cotter

Via Email and U.S. Mail

March 2, 2012

Mr. Edgar Ethington
RAP On-Site Coordinator
Colorado Department of Public Health and Environment
HMWMD-HWC-B-2
4300 Cherry Creek Drive South
Denver, CO 80246-1530

Re: RAP Section 15 and the January 12, 2012 Settlement Agreement and Amended Remedial Action Plan with attached Appendix A RAP Project Schedule – Final Construction Report for Lincoln Park Groundwater Monitoring Wells

Dear Mr. Ethington:

The purpose of this letter is to transmit the Final Construction Report for the Lincoln Park Monitor Wells. Completion of this activity on January 6, 2012, satisfies Line 6 of the Appendix A RAP Project Schedule.

Please feel free to contact me at your convenience if you have any questions regarding this notification.

Sincerely,

John Hamrick
Vice President, Mill Operations

cc: Steve Tarlton (CDPHE)
Fran Costanzi (US EPA)

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LINCOLN PARK NEW MONITORING WELLS
FINAL COMPLETION REPORT

Prepared On Behalf of

Cotter Corporation (N.S.L.) Milling Facility

Canon City, CO

Prepared for

Colorado Department of Public Health and Environment

Prepared By

Wright Environmental Services, Inc.

201 Linden Street, Suite 301

Fort Collins, CO 80524

March 2, 2012

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1.0 INTRODUCTION

1.1 Overview

Uranium (U) and molybdenum (Mo) are present in groundwater at levels that exceed Colorado Groundwater Quality Standards (CGWQS) beneath the Lincoln Park area of Canon City, Colorado, located north of the Cotter Corporation (Cotter) Mill Facility. Eleven new groundwater monitoring wells have been completed in the Lincoln Park area as part of the Remedial Action Plan (RAP) Section 15.2.3 to supplement the existing groundwater monitoring network and to further characterize and delineate the extent of groundwater impacts.

Although there are numerous wells throughout Lincoln Park that are included in the current Cotter Groundwater Monitoring Program (GMP), several of those wells are privately owned, have unknown well completions and may not be suitable for monitoring purposes. Access to many of wells may be limited due to seasonal factors (winterizing) and existing plumbing and pump assemblies. The private wells are not under the control of Cotter Corporation and some of the wells are used for irrigation purposes. It is unclear if those wells are completed within the alluvial or bedrock aquifer. Based on these factors, Cotter installed eleven new monitor wells to collect environmental data at locations where the use of private wells currently included in the Cotter GMP, may not provide data that meets the required quality objectives.

The installation of these wells was completed on January 6, 2012 before the January 19, 2012 date stipulated in Line 5 of the RAP Project Schedule. This Final Completion Report (FCR) describes the well drilling, installation and development process and provides the completion information for these 11 new monitoring wells installed in Lincoln Park during November and December of 2011 and January 2012.

1.2 Objectives

The objectives of the new monitor well locations are to:

- Provide clear delineation of the extent of U and Mo in groundwater that exceeds the CGWQS of 0.03 mg/L and 0.035 mg/L, respectively,
- Provide data to determine if natural attenuation is adequate to reduce levels that will meet the CGWQS, or
- If necessary, provide data to evaluate the effectiveness of potential remedial measures.

1.3 Site Description/Previous Investigations

Geologic, hydrologic and geochemical site conditions within the Lincoln Park Area were described in detail in the December 2009 *Site Conceptual Model and*

Proposed Corrective Measures (HydroSolutions, 2009). Information collected from the new well installations has been used to modify some aspects of that conceptual model.

1.3.1 Geology

Lincoln Park is separated from the Cotter Milling Facility by a bedrock ridge that is an outcrop of the Upper Cretaceous Raton Formation. The Raton Formation is a sequence of sedimentary strata consisting of yellowish-gray to yellowish-brown medium- to coarse-grained massive cross-stratified cliff-forming "rim rock" non-marine sandstone. In the upper part, about 150 feet (45 m) below the base of the Poison Canyon, are sparse thin carbonaceous layers which have Paleocene pollen (Robert H. Tschudy, written communication, 1968) and sandstone beds that are thinner and softer than the underlying cliff-forming sandstone. The Raton Formation ranges from 240 to 500 feet (73-152 m) in thickness.

A surface drainage (Sand Creek) passes through the Cotter Mill Facility, cuts through the bedrock ridge and extends into Lincoln Park. The Soil Conservation Service (SCS) constructed a dam for flood control in 1971 across the Sand Creek drainage incised into the bedrock ridge. The land north of the ridge (Lincoln Park) is characterized by surface alluvial deposits underlain by bedrock. The alluvial deposits generally thicken to the north toward the Arkansas River.

Most of Lincoln Park rests on top of the north limb of a syncline of Upper Cretaceous bedrock, with geologic dip to the south-southeast. Because of this structural orientation, progressively older bedrock units are present under the Lincoln Park alluvium northward toward the Arkansas River from the Cotter Mill Facility. The sequence of Upper Cretaceous bedrock units that directly underlie the alluvium from the SCS Dam to the Arkansas River includes (youngest to oldest) the Raton Formation, Vermejo Formation, Trinidad Sandstone and the Pierre Shale. Data regarding the depth to bedrock within the Lincoln Park Area are limited, particularly further north of the SCS Dam.

Most wells completed within Lincoln Park are private wells for which detailed lithologic information is not available. Near the SCS dam, however there are numerous monitoring wells and the depth to bedrock is known to range from a few feet to over 50 feet. Bedrock immediately north of the SCS dam is predominately the Vermejo Formation. Further north and northeast, the depth to bedrock can be at greater than 125 feet but then becomes very shallow again close the Arkansas River where the Pierre Shale crops out along the banks in some portions of the Arkansas River.

1.3.2 Hydrogeology

The shallowest occurrence of groundwater beneath most of Lincoln Park is

within the Arkansas River alluvium. The depth to water across the area of interest is variable, generally ranging between 5 and 50 feet below ground surface. The saturated thickness of the alluvium is also highly variable, typically between 5 to 30 feet but can be in excess of 80 feet. At Well 020, which is near the Deweese Dye Ditch, the depth to water varies from 10 to 30 feet and the saturated thickness of the alluvium is from 5 to 25 feet (Cotter, 2011). The large variability of depth to water is attributed to seasonal recharge from the DeWeese Dye Ditch and associated irrigation storage ponds.

Prior to installation of the new monitor wells, the alluvial aquifer potentiometric surface orientation in Lincoln Park was uncertain because of the limited number of water level measurements from wells with known screen intervals. The potentiometric surface of the alluvial aquifer was estimated based on water level data collected during development of the new wells, as shown on Figure 1. Based on the available water level and groundwater quality data, the direction of groundwater flow across the Lincoln Park generally follows Sand Creek, flowing north to northeast near the SCS Dam and turning more easterly closer to the Arkansas River (HydroSolutions, 2009).

The transmissivity of the alluvium determined from an aquifer test conducted in 1993 (Galloway, 1994) ranges from 400 to 1400 ft^2/day. Hydraulic conductivity averaged approximately 75 ft/day. Hydraulic conductivity values determined from aquifer tests in the bedrock are orders of magnitude lower. Stephens & Associates (1993) reported that the arithmetic mean value of hydraulic conductivity in 78 tests conducted near the SCS Dam was 0.11 ft/day in the bedrock.

1.4 Rationale for Well Locations

As previously discussed, U and Mo are present beneath Lincoln Park in the shallow alluvial aquifer system at levels that exceed the respective CGWQS. Because many of the existing wells are not ideally suitable for monitoring purposes, Cotter installed 11 wells to further characterize and delineate the groundwater potentiometric surface and the concentrations of U and Mo in Lincoln Park groundwater. These new data will help provide reliable, high quality, defensible data to support the design of potential groundwater corrective actions.

Figure 1 shows the location of existing monitoring wells in the GMP and the new monitor wells installed during November and December of 2011 and January of 2012. The rationale for the new Lincoln Park monitor well locations is described in the Lincoln Park Monitor Well Installation Plan, included as Appendix A to this FCR.

2.0 Results

2.1 Drilling/Coring

Drilling services were provided by Site Services Inc. of Golden, Colorado during November and December, 2011 and January 2012. Twelve borings were drilled to depths between 12.5 feet and 125 feet at the locations shown on Figure 1. Most borings were advanced to bedrock with a CME 75 drill rig though borings LP-06 and LP-07 were not advanced to bedrock. Boring LP-06 was advanced to a depth of 125 feet and no bedrock was encountered. Due to cobbles, boring LP-07 was not able to be advanced beyond a depth of 35 feet and was relocated to LP-07A (Figure 1). Continuous core samples were typically collected with a core barrel inside the 8-inch diameter hollow stem augers. Split spoon samples were also collected at selected depths to confirm the presence of bedrock. However, where very coarse cobble layers were encountered, continuous coring was discontinued and borings were advanced with 10-inch diameter hollow stem augers without continuous core samples.

Geologic logging of the borings during drilling using the Unified Soils Classification System (ASTM D2487) was performed by Engineering Analytics (EA) of Fort Collins, Colorado. Once core sampling and drilling was completed with the 8-inch hollow stem augers, the boring was reamed with 10-inch hollow stem augers. All cuttings were collected in steel drums and disposed of in the Cotter Mill Facility Primary Tailings Impoundment. Boring logs and core photos are shown in Appendix B.

2.2 Well Installation

Eleven wells were installed to depths between 9 feet and 100 feet and constructed in accordance with Colorado State Well Construction Rule (2 CCR 402-2) and RAP Section 3.2.1.2 for Class B wells. Well casing consists of 4-inch diameter threaded Schedule 40 PVC pipe with 0.020-inch machine slotted screens. EA and Site Services backfilled the boreholes around the screened intervals and well casing using 10/20 silica sand, bentonite pellets or chips, and Portland bentonite cement grout with 3% bentonite according to the Lincoln Park Monitoring Well Installation Work Plan (HydroSolutions, 2011). A concrete pad with four corner bollards was placed to protect each wellhead. All the wells have locking metal risers to cover and protect the well casing above the ground surface, except well LP-03, which was mounted flush with the ground surface and protected with a ground vault. Well installation details are shown in Table 1 and on the Well Completion diagrams in Appendix A. Appendix C provides the well permit and well construction completion forms GWS-51, GWS-46 and GWS-31 required by the State Engineers Office.

All the wells except LP-06 and LP-07 were installed to bedrock. After discussions with Site Services about equipment limitations and Errol Lawrence (HydroSolutions) regarding groundwater data needs, it was determined that the well LP-06 could be placed to a depth of 100 feet with a 20 feet screen, without having

reached bedrock at 125 feet. As requested by Errol Lawrence, two wells were installed at LP-06, one to a depth of 100 feet (LP-06) with a 20-foot screen and one to a depth of 50 feet (LP-06A) with a 20-foot screen, to monitor the upper portion and lower portion of the groundwater separately. These well depths and well screen intervals were deemed to be sufficient to characterize the range of aquifer and water quality conditions at this location, despite the deeper well not contacting bedrock. EA and Site Services did not convert the boring at LP-07 into a well due to auger refusal in a zone of large cobbles at approximately 35 feet below ground surface. A replacement boring (LP-07A) was drilled at the southern portion of the property and completed as a monitoring well. The only deviation from the Lincoln Park Monitoring Well Installation Plan (Cotter, 2011) was encountered during the construction of Well LP-05. Because Well LP-05 is shallow (top of screen interval at 4' below ground surface), the sand filter pack was installed to only 1 foot above the screen interval and the bentonite seal was extended to the ground surface (3 feet) under the concrete pad but was less than 5 feet thick.

2.3 Well Development

Wells were developed by EA and Site Services following well installation. Well development was completed by a combination of bailing, pumping and surging, until the water flowed clear. Well development details are summarized in Table 2.

Bailing was performed with either a large bailer (3 feet x 3.5 inch diameter) or a small bailer (2 feet x 2 inch diameter) prior to using a submersible pump in wells where accumulated fines had the potential of clogging the pump. Pumping was performed with a Geotech SS Geosub pump. Approximate pumping rates and amounts bailed are recorded in Table 2. The wells were pumped until the water was visibly clear. After the first pumping the wells were swabbed and surged to agitate sediment that had collected on the inside of the casing and sand pack that could then be pumped out of the well. The well was pumped again after surging until the water ran clear. All well development water was collected in steel drums and disposed of in the Cotter Mill Facility Primary Tailings Impoundment. Well LP-09 contained only 2 feet of water at the time of development and was bailed dry.

2.4 Borehole Abandonment

Boring LP-07 was not converted to a monitor well and was plugged and abandoned using appropriate methods as required by the Colorado State Engineer.

2.5 Decontamination

All down-hole drilling equipment was decontaminated between the drilling of each borehole and all development equipment was decontaminated between development of each monitoring well. Drilling and well development equipment were transported to the Cotter Mill Facility for decontamination and all decontamination effluent was managed on site.

3.0 References

Cotter, 2011. Lincoln Park Monitoring Well Installation Plan. Technical Memorandum from Errol Lawrence, HydroSolutions, to J. Hamrick, Cotter Corp. August 23.

Galloway, 1994. Lincoln Park Aquifer Test. Report with Transmittal Letter. June 8.

Hershey-Wooderson Associates, Inc. 1977. Geohydrology of the Cotter Mill Environment, Prepared by Loyd Hershey. July.

HydroSolutions, 2009. Site Conceptual Model and Proposed Corrective measures for the Canon City Milling Facility, Colorado, HydroSolutions, Inc., Golden CO. December 14.

Stephens & Associates, 1993. From Cotter, 2011. Lincoln Park Monitoring Well Installation Plan. Technical Memorandum from Errol Lawrence, HydroSolutions, to J Hamrick, Cotter Corp. August 23.

Unified Soils Classification System (ASTM D2487)

TABLES

Table 1: Lincoln Park Well Completion Data

Well ID	Northing[1]	Easting[1]	Ground Elevation[2] (ft)[3]	Total Boring Depth (ft)[3]	Bottom of Well (ft)[3]	Well Material[4]	Inside Diameter (in.)	Top of Casing Elevation (ft.)[2]	Screen Length (ft.)	Top of Screen (ft.)[3]	Top of Sand Pack (ft.)[3]	Bottom of Sand Pack (ft.)[3]	Sand Pack Thickness	Thickness of Sand Above Screen (ft.)	Top of Bentonite Seal (ft.)[3]	Bentonite Seal Thickness (ft.)	Screen Bottom (ft.)[2]	Bottom of Boring (ft.)[2]
LP-01	1215515.46	3080549.62	5404.42	49	45.5	PVC	4	5406.11	20	5379.42	5382.42	5355.92	26.5	3	5399.92	17.5	5359.42	5355.42
LP-02	1212661.29	3084676.49	5385.7	34.5	34.5	PVC	4	5387.71	20	5371.2	5373.2	5351.2	22	2	5381.2	8	5351.2	5351.2
LP-03	1217159.11	3082459.93	5359.15	60	60	PVC	4	5358.77	45	5344.15	5346.15	5299.15	47	2	5355.15	9	5299.15	5299.15
LP-04	1216603.96	3085237.56	5345.22	51	49	PVC	4	5347.3	30	5326.22	5328.22	5294.22	34	2	5340.72	12.5	5296.22	5294.22
LP-05	1214788.16	3088593.27	5283.04	12.5	9	PVC	4	5284.83	5	5279.04	5280.04	5270.54	9.5	1	5283.04	3	5274.04	5270.54
LP-06	1214269.50	3083156.22	5383.75	125	100	PVC	4	5385.36	20	5303.25	5310.25	5258.75	51.5	6.5	5379.25	69	5283.75	5258.75
LP-06A	1214270.31	3083143.84	5383.59	50	49	PVC	4	5385.38	20	5354.59	5356.59	5333.59	23	2	5377.59	21	5334.59	5333.59
LP-07	-	-	-	35	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LP-07A	1215844.60	3084838.4	5343.34	47	47	PVC	4	5345.04	30	5326.34	5329.34	5296.34	33	3	5338.84	9.5	5296.34	5296.34
LP-08	1215607.72	3082374.23	5385.66	89	89	PVC	4	5387.68	50	5346.66	5348.66	5296.16	52.5	2	5381.16	32.5	5296.66	5296.66
LP-09	1211461.62	3083703.22	5425.97	44	44	PVC	4	5428.04	20	5401.97	5403.97	5381.97	22	2	5421.97	18	5381.97	5381.97
LP-10	1215289.26	3085752.83	5341.38	60	59	PVC	4	5343.83	40	5322.38	5324.38	5281.38	43	2	5336.88	12.5	5282.38	5281.38

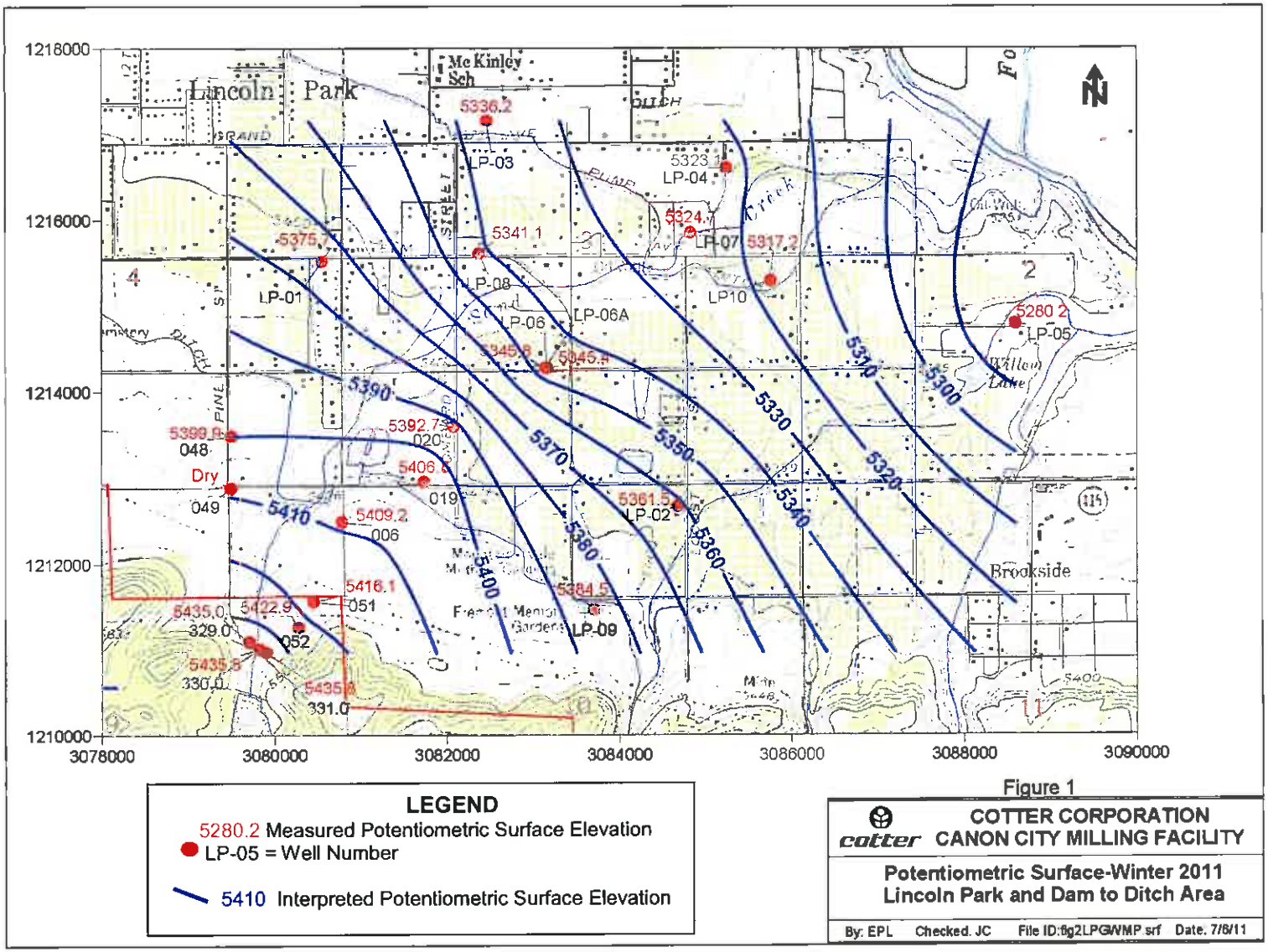
NOTES:
[1] NAD 83 Colorado State Plane, Central
[2] Above Mean Sea Level
[3] Below ground surface
[4] Threaded schedule 40 PVC casing
[5] Flush Mount

Table 2: Lincoln Park Well Development Data

Well ID	Total Boring Depth (ft)[3]	Well Installation Depth	Screen Length (ft.)	Water Level During Drilling (ft)[1]	Water Level Prior to Development	Water level After Development	Water Level 24 Hours After Development	Approximate Amount of Water Bailed (gallons)	Duration of Pumping (minutes)	Approximate Amount of Water Pumped (gallons)
LP-01	49	45.5	20	29	30.4	38.4	30.4	-	39	34
LP-02	34.5	34.5	20	25.5	26.2	26.2	26.2	-	75	66
LP-03	60	60	45	24	22.7	22.6	22.6	-	77	68
LP-04	51	49	30	26	24.4	24.2	24.2	-	71	37.5
LP-05	12.5	9	5	5.75	4.9	4.6	4.6	-	25	22
LP-06	125	100	20	39	38.9	39.9	39.6	-	158	125
LP-06A	50	49	20	35	38.2	40.0	40.0	15	85	75
LP-07A	47	47	30	21.5	20.0	-	20.3	16	90	79
LP-08	89	89	50	45	46.6	47.6	-	-	148	150
LP-09	44	44	20	None	42.0	-	43.5	0.3	Not Pumped	-
LP-10	60	59	40	25	29.0	-	26.6	-	121	90-100

NOTES:
[1] Below ground surface

FIGURES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1214000
1212000
1210000
3078000
3080000
3082000
3084000
3086000
3088000
3090000
Lincoln Park
Mc Kinley Sch
Brookside
LP-01
LP-03
LP-04
LP-05
LP-06
LP-06A
LP-07
LP-08
LP10
LP-02
LP-09
5336.2
5323.1
5324.7
5317.2
5375.7
5341.1
5280.2
5345.8
5345.8
5399.9
048
5392.7
020
Dry
049
5406.6
019
5361.5
5409.2
006
5410
5390
5370
5350
5330
5310
5300
5320
5340
5360
5380
5400
5384.5
5416.1
051
5435.0
329.0
5422.9
052
5435.8
330.0
5435.8
331.0
LEGEND
5280.2 Measured Potentiometric Surface Elevation
LP-05 = Well Number
5410 Interpreted Potentiometric Surface Elevation
Figure 1
COTTER CORPORATION
CANON CITY MILLING FACILITY
Potentiometric Surface-Winter 2011
Lincoln Park and Dam to Ditch Area
By: EPL Checked. JC File ID:fig2LPGWMP.srf Date. 7/6/11

APPENDIX A

Technical Memorandum, Lincoln Park Monitoring Well Installation Plan, HydroSolutions, 8/23/11

APPENDIX B

Engineering Analytics Inc. Technical Memorandum 1/26/12 with New Monitoring Well Completion Diagrams & Photos

APPENDIX C

State Well Permit Forms

- *WS-51 Notice of Intent to Construct Monitoring Hole(s)*
- *GWS-46 Water Well Permit Application*
- *GWS-31 Well Construction and Test Report*