/kg
MW-142-65	MW-142-65 (6.1-6.4)	12/03/13		1138790	6.1-6.4	11.0J	—	—
MW-358-60 [#]	MW-358-60(5-6.5)	10/31/13		1138673	5.0-6.5	<7.74	—	—
MW-365-15	MW-365-15 (7.5-7.9)	12/05/13		1138790	7.5-7.9	<5.95	—	—
MW-366-15	MW-366-15 (5.5-6.5)	12/05/13		1138790	5.5-6.5	<5.25	5570JL*	245000J*
MW-366-15	MW-466-15 (5.5-6.5)	12/05/13	Dup	1138790	5.5-6.5	<5.20	—	—
MW-368-15 ⁺	MW-368-15(7.5-7.8)	11/19/13		1135694	7.5-7.8	<6.15	—	—
MW-470-15	MW-470-15(7.0-7.6)	12/20/13	DUP	1138815	7.0-7.6	94.8	—	—
MW-370-15	MW-370-15(7.0-7.7)	12/20/13		1138815	7.0-7.7	93.2	—	—
O-27-65	O-27-65(10.0-10.7)	11/26/13		1138761	10.0-10.7	19.8	1230	195000

Acronyms and Abbreviations:

— = not analyzed/not calculated

* = Total xylenes are calculated by SWI as the sum of o-, p- and m-xylenes

[#] = Sample was collected and analyzed prior to the November 20, 2013 cutoff date, but was not reported in the Onsite Addendum.

⁺ = Soil sample MW-368-15(7.5-7.8) was misreported as MW-358-15(7.5-7.8) in the 2013 Onsite Addendum (ARCADIS 2103x). The correct location label and corresponding data are presented in this table.

DUP = quality-control field-duplicate sample

ft bgs = feet below ground surface

J = Estimated concentration; detected above the detection limit (DL) but below the limit of quantiation (LOQ)

J* = Result is considered estimated (no direction of bias), due to QC failures or sample-handling anomalies

JL* = Result is considered estimated, biased low

µg/kg = micrograms per kilogram

**Table 5-1
Remediation System Operation - Groundwater Recovery**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Date	Monthly Total (gallons)	Monthly Average (gallons / day)	Monthly Average (gallons / minute)	Highest Daily Flow (gallons)	Lowest Daily Flow (gallons)
2009					
January 2009	5,637,292	181,848	126	223,719	160,077
February 2009	4,965,414	177,336	123	193,239	156,219
March 2009	5,673,504	183,016	127	197,544	161,158
April 2009	5,845,823	194,861	135	211,585	165,629
May 2009	6,430,915	207,449	144	213,643	195,151
June 2009	6,229,883	207,663	144	232,475	191,543
July 2009	6,316,965	203,773	142	243,049	176,412
August 2009	6,243,319	201,397	140	358,591	24,712
September 2009	10,634,423	354,481	246	376,819	291,904
October 2009	5,114,811	164,994	115	374,175	0
November 2009	0	0	0	0	0
December 2009	6,153,173	198,489	138	285,246	0
2010					
January 2010	8,676,601	279,890	194	310,005	238,342
February 2010	9,185,582	328,057	228	349,341	280,463
March 2010	9,424,363	304,012	211	338,199	241,764
April 2010	9,914,262	330,475	229	375,313	283,315
May 2010	9,812,735	316,540	220	352,672	277,754
June 2010	9,282,464	309,415	215	380,474	223,718
July 2010	9,325,475	300,822	209	351,204	93,133
August 2010	9,872,250	318,460	221	356,560	212,790
September 2010	9,122,386	304,080	211	348,426	276,194
October 2010	7,700,526	248,404	173	322,996	731
November 2010	7,489,601	249,653	173	322,261	203,597
December 2010	7,279,463	234,821	163	290,275	206,455
2011					
January 2011	8,605,402	277,594	193	321,282	234,410
February 2011	7,409,928	264,640	184	291,111	196,712
March 2011	7,144,062	230,454	160	275,500	68,270
April 2011	8,034,008	267,800	186	286,026	227,154
May 2011	8,076,367	260,528	181	346,116	0
June 2011	9,735,245	324,508	225	405,251	223,585
July 2011	11,838,286	381,880	265	419,943	323,687
August 2011	12,119,042	390,937	271	553,937	0
September 2011	15,458,620	515,287	358	616,457	449,816
October 2011	15,492,362	499,754	347	575,331	406,852
November 2011	16,279,722	542,657	377	609,830	497,588
December 2011	16,711,381	539,077	374	566,868	515,920
2012					
January 2012	15,645,486	504,381	350	537,854	468,103
February 2012	15,936,577	515,987	358	551,895	486,254
March 2012	16,390,112	530,180	368	553,633	498,110
April 2012	16,010,934	514,711	357	538,278	477,932
May 2012	14,639,653	472,247	328	500,690	418,914
June 2012	14,109,044	451,769	314	527,289	409,056
July 2012	16,721,808	540,994	376	567,123	494,073
August 2012	16,256,379	523,831	364	560,732	476,469

**Table 5-1
Remediation System Operation - Groundwater Recovery**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

September 2012	15,402,121	515,527	358	558,100	438,897
October 2012	16,377,507	527,101	366	558,528	502,787
November 2012	15,069,768	503,018	349	537,145	348,636
December 2012	15,740,566	507,135	352	539,894	470,343
2013					
January 2013	15,663,097	505,261	357	780,314	0
February 2013	14,380,130	513,576	323	557,487	370,088
March 2013	14,398,601	464,471	352	529,499	230,633
April 2013	15,168,307	505,610	351	547,289	437,494
May 2013	15,887,224	512,491	356	693,285	0
June 2013	18,656,997	621,900	432	795,120	0
July 2013	20,702,663	667,828	464	721,949	602,609
August 2013	20,456,333	659,882	458	753,354	566,358
September 2013	19,538,981	651,299	452	721,055	578,760
October 2013	19,438,949	627,063	435	717,919	530,769
November 2013	13,057,783	435,259	302	628,992	87,223
December 2013	13,466,226	434,394	302	635,924	76,838

**Table 5-2
Remediation System Operation - Treatment System Performance**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

October 18th, 2013																							
Method / Analyte	Units	R-21	R-21 Duplicate	R-35R	R-42	R-43	R-44	R-45	R-46	Combined Influent	Air Stripper Effluent (A Tower)	Air Stripper Effluent (A Tower) Duplicate	B Tower	C Tower	D Tower	Sand Filter Influent	GAC Vessel A-Inlet	GAC Vessel A-Outlet	GAC Vessel B-Outlet	GAC Vessel C-Outlet	GAC Vessel D-Outlet	Final Effluent	Percent Removal (%)
EPA 624- Benzene, Toluene, Ethylbenzene, Xylenes total																							
Benzene	µg/L	68.4	62.5	16.3	1.75	50.1	46.5	165	69.9	53.9	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	<0.240	>99.6
Toluene	µg/L	5.19	5.29	3.00	<0.620	10.4	1.39	62.0	64.3	15.4	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	>96.0
Ethylbenzene	µg/L	13.2	12.7	8.28	<0.620	6.49	7.88	29.0	16.5	9.01	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	>93.1
P & M -Xylene	µg/L	71.9	72.1	22.2	<1.24	16.4	17.7	79.3	118	33.3	<1.24	<1.24	<1.24	<1.24	<1.24	<1.24	<1.24	<1.24	<1.24	<1.24	<1.24	<1.24	>96.3
o-Xylene	µg/L	12.5	13.6	2.93	<0.620	5.18	2.66	29.2	45.4	9.69	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	<0.620	>93.6
Total Xylenes	µg/L	84.3	85.7	25.1	<2.00	21.5	20.3	108	163	42.9	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	>95.3
EPA 200.8 - Metals																							
Dissolved Iron	mg/L	3.35	3.72	2.15	2.60	4.01	2.30	2.16	2.46	1.54	0.248J	0.241J	0.252	0.237J	0.204J	0.245J	0.165J	0.103J	0.115J	0.123J	0.102J	<0.156	>89.9
Total Iron	mg/L	3.30	3.58	2.09	2.47	3.87	2.33	2.22	2.44	1.72	<0.641B*	<0.912B*	<0.788B*	<0.629B*	<0.754B*	8.70	<0.720B*	<0.250B*	<0.706B*	<0.250B*	<0.156	0.0800J	ND
Dissolved Manganese	mg/L	-	-	-	-	-	-	-	-	2.52	2.50	2.56	2.54	2.50	2.48	2.92	2.39	0.483	0.361	0.117	0.000972J	-	-
SM21 2540D - TSS																							
Total Suspended Solids	mg/L	2.75J*	1.95J*	0.612	0.300J	1.75J*	1.67	3.12	4.73	3.35	1.19J*	0.594J*	2.00	1.24	1.30	55.5	6.40	<0.304	<0.310	<0.322	<0.326	<0.320	>90.4
EPA 625M-SIMS - Polyaromatic Hydrocarbons																							
Naphthalene	µg/L	-	-	-	-	-	-	-	-	1.89	<0.0696	0.0417J	0.472	0.228	<0.0632	-	-	-	-	-	-	<0.0632	>96.7
Acenaphthylene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Acenaphthene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	0.0206J	<0.0306	-	-	-	-	-	-	<0.0306	ND
Fluorene	µg/L	-	-	-	-	-	-	-	-	0.0543J	<0.0338	0.0168J	0.0359J	0.0376J	0.0217J	-	-	-	-	-	-	<0.0306	ND
Phenanthrene	µg/L	-	-	-	-	-	-	-	-	0.0217J	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Anthracene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Fluoranthene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Pyrene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Benzo(a)anthracene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Chrysene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Benzo(b)fluoranthene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Benzo(k)fluoranthene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Benzo(a)pyrene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Indeno(1,2,3-cd)pyrene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Dibenzo(a,h)anthracene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
Benzo(g,h,i)perylene	µg/L	-	-	-	-	-	-	-	-	<0.0334	<0.0338	<0.0306	<0.0306	<0.0326	<0.0306	-	-	-	-	-	-	<0.0306	ND
EPA 1625B w/Iso Dil - W - Sulfolane																							
Sulfolane	µg/L	260	269	106	20.3	66.6	37.7	42.6	<6.36	68.9	61.6	64.6	68.7	67.5	70.2	29.0	37.3	<6.66	<6.40	<6.20	<6.46	<6.66	>90.3

Acronyms and Abbreviations:

BOLD = Result or limit of quantification (LOQ) exceeds alternative cleanup level (sulfolane), or wastewater disposal permit limit (benzene and total aromatic hydrocarbons).

GAC = Vessels A & B were in series, followed by C & D in parallel.

< = analyte not detected; limit of detection listed

- = analysis is not requested/performed

B* = result is non-detect due to a QC issue; flag added by SWI

J = result is estimated; analyte was detected below the limit of quantitation (LOQ)

J* = result is estimated due to a QC issue; flag added by SWI

mg/L = milligrams per liter

µg/l = micrograms per liter

Table 5-2
Remediation System Operation - Treatment System Performance

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

November 14th, 2013																							
Method / Analyte	Units	R-21	R-21 Duplicate	R-35R	R-42	R-43	R-44	R-45	R-46	Combined Influent	Air Stripper Effluent (A Tower)	Air Stripper Effluent (A Tower) Duplicate	B Tower	C Tower	D Tower	Sand Filter Influent	GAC Vessel A-Inlet	GAC Vessel A-Outlet	GAC Vessel B-Outlet	GAC Vessel C-Outlet	GAC Vessel D-Outlet	Final Effluent	Percent Removal (%)
EPA 624- Benzene, Toluene, Ethylbenzene, Xylenes total																							
Benzene	µg/L	75.9	76.6	18.8	1.29	47.9	36.7	549	61.1	83.6	2.43	2.12	<0.200	<0.200	0.420	1.28	1.22	0.860	0.800	0.800	0.690	0.640	99.2
Toluene	µg/L	39.9	39.7	0.960J	<0.500	9.48	1.40	3020	58.4	252	62.7J*	40.2J*	1.39	2.19	2.19	16.9	15.8	12.3	12.3	12.1	8.90	7.88	96.9
Ethylbenzene	µg/L	29.6	29.9	10.7	<0.500	5.23	5.70	794	12.8	80.4	63.3	47.7	1.25	1.43	1.37	15.4	16.1	33.1	39.3	33.0	25.7	21.1	73.8
P & M -Xylene	µg/L	138	140	26.0	<2.00B*	15.3	7.31	3140	97.8	336	310J*	55.3J*	5.99	6.47	6.25	65.3	69.4	151	178	146	128	104	69.0
o-Xylene	µg/L	36.4	36.4	3.74	<0.500	5.61	0.930J	1360	38.2	134	148J*	31.0J*	2.82	3.11	3.09	32.1	34.1	63.5	72.7	59.9	51.4	43.2	67.8
Total Xylenes	µg/L	174	176	29.8	<1.00	20.9	8.24	4500	136	470	458J*	86.3J*	8.81	9.58	9.34	97.4	103	215	251	205	179	147	68.7
EPA 200.8 - Metals																							
Dissolved Iron	mg/L	3.49	3.61	2.41	2.62	4.39	2.20	2.40	2.41	2.82	0.433	0.340	0.484	0.518	0.790	<0.395B*	<0.275B*	<0.250B*	<0.250B*	<0.125	<0.125	<0.125	>95.6
Total Iron	mg/L	3.71	3.46	2.27	2.41	4.78	2.14	2.57	2.64	4.53	2.14	2.23	2.98	3.84	6.72	3.37	3.72	<0.125	<0.125	<0.125	<0.125	<0.125	>97.2
Dissolved Manganese	mg/L	--	--	--	--	--	--	--	--	2.28	2.37	2.43	2.44	2.43	2.37	2.35	2.15	1.06	0.653	<0.000500	0.780	--	--
SM21 2540D - TSS																							
Total Suspended Solids	mg/L	7.13J*	11.4J*	5.05	5.29	9.00J*	4.85	7.25J*	8.10	10.2	7.06J*	4.85J*	7.65	9.11	11.4	7.82	2.69	0.202J	<0.255	<0.261	<0.258	<0.248	>97.6
EPA 625M-SIMS - Polyaromatic Hydrocarbons																							
Naphthalene	µg/L	--	--	--	--	--	--	--	--	23.3	10.0	9.45	1.11	1.88	1.56	--	--	--	--	--	--	25.7	--
Acenaphthylene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Acenaphthene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	0.331	<0.0257	<0.0266	0.282	--	--	--	--	--	--	0.482	ND
Fluorene	µg/L	--	--	--	--	--	--	--	--	1.14	1.50J*	1.10J*	1.23	1.35	0.967	--	--	--	--	--	--	1.66	--
Phenanthrene	µg/L	--	--	--	--	--	--	--	--	1.40	1.43J*	1.03J*	1.18	1.19	0.785	--	--	--	--	--	--	0.951	32.1
Anthracene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Fluoranthene	µg/L	--	--	--	--	--	--	--	--	0.133	0.100	0.0768	0.0952	0.0921	0.0823	--	--	--	--	--	--	<0.0269	ND
Pyrene	µg/L	--	--	--	--	--	--	--	--	0.0808	0.0837	0.0650	0.0809	0.0573	0.0546	--	--	--	--	--	--	<0.0269	ND
Benzo(a)anthracene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Chrysene	µg/L	--	--	--	--	--	--	--	--	0.0488J	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Benzo(b)fluoranthene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Benzo(k)fluoranthene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Benzo(a)pyrene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Indeno(1,2,3-cd)pyrene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Dibenzo(a,h)anthracene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
Benzo(g,h,i)perylene	µg/L	--	--	--	--	--	--	--	--	<0.0257	<0.0255	<0.0271	<0.0257	<0.0266	<0.0261	--	--	--	--	--	--	<0.0269	ND
EPA 1625B w/Iso Dil - W - Sulfolane																							
Sulfolane	µg/L	245	251	94.9	21.6	71.5	37.7	40.4	<5.20	69.7	47.3	46.2	59.3	50.0	60.0	46.1	24.2	<6.60	<6.20	<6.20	<6.60	<6.60	>90.5

Acronyms and Abbreviations:

BOLD = Result or LOQ exceeds alternative cleanup level (sulfolane), or wastewater disposal permit limit (benzene and total aromatic hydrocarbons).

GAC = Vessels A & B were in series, followed by C & D in parallel.

< = analyte not detected; limit of detection listed

-- = analysis not requested/performed

-- = combined influent is less than the Final Effluent

B* = result is non-detect due to a QC issue; flag added by SWI

J = Result is estimated; analyte was detected below the limit of quantitation (LOQ)

J* = Result is estimated due to a QC issue; flag added by SWI

mg/L = milligrams per liter

µg/L = micrograms per liter

analysis not requested/performed.

Table 5-2
Remediation System Operation - Treatment System Performance

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

December 19th, 2013																							
Method / Analyte	Units	R-21	R-121 Duplicate	R-35R	R-42	R-43	R-44	R-45	R-46	Combined Influent	Air Stripper Effluent (A Tower)	Air Stripper Effluent (A Tower) Duplicate	B Tower	C Tower	D Tower	Sand Filter Influent	GAC Vessel A- Inlet	GAC Vessel A- Outlet	GAC Vessel B- Outlet	GAC Vessel C- Outlet	GAC Vessel D-Outlet	Final Effluent	Percent Removal (%)
EPA 624- Benzene, Toluene, Ethylbenzene, Xylenes total																							
Benzene	µg/L	70.2	70.9	30.6	<0.200	62.5	36.5	223	46.3	45.3	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	>99.6
Toluene	µg/L	16.6	15.2	5.09	<0.500	9.48	2.88	242	53.8	26.9	<0.500	<0.500	<0.500	<0.500	0.530J	0.330J	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	>98.1
Ethylbenzene	µg/L	31.5	37.6	16.9	<0.500	5.59	8.35	62.0	20.2	13.2	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	>96.2
P & M -Xylene	µg/L	206	202	47.0	<1.00	20.1	21.5	144	80.4	46.8	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	>97.9
o-Xylene	µg/L	34.5	31.0	7.45	<0.500	8.15	4.93	53.5	26.8	12.9	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	>96.1
Total Xylenes	µg/L	241	233	54.4	<1.50	28.3	26.4	197	107	59.7	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	>97.5
EPA 200.8 - Metals																							
Dissolved Iron	mg/L	4.06	4.11	2.26	2.34	4.27	2.04	2.69	2.30	2.98	0.136J	0.115J	0.284	0.287	0.313	0.326	0.144J	<0.125	<0.125	<0.125	<0.125	<0.125	>95.8
Total Iron	mg/L	4.10	4.07	2.31	2.42	4.62	2.13	2.64	2.52	2.77	0.509	0.499	0.588	1.09	0.879	0.755	0.270	<0.125	<0.125	<0.125	<0.125	<0.125	>95.5
Dissolved Manganese	mg/L	—	—	—	—	—	—	—	—	2.35	2.39	2.41	2.43	2.37	2.37	2.38	2.32	2.28	2.30	2.01	0.211	—	—
SM21 2540D - TSS																							
Total Suspended Solids	mg/L	7.70	7.75J*	1.50	2.33	10.0	4.80	7.10	5.53	5.54	0.900	1.20	2.30	6.67	1.49	1.09	0.213J	<0.253	<0.253	<0.258	<0.245	<0.255	>95.4
EPA 625M-SIMS - Polyaromatic Hydrocarbons																							
Naphthalene	µg/L	—	—	—	—	—	—	—	—	2.40	<0.0530	<0.0525	<0.0500	<0.0500	<0.0515	—	—	—	—	—	—	<0.0530	ND
Acenaphthylene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Acenaphthene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Fluorene	µg/L	—	—	—	—	—	—	—	—	0.0739	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Phenanthrene	µg/L	—	—	—	—	—	—	—	—	<0.0524B*	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Anthracene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Fluoranthene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Pyrene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Benzo(a)anthracene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Chrysene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Benzo(b)fluoranthene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Benzo(k)fluoranthene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Benzo(a)pyrene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Indeno(1,2,3-cd)pyrene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Dibenzo(a,h)anthracene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
Benzo(g,h,i)perylene	µg/L	—	—	—	—	—	—	—	—	<0.0262	<0.0266	<0.0263	<0.0250	<0.0250	<0.0256	—	—	—	—	—	—	<0.0266	ND
EPA 1625B w/Iso Dil - W - Sulfolane																							
Sulfolane	µg/L	328	311	91.9	25.3	124	55.1	70.8	<5.00	72.5	44.8	47.0	67.6	61.4	66.2	48.3	38.1	8.59J	<5.65	<5.25	<5.00	<5.60	>92.3

Acronyms and Abbreviations:

BOLD = Result or LOQ exceeds alternative cleanup level (sulfolane), or wastewater disposal permit limit (benzene and total aromatic hydrocarbons).

— = not analyzed

J* = result is considered estimated (no direction of bias), due to QC failures or sample-handling anomalies

mg/L = milligrams per liter

UB* = result is considered not detected at the limit of quantitation (LOQ) or reported concentration (higher value), due to contamination identified in a method blank, trip blank, or equipment blank. Displayed as < ... B*.

µg/L = micrograms per liter

**Table 5-3
2013 LNAPL Recovery**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

2013	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
MW-138	0	0	0	10	0	0	0	0	0	0	0	0	10
MW-176-A	2	0	2	0	0	0	0	0	0	2	0	0	6
MW-186-A	0	0	0	0	0	0	0	0	0	0	0	0	0
MW-334-15	0	0	9	0	0	0	0	0	0	48	5	4	66
O-wells	0.1	0.0	2	3	3	2	1	0	0	8.3	0	0	18.7
S-wells	0	0	2	2	0	0	4	0	0.1	1	0	5	14.0
R-14A	0	0	1	0	0	0	0	0	0	0.0	0.0	0.0	0.8
R-18	1	0	0	4	0	0	0	0	0	4	0	0	8.5
R-20-R	0	0	6	11	0	10	0.5	0	20	19	0	20	86.5
R-21	10	0	16	54	24	4	2	2	8	5	85	16	224.8
R-22	0	0	0	0	0	0	0	0	0	0	0	0	0
R-32	3	0	23	81	15	0	5	4	7	40	20	0	198
R-33	0	0	0	0	0	0	0	0	0	0	0	0	0
R-34	0	0	0	11	0	0	0	0	0	3.5	2	0	16.9
R-35-R	0	0	0	0	0	0	0	0	0	0	0	0	0
R-39	0	0	0	0	0	0	0	0	0	0	0	0	0
R-40	8	0	17	13	0	0	0	0	0	0	0	0	37
R-44	***	***	***	***	***	0	3	1	0	0	0	0	3.6
R-45	***	***	***	***	***	0	0	0	0	62	33	0	95
Coalescer	0	0	0	0	0	0	0	0	0	15	3.3	0	18.3
Total	25	0	77	188	42	15	16	7	35	207	148	45	804.2

General Notes:

All units in gallons.

This summary includes only product that has been recovered for recycling. Product that has been recovered but has not yet been removed from the storage tank for recycling is not included in the table.

Table 5-4
Annual LNAPL Recovery

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Well ID	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Well Total (gallons)
O-2																							Installed September 2010	176	0.1	0			176
O-10																								Installed September 2011	12	10			22
O-11																								Installed September 2011	0.6	0.1			1
O-13																								Installed September 2011	2	0			2
O-19																								Installed October 2011	0.3	0			0.3
O-27																								Installed November 2011	0.2	0.3			0.5
O-31																								Installed September 2013		1			1
O-33																								Installed September 2013		1			1
O-34																								Installed September 2013		6			6
Coalescer																							Installed December 2009	264	355	38	18	675	
Annual Total	62,815	101,038	95,611	7,684	12,342	14,059	14,298	17,008	17,562	6,342	4,573	4,111	5,972	1,505	703	537	393	583	1,854	2,150	1,767	7,201	3,345	635	3,634	3,603	2,625	804	394,754

**Table 5-5
Groundwater Recovery System – BTEX Mass Recovery**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska.**

Date	Groundwater Recovery (gpm)	Recovered Benzene Concentration (ug/L)*	Benzene Mass Recovery (lb/day)	Recovered Toluene Concentration (ug/L)*	Toluene Mass Recovery (lb/day)	Recovered Ethylbenzene Concentration (ug/L)*	Ethylbenzene Mass Recovery (lb/day)	Recovered Total Xylene Concentration (ug/L)*	Total Xylene Mass Recovery (lb/day)	Total BTEX Mass Recovered During Month of Sampling (lbs)
1/15/2013	495.0	34.7	0.21	4.51	0.03	13.2	0.08	58.2	0.35	20.39
2/18/2013	361.7	32.5	0.14	4.28	0.02	13.4	0.06	59.5	0.26	13.34
3/12/2013	307.8	26.3	0.10	4.27	0.02	9.16	0.03	37.1	0.14	8.81
4/10/2013	360.4	23.4	0.10	17.5	0.08	9.3	0.04	41.5	0.18	11.91
5/13/2013	458.0	42.5	0.23	52.2	0.29	14.5	0.08	81.5	0.45	32.53
6/11/2013	446.2	71.3	0.38	62.5	0.33	20.2	0.11	102	0.55	41.16
7/27/2013	459.6	60.6	0.33	37.7	0.21	17.7	0.10	74	0.41	32.52
8/14/2013	399.1	78	0.37	43.8	0.21	23	0.11	98.7	0.47	36.19
9/17/2013	454.6	64.6	0.35	30.5	0.17	19.6	0.11	81	0.44	32.06
10/18/2013	465.8	53.9	0.30	15.4	0.09	9.01	0.05	42.9	0.24	20.35
11/14/2013	413.3	83.6	0.42	252	1.25	80.4	0.40	470	2.33	131.97
12/19/2013	423.4	45.3	0.23	26.9	0.14	13.2	0.07	59.7	0.30	22.14
		4Q 2013 Average	0.32	4Q 2013 Average	0.49	4Q 2013 Average	0.17	4Q 2013 Average	0.96	

Total BTEX 4Q2013 Average (lb/day)	1.94
Total BTEX Removal 2013 (lb)	403.37

General Notes:

* = as measured at the combined air stripper influent

lb = pounds

lb/day = pounds per day

Table 5-6a
Groundwater Recovery System - Sulfolane Mass Recovery R-46

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Date	Groundwater Recovery (gpm)	Recovered Sulfolane Concentration (ug/L)	Sulfolane Mass Recovery (lb/day)
5/13/2013	42*	<6.20	0.00
6/11/2013	42	<6.20	0.00
7/24/2013	39	<6.20	0.00
8/14/2013	36	<6.32	0.00
9/17/2013	33	<6.32	0.00
10/18/2013	38	<6.36	0.00
11/14/2013	35	<5.20	0.00
12/19/2013	29	<5.00	0.00
		4Q 2013 Average	0.00

General Notes:

* Flow estimated due to meter malfunction.

Acronyms and Abbreviations:

gpm = gallons per minute

lb/day = lbs per day

µg/L = micrograms per liter

**Table 5-6b
Groundwater Recovery System - Sulfolane Mass Recovery R-45**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Date	Groundwater Recovery (gpm)	Recovered Sulfolane Concentration (ug/L)	Sulfolane Mass Recovery (lb/day)
5/13/2013	67	37.9	0.03
6/11/2013	62	45.8	0.03
7/24/2013	65	44.6	0.03
8/14/2013	64	45.3	0.03
9/17/2013	62	42.9	0.03
10/18/2013	68	42.6	0.03
11/14/2013	50	40.4	0.02
12/19/2013	40*	70.8	0.03
		4Q 2013 Average	0.03

General Notes:

* Flow estimated due to meter malfunction.

Acronyms and Abbreviations:

gpm = gallons per minute

lb/day = lbs per day

µg/L = micrograms per liter

Table 5-6c
Groundwater Recovery System - Sulfolane Mass Recovery R-44

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Date	Groundwater Recovery (gpm)	Recovered Sulfolane Concentration (ug/L)	Sulfolane Mass Recovery (lb/day)
5/13/2013	85	63.1	0.06
6/11/2013	56*	58.6	0.04
7/24/2013	39*	47.9	0.02
8/14/2013	78*	45.7	0.04
9/17/2013	75	40.9	0.04
10/18/2013	78	37.7	0.04
11/14/2013	77	37.7	0.03
12/19/2013	75*	55.1	0.05
4Q 2013 Average			0.04

General Notes:

* Flow estimated due to meter malfunction.

Acronyms and Abbreviations:

gpm = gallons per minute
 lb/day = lbs per day
 µg/L = micrograms per liter

**Table 5-6d
Groundwater Recovery System - Sulfolane Mass Recovery R-43**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Date	Groundwater Recovery (gpm)	Recovered Sulfolane Concentration (ug/L)	Sulfolane Mass Recovery (lb/day)
5/13/2013	84	118	0.12
6/11/2013	75	109	0.10
7/24/2013	79	81.3	0.08
8/14/2013	64	69.1	0.05
9/17/2013	82	65.9	0.06
10/18/2013	81	66.6	0.06
11/14/2013	51	71.5	0.04
12/19/2013	48	124	0.07
		4Q 2013 Average	0.06

General Notes:

* Flow estimated due to meter malfunction.

Acronyms and Abbreviations:

gpm = gallons per minute
 lb/day = lbs per day
 µg/L = micrograms per liter

Table 5-6e
Groundwater Recovery System - Sulfolane Mass Recovery R-42

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Date	Groundwater Recovery (gpm)	Recovered Sulfolane Concentration (ug/L)	Sulfolane Mass Recovery (lb/day)
1/15/2013	113*	47	0.06
2/18/2013	115	39.7	0.05
3/12/2013	114	43.5	0.06
4/10/2013	116*	38.2	0.05
5/13/2013	84	29.4	0.03
6/11/2013	101*	27.6	0.03
7/24/2013	77	21.9	0.03
8/14/2013	64	20	0.03
9/17/2013	85	19.2	0.03
10/18/2013	87	20.3	0.03
11/14/2013	106	21.6	0.03
12/19/2013	96	25.3	0.03
		4Q 2013 Average	0.03

General Notes:

* Flow estimated due to meter malfunction.

Acronyms and Abbreviations:

gpm = gallons per minute

lb/day = lbs per day

µg/L = micrograms per liter

Table 5-6f
Groundwater Recovery System - Sulfolane Mass Recovery R-35R

Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Date	Groundwater Recovery (gpm)	Recovered Sulfolane Concentration (ug/L)	Sulfolane Mass Recovery (lb/day)
1/15/2013	85	124	0.13
2/18/2013	86	124	0.13
3/12/2013	80	124	0.12
4/10/2013	85	111	0.11
5/13/2013	72	100	0.09
6/11/2013	43	107	0.06
7/24/2013	36	114	0.05
8/14/2013	46	126	0.07
9/17/2013	49	119	0.07
10/18/2013	56	106	0.07
11/14/2013	56	94.9	0.06
12/19/2013	51*	91.9	0.06
4Q 2013 Average			0.07

General Notes:

* Flow estimated due to meter malfunction.

Acronyms and Abbreviations:

gpm = gallons per minute

lb/day = lbs per day

µg/L = micrograms per liter

**Table 5-6g
Groundwater Recovery System - Sulfolane Mass Recovery R-21**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Date	Groundwater Recovery (gpm)	Recovered Sulfolane Concentration (ug/L)	Sulfolane Mass Recovery (lb/day)
1/15/2013	52	293	0.18
2/18/2013	55	267	0.18
3/12/2013	43	369	0.19
4/10/2013	56	236	0.16
5/13/2013	46	231	0.13
6/11/2013	50	273	0.16
7/24/2013	47	309	0.17
8/14/2013	44	307	0.16
9/17/2013	50	288	0.17
10/18/2013	50	260	0.16
11/14/2013	56	245	0.16
12/19/2013	52	328	0.20
		4Q 2013 Average	0.18

General Notes:

* Flow estimated due to meter malfunction.

Acronyms and Abbreviations:

gpm = gallons per minute

lb/day = lbs per day

µg/L = micrograms per liter

**Table 5-7
Groundwater Recovery System - Sulfolane Mass Recovery**

**Fourth Quarter 2013 Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska**

Date	Groundwater Recovery (gpm)	Recovered Sulfolane Concentration (ug/L)*	Sulfolane Mass Recovery (lb/day)
2012			
1/6/2012	365.8	97.2	0.43
1/18/2012	354.0	104	0.44
2/1/2012	368.7	99	0.44
2/16/2012	373.4	101	0.45
3/5/2012	368.0	93.3	0.41
3/20/2012	373.6	92	0.41
4/5/2012	373.8	96.6	0.43
4/18/2012	343.6	80.5	0.33
5/4/2012	332.7	95.9	0.38
5/16/2012	337.4	102	0.41
6/5/2012	321.2	102	0.39
6/19/2012	284.1	117	0.40
7/17/2012	372.4	102	0.46
8/9/2012	371.5	103	0.46
9/13/2012	368.0	103	0.46
10/16/2012	362.6	90.2	0.39
11/13/2012	330.6	100	0.40
12/12/2012	361.7	94.7	0.41
2013			
1/15/2013	495.0	94.9	0.56
2/18/2013	361.7	85.4	0.37
3/12/2013	307.8	50.1	0.19
4/10/2013	360.4	71.5	0.31
5/13/2013	458.0	78.3	0.43
6/11/2013	446.2	82.9	0.44
7/27/2013	459.6	74.6	0.41
8/14/2013	399.1	89.7	0.43
9/17/2013	454.6	75.2	0.41
10/18/2013	465.8	68.9	0.39
11/14/2013	413.3	69.7	0.35
12/19/2013	423.4	72.5	0.37
4Q 2013 Average			0.37
2013 Average			0.39
2013 Total (pounds)			141.7

Acronyms and Abbreviations:

* = as measured at the combined air stripper influent

Table 6-1
Data Quality Flags

Fourth Quarter Groundwater Monitoring Report
Flint Hills Resources Alaska, LLC
North Pole Refinery, North Pole, Alaska

Work Order	Sample Name	CAS	Analyte	Method	Display	Result	Result Flag	LOD	Final Value	QC Flag	Bias	QC Note
1138557	O-31	126-33-0	Sulfolane	Sulfolane-EPA1625B w/Iso Dil-W	R		R*	0.00632		R	None	Result not able to be quantified due to hydrocarbon interference. Limited volume and lab error prevented re-extraction.
1138592	O-36	126-33-0	Sulfolane	Sulfolane-EPA1625B w/Iso Dil-W	<0.00620J*	0.0062	UJ*	0.0062	0.0062	UJ	Low	Holding-time exceedance
1138592	O-37	126-33-0	Sulfolane	Sulfolane-EPA1625B w/Iso Dil-W	0.00771JL*	0.00771	JL*	0.0062	0.00771	JL	Low	Holding-time exceedance
1138595	O-34	126-33-0	Sulfolane	Sulfolane-EPA1625B w/Iso Dil-W	1.70JL*	1.7	JL*	0.124	1.7	JL	Low	Holding-time exceedance
1138670	MW-109-15	P & M -Xylene	P & M -Xylene	SW8260B	<0.00200B*	0.002	UB*	0.00124	0.002	UB	None	Trip blank detection
1138670	MW-124-25	P & M -Xylene	P & M -Xylene	SW8260B	<0.00200B*	0.002	UB*	0.00124	0.002	UB	None	Trip blank detection
1138695	MW-132-20	100-41-4	Ethylbenzene	SW8260B	0.00102J*	0.00102	J*	0.00062	0.00102	J	None	Field-duplicate RPD failure
1138695	MW-132-20	95-47-6	o-Xylene	SW8260B	0.00268J*	0.00268	J*	0.00062	0.00268	J	None	Field-duplicate RPD failure
1138695	MW-132-20	P & M -Xylene	P & M -Xylene	SW8260B	0.0137J*	0.0137	J*	0.00124	0.0137	J	None	Field-duplicate RPD failure
1138695	MW-132-20	1330-20-7	Xylenes (total)	SW8260B	0.0164J*	0.0164	J*	0.00188	0.0164	J	None	Field-duplicate RPD failure
1138695	MW-232-20	1330-20-7	Xylenes (total)	SW8260B	0.00774J*	0.00774	J*	0.00188	0.00774	J	None	Field-duplicate RPD failure
1138695	MW-232-20	100-41-4	Ethylbenzene	SW8260B	0.000640J*	0.00064	J*	0.00062	0.00064	J	None	Field-duplicate RPD failure
1138695	MW-232-20	P & M -Xylene	P & M -Xylene	SW8260B	0.00638J*	0.00638	J*	0.00124	0.00638	J	None	Field-duplicate RPD failure
1138695	MW-232-20	95-47-6	o-Xylene	SW8260B	0.00136J*	0.00136	J*	0.00062	0.00136	J	None	Field-duplicate RPD failure
1138716	MW-176A-15	126-33-0	Sulfolane	Sulfolane-EPA1625B w/Iso Dil-W	1.51JL*	1.51	JL*	0.05	1.51	JL	Low	Holding-time exceedance
1138716	MW-180A-15	100-41-4	Ethylbenzene	SW8260B	0.0344J*	0.0344	J*	0.0005	0.0344	J	None	Field-duplicate RPD failure
1138716	MW-180A-15	95-47-6	o-Xylene	SW8260B	0.00790J*	0.0079	J*	0.0005	0.0079	J	None	Field-duplicate RPD failure
1138716	MW-180A-15	1330-20-7	Xylenes (total)	SW8260B	0.0576J*	0.0576	J*	0.0015	0.0576	J	None	Field-duplicate RPD failure
1138716	MW-180A-15	P & M -Xylene	P & M -Xylene	SW8260B	0.0497J*	0.0497	J*	0.001	0.0497	J	None	Field-duplicate RPD failure
1138716	MW-280A-15	100-41-4	Ethylbenzene	SW8260B	0.0188J*	0.0188	J*	0.0005	0.0188	J	None	Field-duplicate RPD failure
1138716	MW-280A-15	95-47-6	o-Xylene	SW8260B	0.00471J*	0.00471	J*	0.0005	0.00471	J	None	Field-duplicate RPD failure
1138716	MW-280A-15	P & M -Xylene	P & M -Xylene	SW8260B	0.0275J*	0.0275	J*	0.001	0.0275	J	None	Field-duplicate RPD failure
1138716	MW-280A-15	1330-20-7	Xylenes (total)	SW8260B	0.0322J*	0.0322	J*	0.0015	0.0322	J	None	Field-duplicate RPD failure
1138716	O-1	126-33-0	Sulfolane	Sulfolane-EPA1625B w/Iso Dil-W	5.08JL*	5.08	JL*	0.5	5.08	JL	Low	Holding-time exceedance
1138731	MW-134-20	1330-20-7	Xylenes (total)	SW8260B	<0.00300B*	0.003	UB*	0.0015	0.003	UB	None	Equipment blank detection
1138731	MW-134-20	P & M -Xylene	P & M -Xylene	SW8260B	<0.00200B*	0.002	UB*	0.001	0.002	UB	None	Equipment blank detection
1138731	MW-137-20	95-47-6	o-Xylene	SW8260B	<0.00100B*	0.001	UB*	0.0005	0.001	UB	None	Equipment blank detection
1138731	O-2	108-88-3	Toluene	SW8260B	0.00564J*	0.00564	J*	0.0005	0.00564	J	None	Field-duplicate RPD failure
1138731	O-2	71-43-2	Benzene	SW8260B	0.275J*	0.275	J*	0.01	0.275	J	None	Field-duplicate RPD failure
1138731	O-200	71-43-2	Benzene	SW8260B	0.160J*	0.16	J*	0.004	0.16	J	None	Field-duplicate RPD failure
1138731	O-200	108-88-3	Toluene	SW8260B	0.00330J*	0.0033	J*	0.0005	0.0033	J	None	Field-duplicate RPD failure
10239311	PW-0609	126-33-0	Sulfolane	EPA 8270	0.0827JL*	0.0827	JL*	0.0031	0.0827	JL	Low	Holding-time exceedance
10239311	PW-0609.C1	126-33-0	Sulfolane	EPA 8270	<0.00310J*	0.0031	UJ*	0.0031	0.0031	UJ	Low	Holding-time exceedance
10243140	PW-0946	126-33-0	Sulfolane	EPA 8270	<0.00310J*	0.0031	UJ*	0.0031	0.0031	UJ	Low	MS recovery failure
10243142	PW-0504.C1	126-33-0	Sulfolane	EPA 8270	<0.00310J*	0.0031	UJ*	0.0031	0.0031	UJ	None	Sulfolane-d8 recovery failure
10249901	PW-0296	126-33-0	Sulfolane	EPA 8270	0.0106J*	0.0106	J*	0.0031	0.0106	J	None	Sulfolane-d8 recovery failure

Acronyms and Abbreviations:

< = analyte not detected; limit of detection listed
LOD = Limit of Detection
MS = Matrix Spike
ND = not detected
QC = Quality Control
RPD = Relative Percent Difference