

APPENDIX H – FINANCIAL ASSURANCE

Post-Closure Care Cost Estimate

TECHNICAL MEMORANDUM

DATE October 28, 2022

Project No. 31404097.007

TO Mr. Eric Chavers
Luminant

FROM Patrick J. Behling, PE/Will Vienne, PG

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MARTIN LAKE POWER PLANT PDP-5, ASH PONDS AND A1 AREA LANDFILL POST CLOSURE CARE COST ESTIMATES

Luminant Generation Company, LLC (Luminant) owns and operates the Martin Lake Steam Electric Station (MLSES) located approximately five miles southwest of Tatum in Rusk County, Texas. Coal Combustion Residuals (CCR) including fly ash, bottom ash, and gypsum are generated as part of MLSES unit operation and managed in Permanent Disposal Pond No. 5 (PDP-5), the Bottom Ash Ponds and New Scrubber Pond (referred to collectively as the Ash Ponds) and in the A1 Area Landfill (A1 LF).

These CCR Units are regulated under 40 CFR 257, Subpart D (the "Federal CCR Rule") and 30 Texas Administrative Code (TAC) Chapter 352 (The "TCEQ CCR Rule"). In accordance with 30 TAC §352.201, Luminant is required to submit an application to TCEQ to obtain a registration for each of these CCR Units. WSP Golder (Golder) has been retained by Luminant to assist with preparation of Post Closure Care Cost Estimates (PCCEs) for PDP-5, the Ash Ponds and the A1 LF in accordance with §352.1101. This technical memorandum presents the PCCEs estimated by Golder for these units. The PCCEs were prepared using TCEQ Technical Guidance Documents TG-30 and TG-31 and related documents.

1.0 CCR Unit Closure Assumptions

The PCCEs were prepared based on the following closure assumptions for the MLSES CCR Units:

- PDP-5:
 - CCR Unit Closure:
 - Closure in Place with low permeability cap
 - Cap Area: 40 acres
 - Groundwater Closure:
 - No evidence of a release to groundwater to date
 - Continuation of Detection Monitoring for Groundwater
 - Nine (9) monitoring wells sampled semi-annually
 - Existing Leachate Collection System operated throughout post closure care period
- Ash Ponds:
 - West Ash Pond (WAP), East Ash Pond (EAP) and New Scrubber Pond (NSP) managed as one CCR Unit
 - CCR Unit Closure:
 - Closure in Place with low permeability cap
 - Cap Areas:
 - WAP and EAP Cap Area: 25 acres

- NSP Cap Area: 36 acres
 - Total: 61 acres
- Groundwater Closure:
 - Monitored Natural Attenuation (MNA) with MNA Groundwater Monitoring
 - Continuation of Detection and Assessment Monitoring for Groundwater
 - Seven (7) monitoring wells sampled semi-annually
- A-1 Area Landfill:
 - CCR Unit Closure:
 - Closure in Place with low permeability cap
 - Cap Areas:
 - Existing Cap Area: 464 acres
 - Future Cap Area: 321 acres
 - Total: 785 acres
 - Groundwater Closure:
 - Monitored Natural Attenuation (MNA) with MNA Groundwater Monitoring
 - Continuation of Detection and Assessment Monitoring for Groundwater
 - Twelve (12) monitoring wells sampled semi-annually

2.0 Post Closure Care Cost Assumptions

The following general assumptions were incorporated into the PCCEs:

- Post Closure Care Period. A post-closure care period of 30 years is assumed in accordance with 30 TAC §352.1241 and 40 CFR § 257.104(c).
- CCR Unit Inspections. Weekly and annual inspections of the CCR Units are required under §352.831 and §352.841. It is assumed that these inspections will continue throughout the Post Closure Care Period.
- Final Cover Maintenance. It is likely that some level of maintenance/repair will be required for the final cover systems used to close the CCR Units. The PCCEs include the following assumptions for final cover maintenance/repair:
 - Years 1-5 After Closure - it is assumed that erosion damage on 5% of the cap soil will be repaired each year. The thickness of each repair is assumed to average 6 inches of soil. In addition, the repaired areas will be revegetated.
 - Years 6-30 After Closure - it is assumed that erosion damage on 5% of the cap soil will be repaired three times during this period. The thickness of each repair is assumed to average 6 inches of soil. In addition, the repaired areas will be revegetated.
 - Estimated engineering/mobilization costs associated with the repairs/revegetation are included in the PCCEs.
 - Annual mowing costs for the final cover are included in the PCCEs.
- General Site Maintenance. Maintenance of run-off/drainage structures, access roads, fencing, signs, etc. are included in the PCCEs.
- Groundwater Monitoring. Semi-annual groundwater monitoring in accordance with the Federal/TCEQ CCR Rules (detection monitoring or assessment monitoring) is on-going for the units. It is assumed that the current groundwater monitoring program will continue throughout the Post Closure Care Period. It is

also likely that maintenance of the monitoring well system at the units will be required during the post closure care period. The PCCEs assume that one monitoring well will be replaced every 10 years at each CCR Unit.

In addition, the Ash Ponds and A1 LF incorporate MNA as a groundwater remedy as part of closure. For those CCR Units, it is assumed that MNA analyses will be included in the semi-annual groundwater monitoring events.

- One Time Post Closure Care Costs. The following on time activities associated with post closure care are included in the PCCEs:
 - Deed Notices/Surveys
 - Monitoring Well Plugging and Abandonment
- Leachate Collection – PDP-5. Martin Lake PDP-5 is constructed with a leachate collection system to remove leachate from the unit after closure. For the PDP-5 PCCE, it is assumed that all free liquids in PDP-5 will be removed during closure and the existing leachate collection system will be operated throughout the post closure care period to remove water that infiltrates through the low permeability cap. For the PCCE, the average annual volume of leachate generated following closure was estimated to be approximately 1,000 gallons per year using the Hydrologic Evaluation of Landfill Performance (HELP) Model (see Attachment A). Costs to dispose of this estimated volume of leachate as Class II Industrial Waste and maintain the leachate collection system through the post closure care period are included in the PCCE for PDP-5.
- Contingency. A 10% contingency factor is included in the PCCEs.
- All costs are in 2021 dollars.

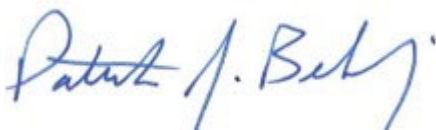
3.0 Post Closure Care Cost Estimate

Based on the assumptions listed above, the 30-Year post closure care cost estimates for the MLSES CCR Units are as follows (see Tables 1, 2 and 3 for details):

- PDP-5: \$2,026,787
- Ash Ponds: \$2,228,065
- A1 LF: \$8,273,063

It should be noted that the PCCEs presented herein are considered Opinions of Probable Cost and represent Golder's best judgement based on the assumptions stated, information available at the time the estimates were prepared, and Golder's experience with similar sites. The PCCEs are susceptible to variations in future cost of materials, labor, and equipment and should not be considered guaranteed maximum prices for post closure care activities.

Please do not hesitate to contact us if you have any questions or comments.



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TABLES

Table 1

**Martin Lake Steam Electric Station - PDP-5
Post Closure Care Cost Estimate - 30 TAC 352.1101**

Item	Unit	Rate	Quantity	Cost/Event	No. of Events	30-Year Cost
<u>CCR Unit Inspections (Annually)</u>	LS	\$15,000	1	\$15,000	30	\$450,000
<u>Final Cover Maintenance</u>						
- Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5	CY	\$5	1,613	\$8,067	5	\$40,333
- Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30	CY	\$5	1,613	\$8,067	3	\$24,200
- Revegetation, 5% of cap area per year, Years 1-5	AC	\$1,500	2.0	\$3,000	5	\$15,000
- Revegetation, 5% of cap area, 3 times, Years 6-30	AC	\$1,500	2.0	\$3,000	3	\$9,000
- Engineering/Mobilization for Final Cover Repairs/Revegetation Events	LS	\$5,000	1	\$5,000	8	\$40,000
- Mowing, per year	AC	\$150	40	\$6,000	30	\$180,000
<u>General Site Maintenance (Annually)</u>						
- Run-off/Drainage Structures	LS	\$2,000	1	\$2,000	30	\$60,000
- Access Roads, fencing, signs, etc.	LS	\$1,000	1	\$1,000	30	\$30,000
<u>Leachate Management (Annually)</u>						
- Leachate Disposal (Class II)	Gal	\$10	1,000	\$10,000	30	\$300,000
- Leachate System Maintenance	LS	\$2,000	1	\$2,000	30	\$60,000
<u>GW Monitoring (Annually)</u>						
- Detection Monitoring - Semi-annual Collection/Analysis, (9 MWs, 1 Dup)	EA	\$500	10	\$5,000	60	\$300,000
- Annual Report	LS	\$10,000	1	\$10,000	30	\$300,000
- Monitoring Well Maintenance (1 MW replaced every 10 years)	EA	\$5,000	1	\$5,000	3	\$15,000
<u>One Time Post Closure Care Costs</u>						
- Deed Notices/Surveys	LS	\$10,000	1	\$10,000	1	\$10,000
- Monitoring Well Plugging and Abandonment	EA	\$1,000	9	\$9,000	1	\$9,000
Subtotal 30-Year Post Closure Care Costs:						\$1,842,533
Contingency (10%):						\$184,253
30-Year Post Closure Cost Estimate:						\$2,026,787

Notes:

1. All Costs in 2021 Dollars
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

Table 2

**Martin Lake Steam Electric Station - Ash Ponds
Post Closure Care Cost Estimate - 30 TAC 352.1101**

Item	Unit	Rate	Quantity	Cost/Event	No. of Events	30-Year Cost
<u>CCR Unit Inspections (Annually)</u>	LS	\$15,000	1	\$15,000	30	\$450,000
<u>Final Cover Maintenance</u>						
- Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5	CY	\$5	2,460	\$12,302	5	\$61,508
- Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30	CY	\$5	2,460	\$12,302	3	\$36,905
- Revegetation, 5% of cap area per year, Years 1-5	AC	\$1,500	3.1	\$4,575	5	\$22,875
- Revegetation, 5% of cap area, 3 times, Years 6-30	AC	\$1,500	3.1	\$4,575	3	\$13,725
- Engineering/Mobilization for Final Cover Repairs/Revegetation Events	LS	\$5,000	1	\$5,000	8	\$40,000
- Mowing, per year	AC	\$150	61	\$9,150	30	\$274,500
<u>General Site Maintenance (Annually)</u>						
- Run-off/Drainage Structures	LS	\$3,000	1	\$3,000	30	\$90,000
- Access Roads, fencing, signs, etc.	LS	\$1,500	1	\$1,500	30	\$45,000
<u>GW Monitoring (Annually)</u>						
- Detection Monitoring - Semi-annual Collection/Analysis, (7 MWs, 1 Dup)	EA	\$500	8	\$4,000	60	\$240,000
- Assessment Monitoring - Semi-annual Analysis, (7 MWs, 1 Dup)	EA	\$350	8	\$2,800	60	\$168,000
- MNA Monitoring - Semi-annual Analysis, (7 MWs, 1 Dup)	EA	\$200	8	\$1,600	60	\$96,000
- Annual Report (Including MNA)	LS	\$15,000	1	\$15,000	30	\$450,000
- Monitoring Well Maintenance (1 MW replaced every 10 years)	EA	\$5,000	1	\$5,000	3	\$15,000
<u>One Time Post Closure Care Costs</u>						
- Deed Notices/Surveys	LS	\$15,000	1	\$15,000	1	\$15,000
- Monitoring Well Plugging and Abandonment	EA	\$1,000	7	\$7,000	1	\$7,000
Subtotal 30-Year Post Closure Care Costs:						\$2,025,513
Contingency (10%):						\$202,551
30-Year Post Closure Cost Estimate:						\$2,228,065

Notes:

1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

Table 3

**Martin Lake Steam Electric Station - A1 Area Landfill
Post Closure Care Cost Estimate - 30 TAC 352.1101**

Item	Unit	Rate	Quantity	Cost/Event	No. of Events	30-Year Cost
<u>CCR Unit Inspections (Annually)</u>	LS	\$15,000	1	\$15,000	30	\$450,000
<u>Final Cover Maintenance</u>						
- Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5	CY	\$5	31,662	\$158,308	5	\$791,542
- Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30	CY	\$5	31,662	\$158,308	3	\$474,925
- Revegetation, 5% of cap area per year, Years 1-5	AC	\$1,500	39.3	\$58,875	5	\$294,375
- Revegetation, 5% of cap area, 3 times, Years 6-30	AC	\$1,500	39.3	\$58,875	3	\$176,625
- Engineering/Mobilization for Final Cover Repairs/Revegetation Events	LS	\$15,000	1	\$15,000	8	\$120,000
- Mowing, per year	AC	\$150	785	\$117,750	30	\$3,532,500
<u>General Site Maintenance (Annually)</u>						
- Run-off/Drainage Structures	LS	\$8,000	1	\$8,000	30	\$240,000
- Access Roads, fencing, signs, etc.	LS	\$4,000	1	\$4,000	30	\$120,000
<u>GW Monitoring (Annually)</u>						
- Detection Monitoring - Semi-annual Collection/Analysis, (12 MWs, 1 Dup)	EA	\$500	13	\$6,500	60	\$390,000
- Assessment Monitoring - Semi-annual Analysis, (12 MWs, 1 Dup)	EA	\$350	13	\$4,550	60	\$273,000
- MNA Monitoring - Semi-annual Analysis, (12 MWs, 1 Dup)	EA	\$200	13	\$2,600	60	\$156,000
- Annual Report (Including MNA)	LS	\$15,000	1	\$15,000	30	\$450,000
- Monitoring Well Maintenance (1 MW replaced every 10 years)	EA	\$5,000	1	\$5,000	3	\$15,000
<u>One Time Post Closure Care Costs</u>						
- Deed Notices/Surveys	LS	\$25,000	1	\$25,000	1	\$25,000
- Monitoring Well Plugging and Abandonment	EA	\$1,000	12	\$12,000	1	\$12,000
Subtotal 30-Year Post Closure Care Costs:						\$7,520,967
Contingency (10%):						\$752,097
30-Year Post Closure Cost Estimate:						\$8,273,063

Notes:

1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

ATTACHMENT A
PDP-5 HELP MODEL RESULTS

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: Martin Lake PDP 5 **Simulated On:** 1/3/2022 14:52

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)

SiL - Silty Loam(Moderate)

Material Texture Number 23

Thickness	=	18 inches
Porosity	=	0.461 vol/vol
Field Capacity	=	0.36 vol/vol
Wilting Point	=	0.203 vol/vol
Initial Soil Water Content	=	0.2798 vol/vol
Effective Sat. Hyd. Conductivity	=	9.00E-06 cm/sec

Layer 2

Type 4 - Flexible Membrane Liner

LDPE Membrane

Material Texture Number 36

Thickness	=	0.04 inches
Effective Sat. Hyd. Conductivity	=	4.00E-13 cm/sec
FML Pinhole Density	=	1 Holes/Acre
FML Installation Defects	=	4 Holes/Acre
FML Placement Quality	=	2 Excellent

Layer 3

Type 1 - Vertical Percolation Layer

Clay

Material Texture Number 43

Thickness	=	24 inches
Porosity	=	0.451 vol/vol
Field Capacity	=	0.419 vol/vol
Wilting Point	=	0.332 vol/vol
Initial Soil Water Content	=	0.4174 vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07 cm/sec

Layer 4

Type 1 - Vertical Percolation Layer (Waste)

High-Density Electric Plant Coal Fly Ash

Material Texture Number 30

Thickness	=	720 inches
Porosity	=	0.541 vol/vol
Field Capacity	=	0.187 vol/vol
Wilting Point	=	0.047 vol/vol
Initial Soil Water Content	=	0.187 vol/vol
Effective Sat. Hyd. Conductivity	=	5.00E-05 cm/sec

Layer 5

Type 3 - Barrier Soil Liner

C (Moderate)

Material Texture Number 29

Thickness	=	48 inches
Porosity	=	0.451 vol/vol
Field Capacity	=	0.419 vol/vol
Wilting Point	=	0.332 vol/vol
Initial Soil Water Content	=	0.451 vol/vol
Effective Sat. Hyd. Conductivity	=	6.80E-07 cm/sec

 Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	84.2
Fraction of Area Allowing Runoff	=	100 %
Area projected on a horizontal plane	=	40 acres
Evaporative Zone Depth	=	18 inches
Initial Water in Evaporative Zone	=	5.037 inches
Upper Limit of Evaporative Storage	=	8.298 inches
Lower Limit of Evaporative Storage	=	3.654 inches
Initial Snow Water	=	0 inches
Initial Water in Layer Materials	=	171.343 inches
Total Initial Water	=	171.343 inches
Total Subsurface Inflow	=	0 inches/year

 Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	32.31 Degrees
Maximum Leaf Area Index	=	5
Start of Growing Season (Julian Date)	=	0 days
End of Growing Season (Julian Date)	=	367 days
Average Wind Speed	=	6 mph

Average 1st Quarter Relative Humidity	=	1 %
Average 2nd Quarter Relative Humidity	=	22 %
Average 3rd Quarter Relative Humidity	=	88 %
Average 4th Quarter Relative Humidity	=	22 %

Note: Evapotranspiration data was obtained for Dirgin, Texas

Normal Mean Monthly Precipitation (inches)

<u>Jan/Jul</u>	<u>Feb/Aug</u>	<u>Mar/Sep</u>	<u>Apr/Oct</u>	<u>May/Nov</u>	<u>Jun/Dec</u>
3.940712	3.384053	4.449471	3.632658	4.152557	5.603921
3.172363	2.83961	2.855806	4.403743	4.552789	4.108209

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 32.31/-94.55

Normal Mean Monthly Temperature (Degrees Fahrenheit)

<u>Jan/Jul</u>	<u>Feb/Aug</u>	<u>Mar/Sep</u>	<u>Apr/Oct</u>	<u>May/Nov</u>	<u>Jun/Dec</u>
51.6	52.5	64.1	73	79.7	89.4
92.3	89.7	84.1	74	66.1	57.1

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 32.31/-94.55
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 32.31/-94.55

Average Annual Totals Summary

Title: Martin Lake PDP 5
Simulated on: 1/6/2022 8:32

	Average Annual Totals for Years 1 - 30*				
	(inches)	[std dev]	(cubic feet)	(gallons)	(percent)
Precipitation	47.10	[5.76]	6,838,323.4	51,154,215.3	100.00
Runoff	4.062	[2.566]	589,755.5	4,411,677.7	8.62
Evapotranspiration	42.959	[5.448]	6,237,618.8	46,660,632.2	91.22
Subprofile1					
Percolation/leakage through Layer 2	0.000690	[0.000293]	100.1	749.1	0.00
Average Head on Top of Layer 2	2.5255	[1.058]	---	---	---
Subprofile2					
Percolation/leakage through Layer 5	0.000690	[0.000293]	100.1	749.1	0.00
Average Head on Top of Layer 5	0.0000	[0]	---	---	---
Water storage					
Change in water storage	0.0747	[1.8339]	10,849.0	81,156.3	0.16

* Note: Average inches are converted to volume based on the user-specified area.

Peak Annual Totals Summary

Year	Percolation/leakage through Layer 2 (cubic feet)	Percolation/leakage through Layer 2 (gallons)
1	94.36	705.86
2	90.86	679.71
3	114.98	860.12
4	133.94	1001.98
5	68.53	512.66
6	72.73	544.05
7	65.14	487.29
8	129.67	969.97
9	145.04	1084.99
10	96.08	718.70
11	113.33	847.75
12	127.05	950.38
13	170.85	1278.05
14	110.62	827.46
15	176.37	1319.34
16	32.26	241.34
17	135.53	1013.81
18	114.29	854.96
19	124.03	927.84
20	9.75	72.90
21	36.21	270.86
22	65.90	492.99
23	79.54	594.98
24	31.83	238.14
25	99.15	741.70
26	78.99	590.87
27	111.77	836.07
28	180.88	1353.09
29	76.11	569.33
30	118.42	885.85