REPORT

Run-on and Run-off Control System Plan
5 Year Update

Martin Lake Steam Electric Station
A1 Area Landfill
Panola County, Texas

Submitted to:

Luminant Generation Company, LLC
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Submitted by:

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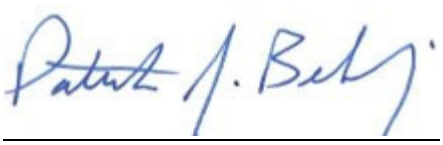
October 2021

PROFESSIONAL CERTIFICATION

This document and all attachments were prepared by Golder Associates Inc. under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I hereby certify that the Run-on and Run-off Control System Plan has been prepared in accordance with the requirements of 40 C.F.R. § 257.81 and 30 T.A.C. § 352.811.



Patrick J. Behling, P.E.
Principal Engineer
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Firm Registration No. F-2578

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1.0 INTRODUCTION

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. The power plant and related support areas occupy approximately 700 acres on a peninsula on the southwest side of Martin Lake (Figure 1). The MLSES consists of three coal/lignite-fired units with a combined operating capacity of approximately 2,250 megawatts. Coal Combustion Residuals (CCR) including fly ash, bottom ash, and gypsum are generated as part of MLSES unit operation. The CCRs are transported off-site for beneficial use by third-parties, are managed by Luminant on-site at Permanent Disposal Pond No. 5 (PDP-5) or are disposed at Luminant's A1 Area Landfill. The A1 Area Landfill (A1 LF) is located approximately 2.5 miles southeast of the MLSES power plant within a reclaimed section of the Luminant Beckville Mine in Panola County (Figure 2).

The U.S. Environmental Protection Agency promulgated 40 C.F.R. Part 257, Subpart D (the CCR Rule) and the Texas Commission on Environmental Quality (TCEQ) promulgated 30 T.A.C. Chapter 352 (which largely adopts the federal CCR Rule by reference) to establish technical requirements for new and existing CCR landfills and surface impoundments. On June 28, 2021, USEPA approved the majority of TCEQ's CCR program, which will now operate in lieu of the federal regulations. The A1 LF at the MLSES has been identified as an Existing CCR Landfill regulated under the CCR Rule.

Section 257.81(c) requires that a Run-On/Run-Off Control System Plan (RRCSP) be developed for all CCR Landfills and 30 T.A.C. 352.811 adopts this requirement by reference. In accordance with § 257.81(c)(3), the initial RRCSP for the A1 LF was completed and placed in the facility operating record in October 2016 (PBW, 2016). As specified in §257.81(c)(4), the RRCSP must be updated every five years from the completion date of the initial plan. Golder Associates Inc., member of WSP, was retained by Luminant to prepare this updated RRCSP for the A1 LF.

1.1 CCR Landfill Run-on and Run-off Control System Plan Requirements

Section 257.81(c) specifies that a written run-on and run-off control system plan be prepared for each existing CCR landfill that describes the systems that have been designed and constructed to control run-on to and run-off from the landfill consistent with the requirements of the CCR Rule and recognized and generally accepted good engineering practices. The RRCSP must include, at a minimum, design, construction, operation, and maintenance information for the following:

- A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and
- A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm. Run-off from the active portion of the CCR unit must be managed in accordance with the requirements of 40 CFR 257.3–3 (prohibition against pollution of waters of the United States).

The RRCSP must be supported by appropriate engineering calculations and must be certified by a qualified professional engineer. The RRCSP must document how the run-on and run-off control system has been designed and constructed to comply with the requirements of § 257.81.

1.2 Description of A1 Area Landfill

An existing a site plan for the A1 LF is shown on Figure 3. The A1 LF began receiving CCR in 1980. Dewatered CCR is transported from MLSES to the A1 LF by railcar for disposal.

The A1 LF is an above grade landfill surrounded by earthen embankments constructed of mine spoil that extend approximately 10 to 20 feet or more above surrounding grade. The bottom of the A1 LF is lined with a 1-foot thick compacted bottom liner consisting of clay-rich mine spoil scarified and re-compacted to achieve an in-place permeability of 1 x 10^{-7} cm/sec or less. The interior faces of the earthen embankments are constructed with a 3-foot thick compacted mine spoil liner designed to achieve an in-place permeability of 1x10^{-7} cm/sec or less. The landfill footprint is underlain by low permeability, clay-rich mine spoil 70 to 100 feet in thickness.

Progressive capping/closure of the A1 LF is performed as placement of CCR in the landfill reaches design elevations. Existing capped areas have been capped/closed using a compacted clay cap (in-place permeability of 1x10-7 cm/sec or less) covered with a vegetative soil cover layer. Prior to 2020, approximately 428 acres of the landfill had been capped (see Figure 3). An additional approximately 36 acre area of the landfill was capped in 2020 (see Figure 3). The total area of the A1 LF that is currently capped is approximately 464 acres.

1.3 Previous RRCSP for A1 Area Landfill

The Initial RRCSP for the A1 LF was completed and placed in the MLSES operating record in October 2016 (PBW, 2016). Key Findings from the Initial RRCSP can be summarized as follows:

- In accordance with § 257.81(a)(1), the A1 LF has been constructed to limit contact between storm water run-off from areas outside the landfill and CCR placed in the landfill. A significant portion of the landfill is surrounded by exterior earthen dikes that extend 10 to 15 feet or more above the surrounding grade and storm water generated from areas outside the landfill is diverted away from the landfill by the dikes and associated drainage ditches, swales, interim run-on controls implemented in active CCR placement areas, and other surface features.

- In accordance with § 257.81(a)(2), the A1 LF has been constructed to contain precipitation that falls directly on the active portions of the landfill. The majority of the landfill is surrounded by earthen dikes that extend 10 to 15 feet or more above the surrounding grade, so precipitation that falls within the active areas of the landfill is contained and managed within run-off collection areas. Similar to the run-on controls, interim controls are in-place within the active disposal area to divert run-off to collection areas present at the downgradient edge of the active disposal areas.

2.0 UPDATED RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

The Updated RRCSP for the A1 LF is described in this section. In accordance with § 257.81(c), the RRCSP addresses run-on and run-off control for the active portions of the landfill. Run-on and runoff control systems for closed sections of the A1 LF are described in the Closure Plan for the landfill.

2.1 Design Storm Event

In accordance with §§ 257.81(a)(1) and 257.81(a)(2), the run-on and run-off control systems for the A1 LF must be designed to prevent run-on into the landfill and control run-off from the landfill during the peak discharge from a 25-year, 24-hour storm. The 25-year, 24-hour storm for the A1 LF was estimated to be 8.02 inches based on the Point Precipitation Frequency Estimate Table from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for Tatum, TX (NOAA, 2021, see Appendix A).

2.2 Run-on Control System

The CCR Rule defines run-on as “any rainwater, leachate, or other liquid that drains overland onto any part of a CCR landfill or lateral expansion of a CCR landfill.” The run-on control system for the A1 LF is shown on Figure 4 and is described below.

2.2.1 Design and Construction

The A1 LF has been constructed to limit contact between storm water run-off from areas outside the landfill and CCR placed in the landfill. A significant portion of the landfill is surrounded by exterior earthen dikes that extend 10 to 15 feet or more above the surrounding grade. Storm water run-off generated from areas outside the landfill is diverted away from the landfill by the dikes and associated drainage ditches, swales and other surface features. Additional interim run-on controls (raised perimeter roadbeds and associated safety berms, an existing stockpile of suitable clay cap material and drainage diversions) are also implemented as placement of CCR progresses. In accordance with § 257.81(a)(1), the height of the exterior landfill dikes and additional interim controls relative to the surrounding topography indicate that run-off from a 25-year 24-hour storm will be diverted around the landfill and not flow onto any part of the landfill actively receiving CCR.

The landfill dikes and storm water drainage features are also designed and constructed to minimize soil erosion. The exterior of the existing dikes, post-reclamation drainage features and other permanent earthen structures are permanently vegetated to control erosion. Consistent with on-going mine reclamation, additional erosion protection (channel linings, rip rap, etc.) are used for maintenance of interim controls as well as at locations with higher storm water flow velocities and increased erosion potential.

2.2.2 Operation and Maintenance

Storm water drainage features along the exterior of A1 LF will be operated and maintained to ensure that proper storm water run-on control is maintained throughout the life of the landfill. Storm water run-on operation and maintenance activities implemented at the landfill include:

- The landfill is inspected on a weekly basis by a qualified person in accordance § 257.83(a) and annually by a professional engineer in accordance with § 257.83 (b). The weekly and annual inspections address the exterior dikes around the landfill and storm water run-on control features along the dikes and include:
    - Verification that storm water generated from areas outside the CCR placement areas is diverted around the landfill by the dikes and associated drainage ditches, swales and other drainage features.
    - Verification that the drainage ditches, swales and other drainage features do not contain significant

accumulated sediments or other flow obstructions;

- Identification of areas of dike or drainage feature erosion/scouring that require repair.

- Accumulated sediment/debris are removed, as required, from the drainage features to maintain adequate storm water drainage. Areas of erosion/scour are repaired through backfilling, grading/reshaping, seeding and related activities. Drainage features may be redesigned/reconfigured if erosion/scouring are observed repeatedly in certain areas.

- Inspection and maintenance activities are documented in inspection and maintenance records.

2.3 Run-off Control System

The CCR Rule defines run-off as "any rainwater, leachate, or other liquid that drains overland from any part of a CCR landfill or lateral expansion of a CCR landfill." For the purposes of this RRCSP, the term "run-off" has been further classified into run-off from active landfill areas and run-off from capped landfill areas. The run-off control system for the A1 LF is shown on Figure 5 and is described below.

2.3.1 Design and Construction

The A1 LF has been constructed to contain precipitation that falls on the active portions of the landfill. The majority of the landfill is surrounded by earthen dikes that extend 10 to 15 feet or more above the surrounding grade, so precipitation that falls within the active areas of the landfill is contained and managed within run-off collection areas. Similar to the run-on controls discussed above, interim controls are in-place within the active disposal area to divert run-off to the following run-off collection areas present at the downgradient edge of the active disposal areas (see Figure 5).

- South Run-off Collection Area (SROCA), and

- Former South Run-off Collection Area (FSROCA).

It should be noted that an additional collection area identified as the North Run-Off Collection Area (NROCA) was formerly used to collect run-off from active areas in the northwest part of the A1 LF (see Figure 5). With the construction of the 36 acre cap area in 2020, there are no longer any exposed CCR areas in the watershed of the NROCA.

Luminant anticipates that construction of the final CCR cover system will continue in phases over several years. While a portion of the landfill is active, all precipitation that comes into contact with exposed CCR will be contained and managed within run-off collection areas. Once a portion of the landfill has been capped (either with a permanent cap or with a temporary soil cover), precipitation that falls on the capped area will be diverted away from the active areas of the landfill and/or the run-off collection areas. This storm water run-off will flow off of the capped portions of the landfill and be diverted away from the landfill by the drainage ditches, swales and other surface features along the perimeter of the landfill.

Run-off from the current configuration of the A1 LF will be evaluated in this Updated RRCSP (see Figure 5 for the Run-off Control Plan).

Run-off Volume Calculation Procedures

In accordance with § 257.81(a)(2), the A1 LF has been designed and constructed to contain the estimated volume of run-off from active landfill areas generated from a 25-year, 24-hour storm.

Run-off volumes were estimated using the Curve Number (CN) method as described in the USDA publication TR-55 - Urban Hydrology for Small Water Sheds (USDA-NRCS, 1986). A key component of the TR-55 procedure is identifying the appropriate CN used in the evaluations. Published CNs vary depending on material type, degree of saturation and other variables, ranging from 98 for impervious surfaces (concrete/asphalt pavement, etc.) to 50 or less for vegetated, well drained soils (USDA-NRCS, 1986). As described in the Initial RRCSP, then following CNs were assumed for this evaluation (PBW, 2016):

- Exposed fly and bottom ash: CN = 94
- Capped area: CN = 66
- Partially reclaimed area: CN = 72

One hundred percent (CN = 100) of the direct precipitation on the run-off collection areas themselves was assumed to be collected in the run-off collection areas.

The surface areas of the watersheds contributing to each of the collection areas were used to calculate run-off volumes. The surface area of the watershed contributing to each run-off collection area were measured using AutoCAD Civil 3D (see Appendix B). The estimated surface areas of the watersheds were as follows:

- SROCA Watershed (Total Approximately 200 acres):
  - Exposed Ash Area: 111 acres
  - Capped Area: 35 acres
  - Partially Reclaimed Area: 54 acres
- FSROCA Watershed (Total Approximately 121 acres):
  - Exposed Ash Area: 41 acres
  - Partially Reclaimed Area: 80 acres

Run-off Containment Capacities

The following run-off containment capacities for the run-off collection areas were calculated using AutoCAD Civil 3D (see Appendix C):

- SROCA: 524,112 cubic yards (14,151,024 cf)
- FSROCA: 120,611 cubic yards (3,256,497 cf)

The estimated containment capacities of each run-off collection area are based on the following assumptions:

- Luminant will continue to minimize storage of run-off in each area between precipitation events;
- Existing topography surrounding each run-off collection area will not be modified in a manner that would reduce the currently available storage volume and the ponds; and
- Periodic removal of accumulated sediment/CCR will be performed.

Run-off Evaluation

Run-off volume estimates for the A1 LF are shown in Appendix D. Estimated volumes of run-off were compared to run-off collection area containment capacities to confirm that adequate run-off containment is provided for the 25-year, 24-hour storm (8.02 inches).

The results of the run-off evaluation can be summarized as follows:

- SROCA:
  - Total Volume of Runoff to SROCA: 5,656,584 cf
  - Storage Capacity of SROCA: 14,151,024 cf

Since the volume of run-off to the SROCA is less than the storage capacity of the SROCA, the SROCA can contain the run-off from a 25-yr, 24-hr storm.

- FSROCA:
  - Total Volume of Runoff to FSROCA: 2,625,167 cf
  - Storage Capacity of FSROCA: 3,256,497 cf

Since the volume of run-off to the FSROCA is less than the storage capacity of the FSROCA, the FSROCA can contain the run-off from a 25-yr, 24-hr storm.

2.3.2 Operation and Maintenance

The run-off containment features of the A1 LF will be operated and maintained to ensure that proper run-off control is maintained throughout the life of the landfill. Run-off control operation and maintenance activities implemented at the landfill include:

- Run-off from active landfill areas is stored in the run-off collection areas for the shortest time practicable. Run-off accumulated in the collection areas is applied to active areas of the landfill to control dust and/or is allowed to evaporate. Run-off discharged from the collection areas will be monitored in accordance with the existing TCEQ TPDES permit for the Beckville Mine or similar authorization.

- The landfill is inspected on a weekly basis by a qualified person in accordance with § 257.83(a) and annually by a professional engineer in accordance with § 257.83 (b). The weekly and annual inspections address the interior and exterior dikes at the landfill and include:
  - Verification that run-off from active areas is being contained in the collection areas and a minimum of 2 feet of freeboard is maintained in the collection areas.
  - Inspection and maintenance activities are documented in inspection and maintenance records.

2.4 Updates to Run-on and Run-off Control System Plan

In accordance with § 257.81(c)(3), this Updated RRCSP must be placed in the MLSES operating record no later than October 12, 2021. Subsequent RRCSPs must be completed every five years.

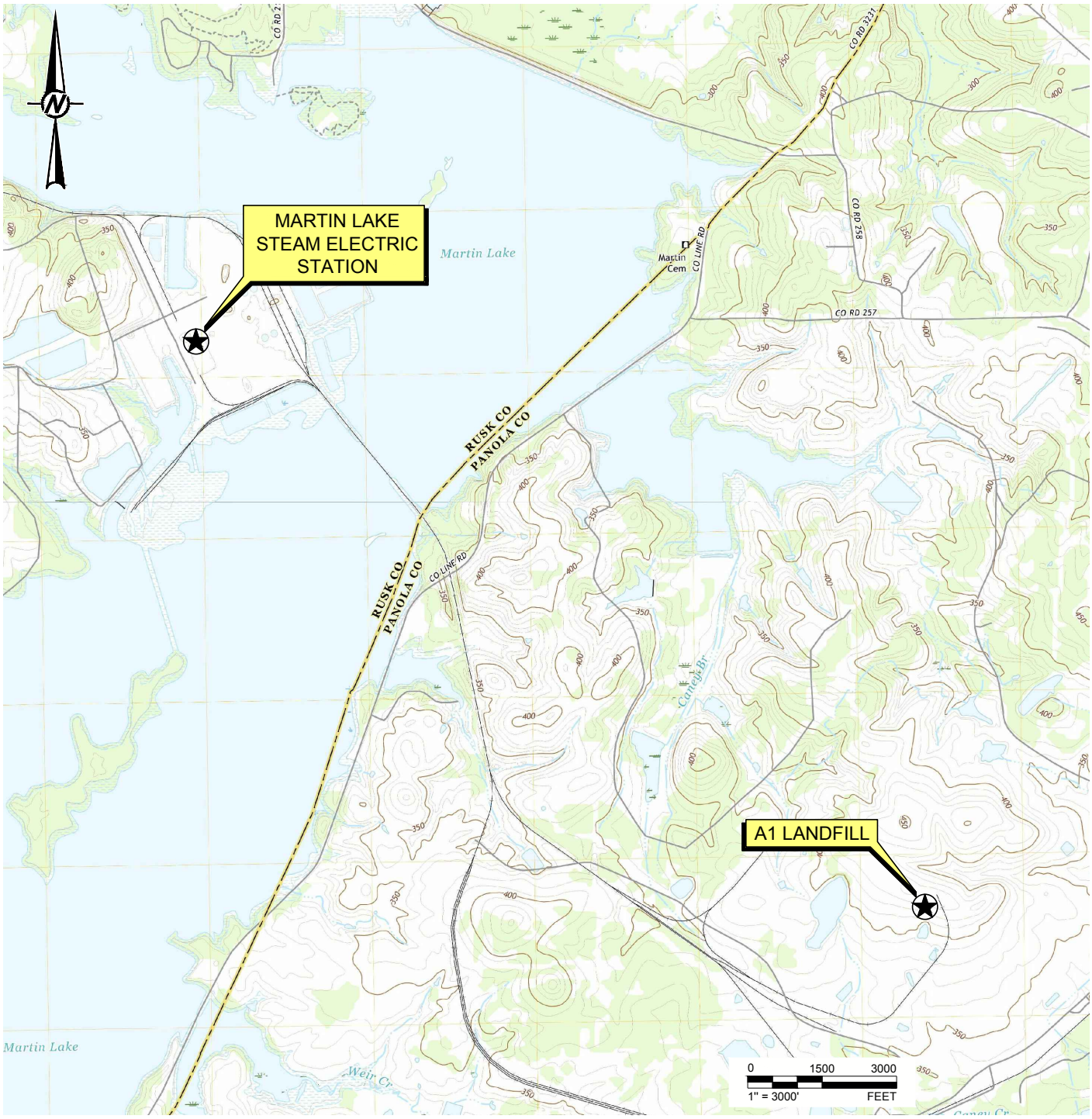
3.0 REFERENCES

Pastor, Behling & Wheeler, LLC (PBW), 2016. Run-on and Run-off Control System Plan – A1 Area Landfill, Martin Lake Steam Electric Station, October.

National Oceanic and Atmospheric Administration (NOAA), 2021. Atlas 14 – Point Precipitation Frequency Estimates Website, Tatum, Texas. September.

United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS), 1986. Urban Hydrology for Small Watersheds - TR-55, June.

FIGURES



REFERENCE(S)

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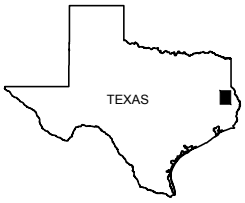

QUADRANGLE LOCATION

CLIENT

LUMINANT GENERATION COMPANY

PROJECT

MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE

SITE LOCATION MAP

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-30
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	FIGURE
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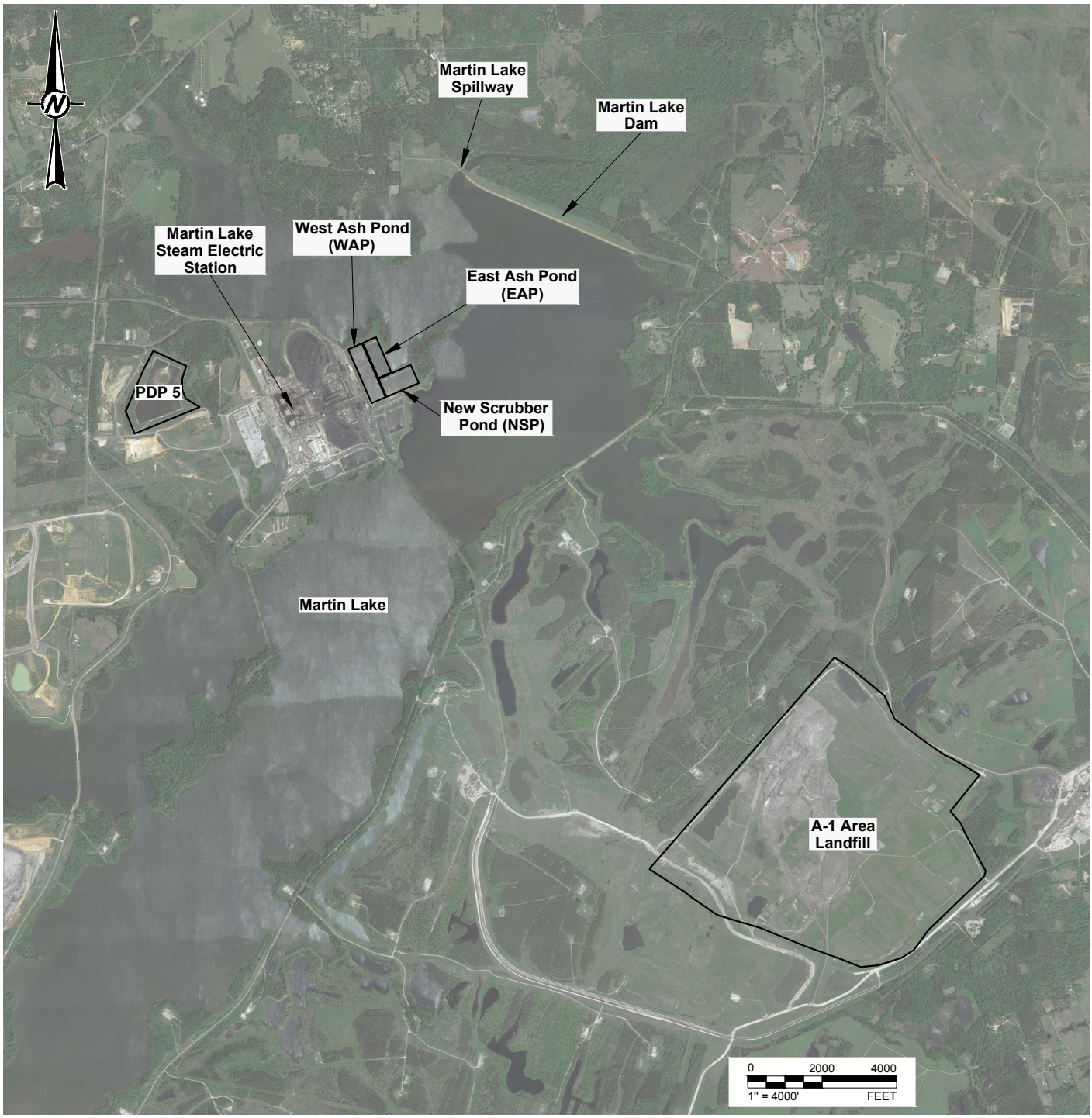

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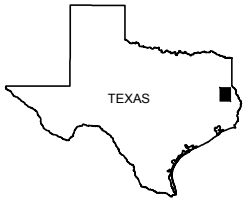

PHOTOGRAPH LOCATION

CLIENT

LUMINANT GENERATION COMPANY

PROJECT

MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE

SITE VICINITY MAP

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-30
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	FIGURE
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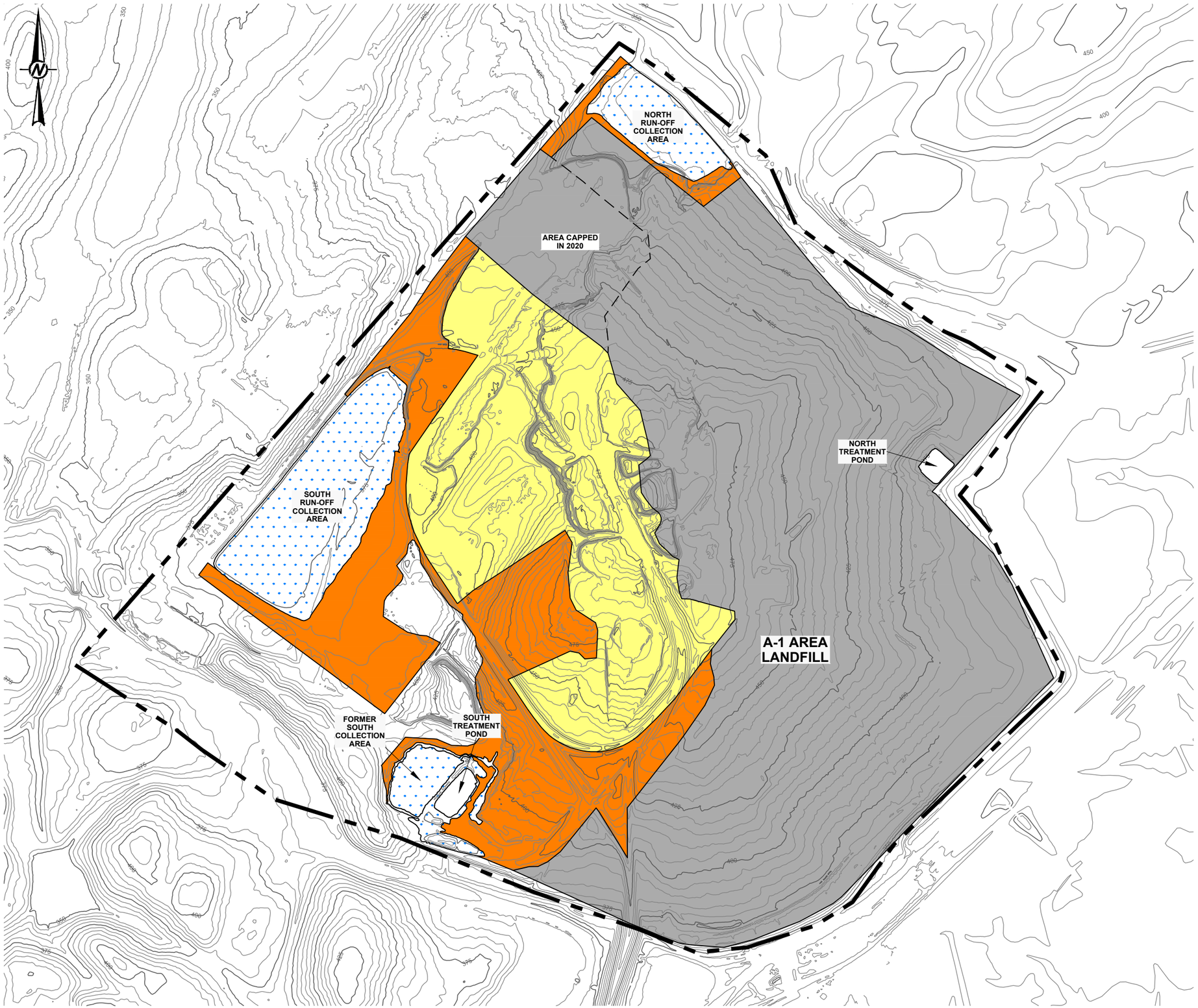

LEGEND

- LANDFILL REGISTRATION BOUNDARY
- EXISTING GRADE CONTOUR - 5 FT INTERVAL
- EXISTING GRADE CONTOUR - 25 FT INTERVAL
- CAPPED AREA (EXISTING)
- ACTIVE CCR DISPOSAL/DISTURBED AREA
- EXISTING COMPACTED CLAY LINER
- RUN-OFF COLLECTION AREA

NOTE(S)

1. EXTENT OF CAPPED AREAS BASED ON OCTOBER 2016 SITE CONDITIONS.
2. RUN-OFF COLLECTION AREAS AND TREATMENT PONDS ARE LINED WITH COMPACTED CLAY.

0 450 900
1" = 900' FEET

CLIENT
LUMINANT GENERATION COMPANY

PROJECT
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
EXISTING SITE PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-30
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO. 21465177 | CONTROL | REV. 0 | FIGURE 3

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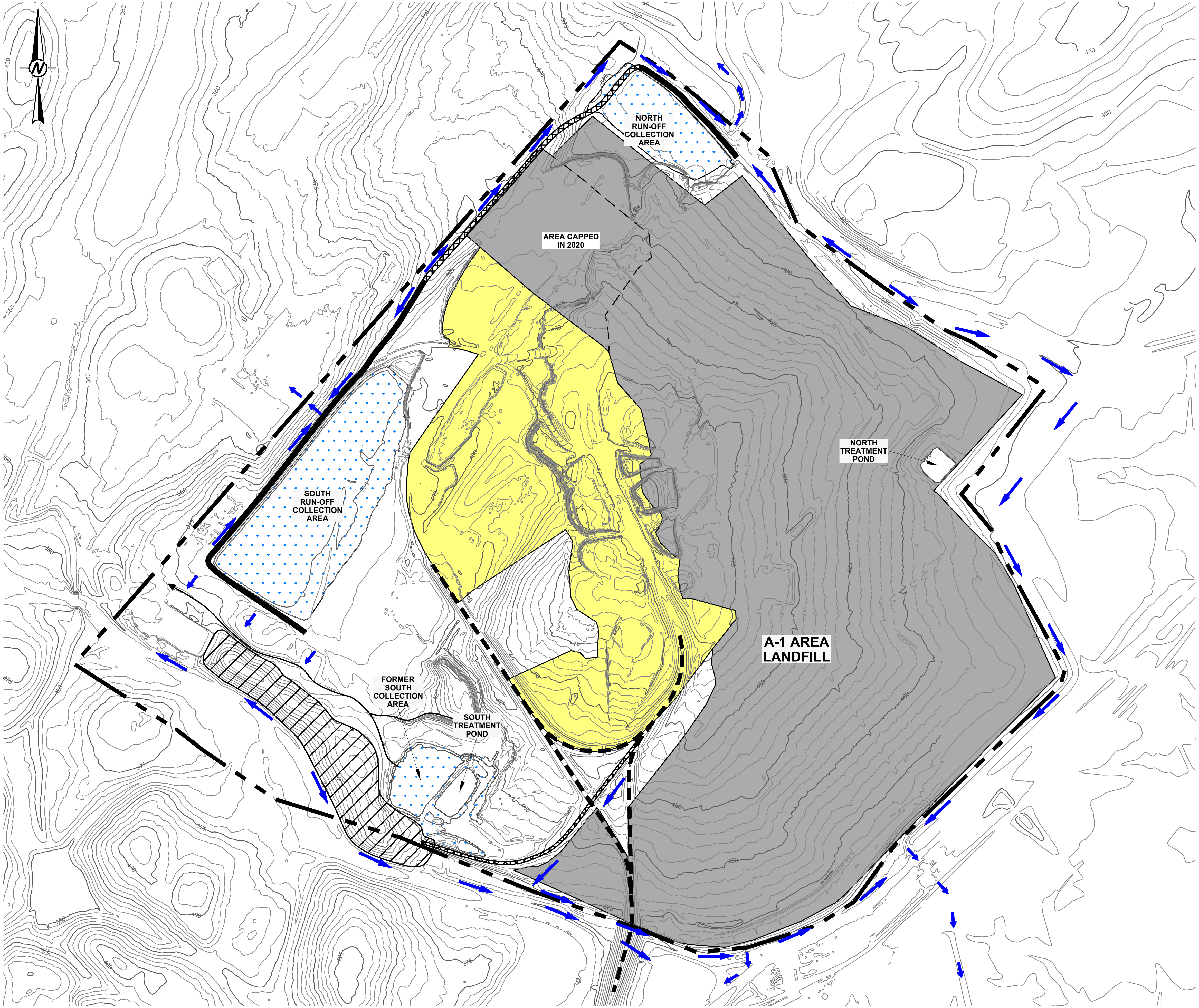

LEGEND

- LANDFILL REGISTRATION BOUNDARY
- EXISTING GRADE CONTOUR - 5 FT INTERVAL
- EXISTING GRADE CONTOUR - 25 FT INTERVAL
- APPROX. LIMITS OF EXISTING CAP/COVER SYSTEM
- ACTIVE CCR DISPOSAL/DISTURBED AREA
- PERIMETER RUN-ON CONTROL (ELEVATED ROADBED/BERMS
- EXISTING EMBANKMENT
- CLAY CAP MATERIAL STOCKPILE
- RAISED RAIL SPUR EMBANKMENT
- STORMWATER RUN-OFF FLOW DIRECTION
- RUN-OFF COLLECTION AREA

0 450 900
1" = 900' FEET

CLIENT
LUMINANT GENERATION COMPANY

PROJECT
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
RUN-ON CONTROL PLAN

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-09-30
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	FIGURE
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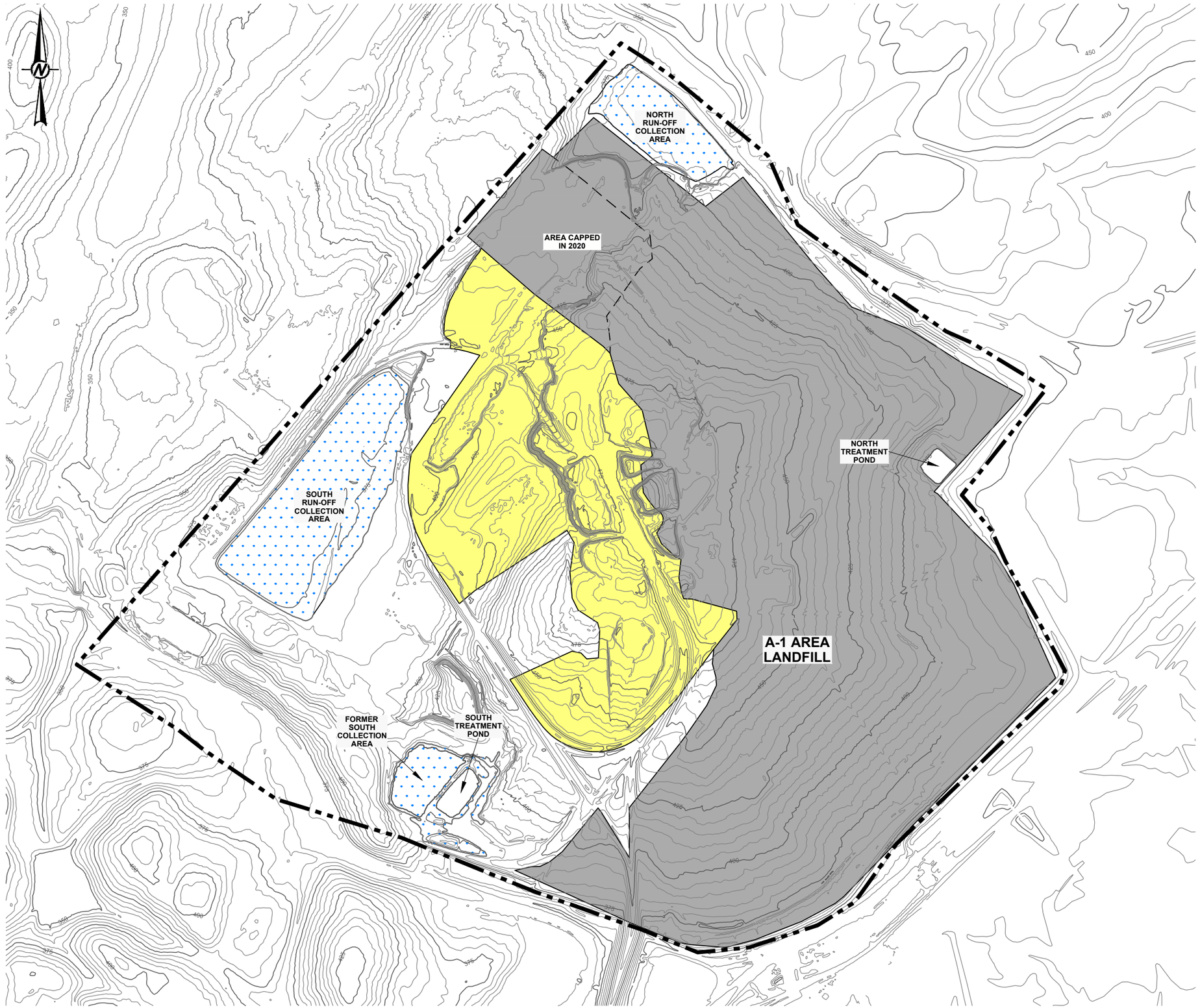

LEGEND

- LANDFILL REGISTRATION BOUNDARY
- EXISTING GRADE CONTOUR - 5 FT INTERVAL
- EXISTING GRADE CONTOUR - 25 FT INTERVAL
- CAPPED AREA
- APPROXIMATE ACTIVE CCR DISPOSAL/DISTURBED AREA
- RUN-OFF COLLECTION AREA

0 450 900
1" = 900' FEET

CLIENT
LUMINANT GENERATION COMPANY

PROJECT
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
RUN-OFF CONTROL PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-09-30
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PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO. 21465177 | CONTROL | REV. 0 | FIGURE 5

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APPENDIX A

NOAA Atlas 14 Precipitation Data – Tatum, Texas

NOAA Atlas 14, Volume 11, Version 2
Location name: Tatum, Texas, USA*
Latitude: 32.2589°, Longitude: -94.5721°
Elevation: 308.84 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.443** (0.336-0.585)	**0.512** (0.391-0.670)	**0.623** (0.475-0.819)	**0.716** (0.537-0.954)	**0.844** (0.613-1.16)	**0.942** (0.666-1.33)	**1.04** (0.718-1.51)	**1.15** (0.770-1.70)	**1.29** (0.836-1.98)	**1.40** (0.884-2.20)
10-min	**0.707** (0.535-0.934)	**0.817** (0.624-1.07)	**0.996** (0.759-1.31)	**1.15** (0.860-1.53)	**1.35** (0.983-1.86)	**1.51** (1.07-2.13)	**1.67** (1.15-2.42)	**1.83** (1.23-2.72)	**2.04** (1.33-3.14)	**2.20** (1.39-3.47)
15-min	**0.886** (0.671-1.17)	**1.02** (0.781-1.34)	**1.24** (0.948-1.64)	**1.43** (1.07-1.90)	**1.68** (1.22-2.30)	**1.87** (1.32-2.63)	**2.06** (1.42-2.99)	**2.27** (1.52-3.37)	**2.55** (1.65-3.91)	**2.76** (1.75-4.35)
30-min	**1.25** (0.943-1.65)	**1.43** (1.10-1.88)	**1.74** (1.32-2.29)	**1.99** (1.49-2.65)	**2.34** (1.69-3.20)	**2.60** (1.83-3.65)	**2.86** (1.97-4.14)	**3.15** (2.12-4.68)	**3.54** (2.30-5.45)	**3.86** (2.44-6.08)
60-min	**1.63** (1.23-2.15)	**1.88** (1.43-2.46)	**2.29** (1.74-3.01)	**2.63** (1.97-3.50)	**3.10** (2.25-4.24)	**3.45** (2.44-4.86)	**3.82** (2.63-5.53)	**4.22** (2.84-6.28)	**4.79** (3.12-7.37)	**5.25** (3.32-8.27)
2-hr	**1.99** (1.52-2.61)	**2.33** (1.78-3.02)	**2.88** (2.20-3.75)	**3.34** (2.52-4.43)	**4.00** (2.92-5.44)	**4.51** (3.21-6.30)	**5.06** (3.51-7.26)	**5.68** (3.83-8.34)	**6.56** (4.28-9.97)	**7.29** (4.63-11.3)
3-hr	**2.20** (1.68-2.88)	**2.61** (2.00-3.35)	**3.25** (2.49-4.21)	**3.80** (2.88-5.01)	**4.59** (3.36-6.22)	**5.23** (3.73-7.26)	**5.91** (4.11-8.43)	**6.69** (4.52-9.76)	**7.81** (5.11-11.8)	**8.75** (5.57-13.5)
6-hr	**2.58** (1.98-3.36)	**3.11** (2.38-3.94)	**3.90** (3.01-5.03)	**4.62** (3.51-6.05)	**5.66** (4.17-7.61)	**6.51** (4.67-8.98)	**7.45** (5.20-10.5)	**8.52** (5.79-12.3)	**10.1** (6.61-15.0)	**11.4** (7.27-17.3)
12-hr	**2.97** (2.30-3.84)	**3.63** (2.78-4.55)	**4.60** (3.56-5.88)	**5.48** (4.20-7.14)	**6.80** (5.05-9.10)	**7.91** (5.71-10.8)	**9.14** (6.41-12.8)	**10.5** (7.19-15.0)	**12.6** (8.29-18.5)	**14.3** (9.18-21.5)
24-hr	**3.42** (2.66-4.39)	**4.21** (3.23-5.23)	**5.36** (4.17-6.81)	**6.42** (4.94-8.30)	**8.02** (5.99-10.6)	**9.37** (6.80-12.7)	**10.9** (7.66-15.0)	**12.6** (8.60-17.7)	**15.0** (9.92-21.8)	**17.0** (11.0-25.2)
2-day	**3.96** (3.10-5.06)	**4.87** (3.77-6.02)	**6.20** (4.85-7.84)	**7.43** (5.75-9.54)	**9.25** (6.96-12.2)	**10.8** (7.89-14.6)	**12.5** (8.85-17.1)	**14.3** (9.85-20.0)	**16.9** (11.2-24.2)	**19.0** (12.3-27.8)
3-day	**4.37** (3.43-5.55)	**5.33** (4.15-6.60)	**6.77** (5.32-8.54)	**8.08** (6.27-10.3)	**10.0** (7.55-13.1)	**11.6** (8.51-15.6)	**13.4** (9.49-18.2)	**15.2** (10.5-21.1)	**17.9** (11.9-25.4)	**19.9** (12.9-28.9)
4-day	**4.71** (3.70-5.97)	**5.70** (4.47-7.07)	**7.21** (5.68-9.07)	**8.55** (6.66-10.9)	**10.5** (7.94-13.7)	**12.1** (8.90-16.2)	**13.9** (9.87-18.8)	**15.8** (10.9-21.7)	**18.4** (12.2-26.0)	**20.5** (13.3-29.5)
7-day	**5.55** (4.38-7.00)	**6.57** (5.20-8.17)	**8.17** (6.48-10.3)	**9.56** (7.48-12.1)	**11.5** (8.71-14.9)	**13.1** (9.62-17.3)	**14.8** (10.5-19.8)	**16.6** (11.5-22.7)	**19.2** (12.8-26.9)	**21.3** (13.9-30.4)
10-day	**6.24** (4.94-7.85)	**7.29** (5.82-9.08)	**8.98** (7.15-11.2)	**10.4** (8.16-13.2)	**12.4** (9.37-15.9)	**13.9** (10.2-18.2)	**15.5** (11.1-20.8)	**17.4** (12.1-23.6)	**19.9** (13.4-27.7)	**22.1** (14.4-31.2)
20-day	**8.33** (6.64-10.4)	**9.51** (7.68-11.9)	**11.5** (9.24-14.3)	**13.1** (10.3-16.4)	**15.2** (11.6-19.4)	**16.8** (12.4-21.8)	**18.4** (13.2-24.3)	**20.1** (14.1-27.0)	**22.5** (15.2-30.9)	**24.4** (16.0-34.0)
30-day	**10.0** (8.03-12.5)	**11.3** (9.22-14.2)	**13.6** (11.0-16.9)	**15.3** (12.1-19.2)	**17.6** (13.4-22.3)	**19.3** (14.2-24.8)	**20.8** (15.0-27.4)	**22.5** (15.8-30.0)	**24.8** (16.7-33.7)	**26.5** (17.4-36.6)
45-day	**12.4** (9.97-15.4)	**13.9** (11.3-17.3)	**16.4** (13.3-20.4)	**18.4** (14.6-23.0)	**21.0** (16.0-26.4)	**22.7** (16.9-29.1)	**24.4** (17.6-31.8)	**26.1** (18.3-34.5)	**28.2** (19.1-38.1)	**29.9** (19.6-40.8)
60-day	**14.5** (11.7-18.0)	**16.1** (13.2-20.1)	**19.0** (15.4-23.5)	**21.2** (16.9-26.3)	**23.9** (18.3-30.1)	**25.8** (19.2-33.0)	**27.6** (20.0-35.8)	**29.3** (20.6-38.6)	**31.4** (21.3-42.2)	**33.0** (21.7-44.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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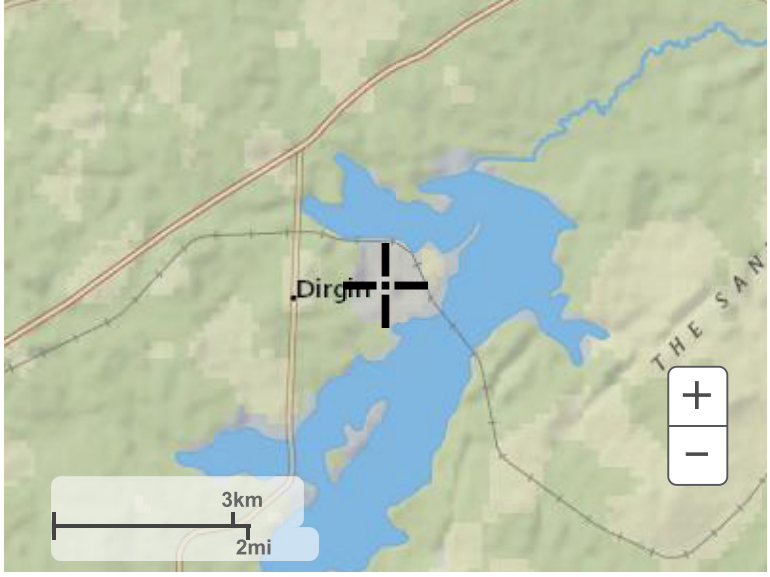
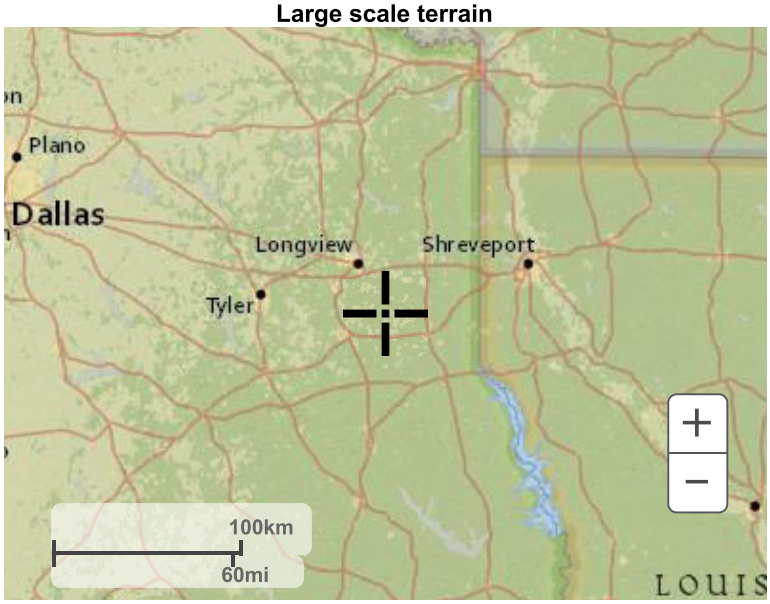
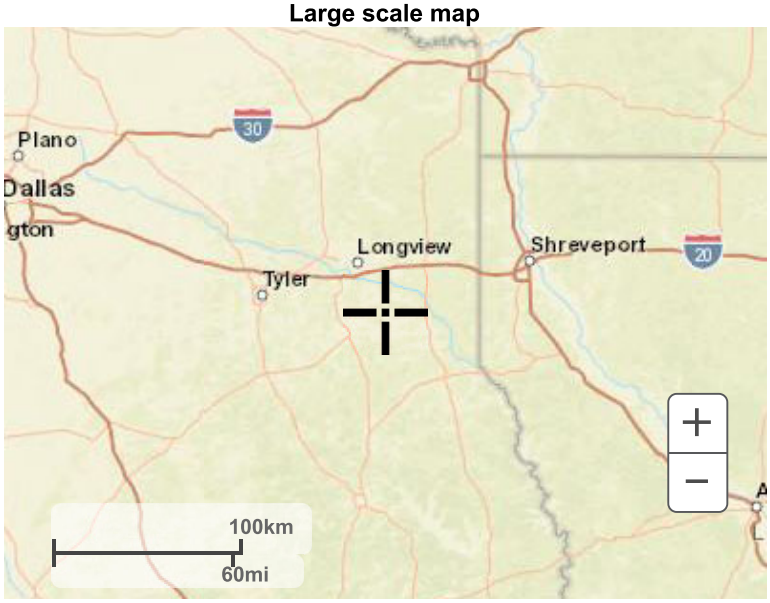
PF graphical



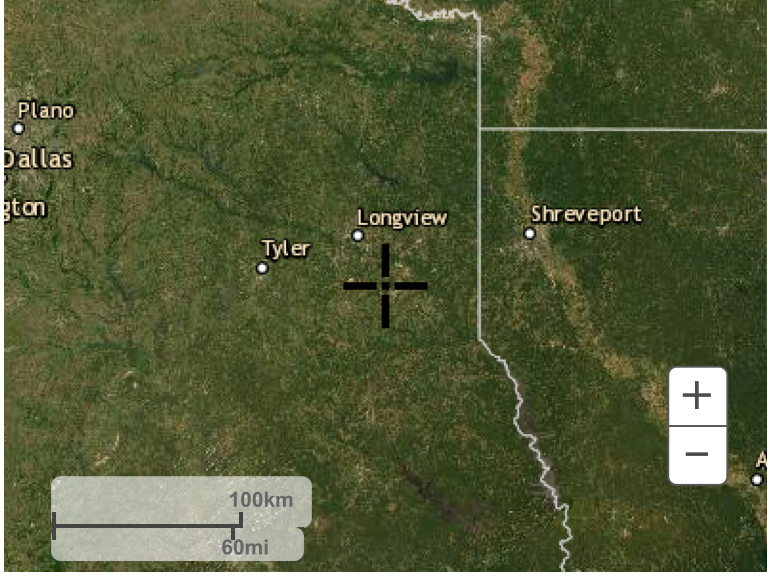
Large scale terrain



Large scale map



Large scale aerial



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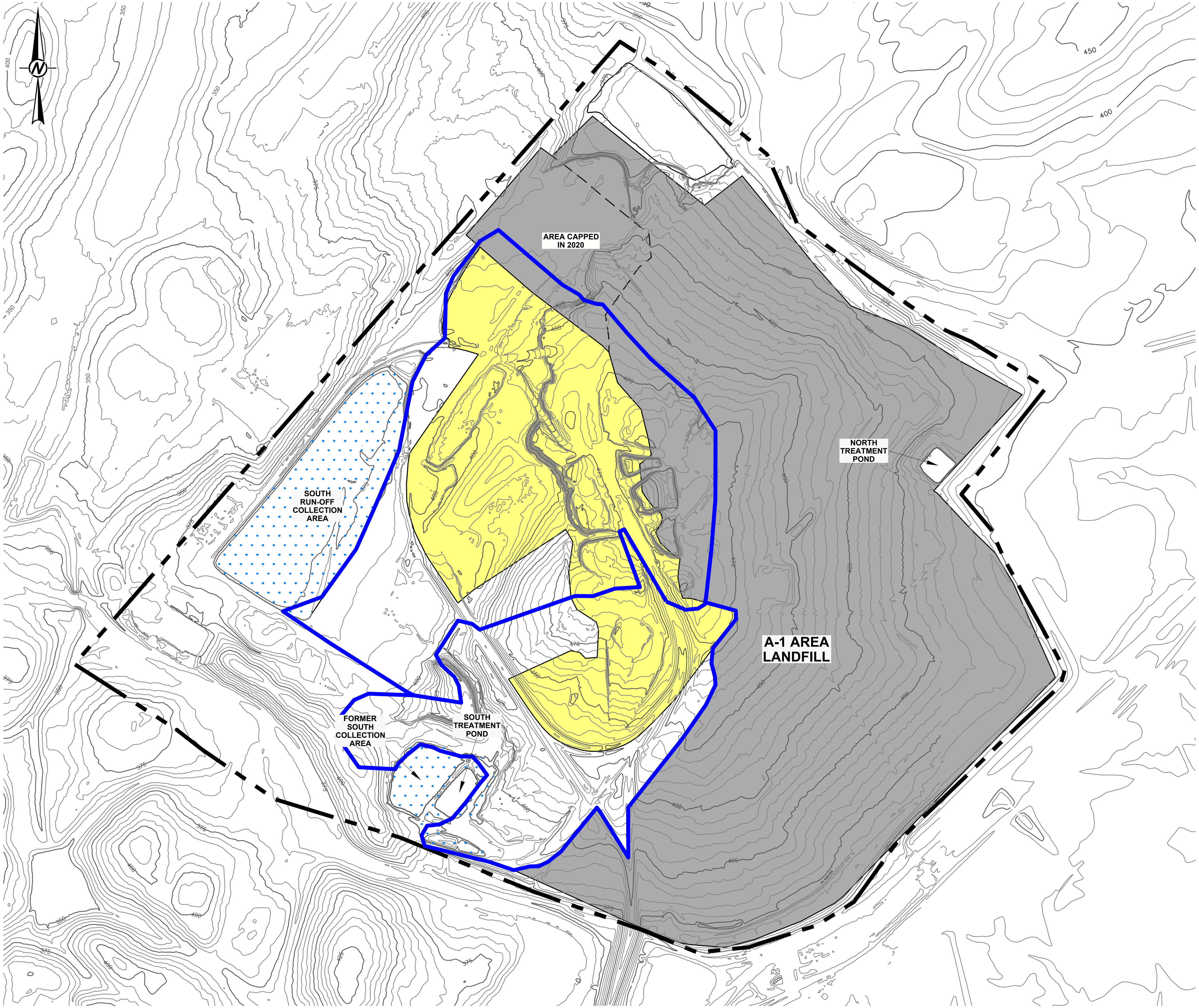
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX B

Run-off Collection Watershed Areas



LEGEND

- LANDFILL REGISTRATION BOUNDARY
- EXISTING GRADE CONTOUR - 5 FT INTERVAL
- EXISTING GRADE CONTOUR - 25 FT INTERVAL
- CAPPED AREA
- APPROXIMATE ACTIVE CCR DISPOSAL/DISTURBED AREA
- RUN-OFF COLLECTION AREA
- WATERSHED BOUNDARY

WATERSHED SUMMARY

Active CCR Disposal/Disturbed	= 111 acres
Capped/Closed Area	= 35 acres
Partial Reclaim	= 54 acres
Total Area	**= 200 acres**

FORMER SOUTH RUN-OFF POND

Active CCR Disposal	= 41 acres
Partial Reclaim	= 80 acres
Total Area	**= 121 acres**

0 450 900
1" = 900' FEET

CLIENT
LUMINANT GENERATION COMPANY

PROJECT
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
WATERSHED BOUNDARIES - EXISTING CONDITIONS

CONSULTANT

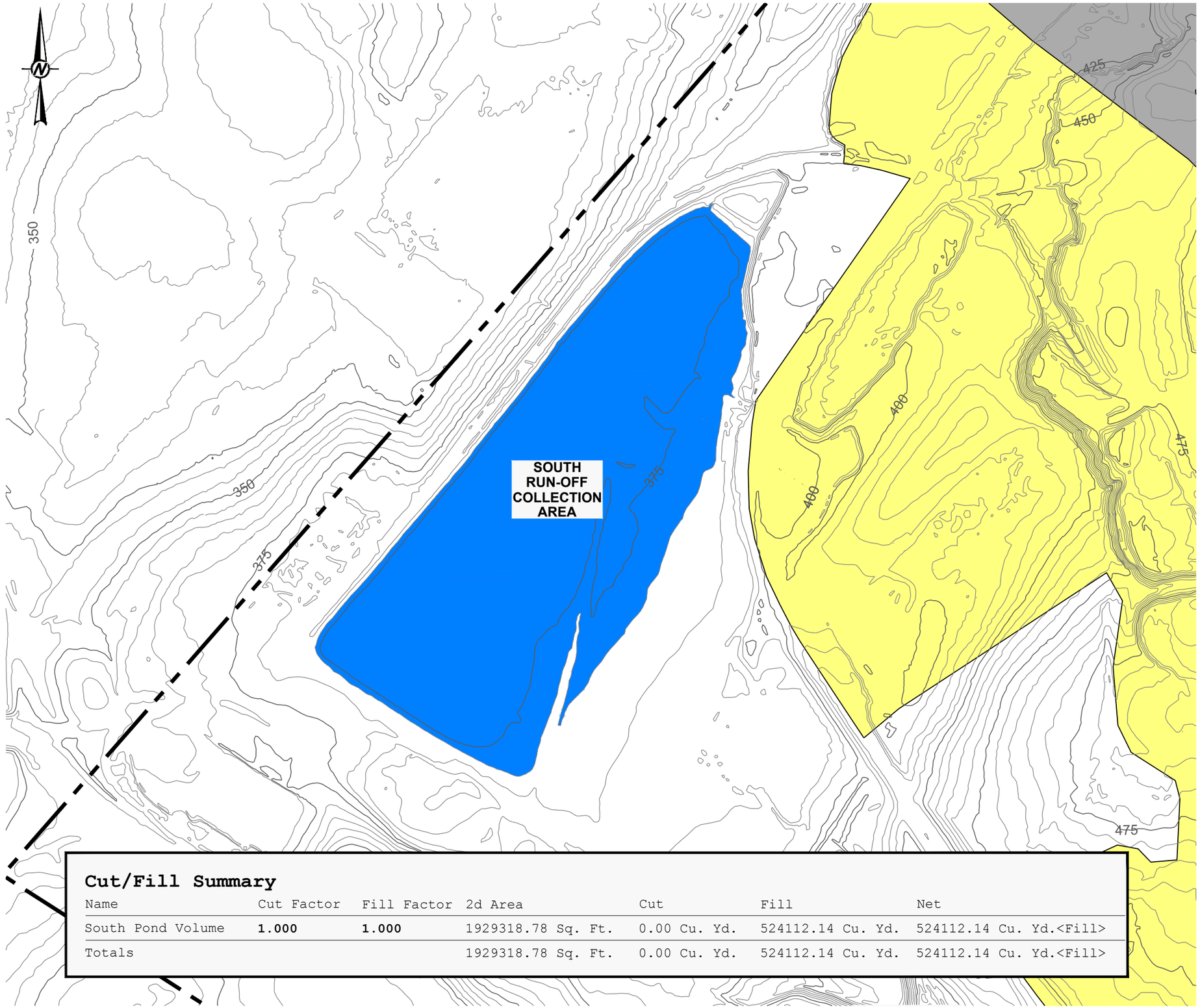
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-10-01
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	APPENDIX
21465177		0	B

APPENDIX C

Run-off Collection Area Capacities



Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
South Pond Volume	**1.000**	**1.000**	1929318.78 Sq. Ft.	0.00 Cu. Yd.	524112.14 Cu. Yd.	524112.14 Cu. Yd.<Fill>
Totals			1929318.78 Sq. Ft.	0.00 Cu. Yd.	524112.14 Cu. Yd.	524112.14 Cu. Yd.<Fill>

LEGEND

- LANDFILL REGISTRATION BOUNDARY
- EXISTING GRADE CONTOUR - 5 FT INTERVAL
- EXISTING GRADE CONTOUR - 25 FT INTERVAL
- CAPPED AREA
- ACTIVE CCR DISPOSAL/DISTURBED AREA
- RUN-OFF COLLECTION AREA

NOTE(S)

1. SOUTH RUN-OFF POND CAPACITY ESTIMATED BASED ON TOP OF EMBANKMENT ELEVATION OF 380 FT-MSL AND ASSUMED MINIMUM WATER ELEVATION OF 370.6 FT-MSL (BASED ON JANUARY 2016 SURVEY).

0 200 400
1" = 400' FEET

CLIENT
LUMINANT GENERATION COMPANY

PROJECT
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
SOUTH RUN-OFF COLLECTION AREA CONTAINMENT CAPACITY

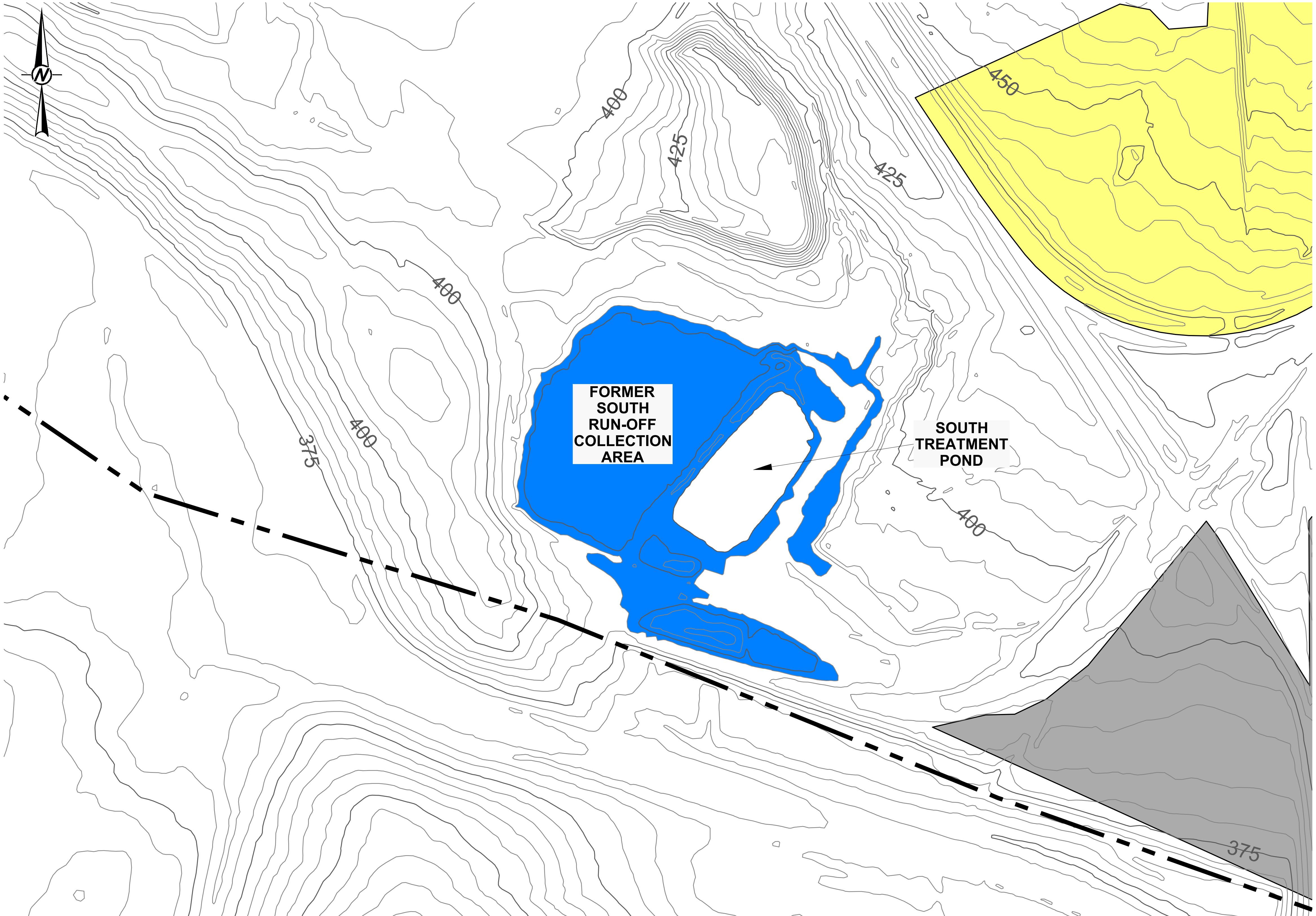
CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-01
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO. 21465177 | CONTROL | REV. 0 | APPENDIX C-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Path: \\golder.gds\complexdata\office\T\exarkana\Projects - Round Rock_20212\1465177 - Luminant MLSES\PRODUCT\ONC - 2021 ROROCSP\ | File Name: C1-South Runoff Pond.dwg | Last Edited By: adiamond Date: 2021-10-01 Time:9:18:25 AM | Printed By: adiamond Date: 2021-10-01 Time:9:31:13 AM



Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
Former South Run-off Pond	**1.000**	**1.000**	645677.37 Sq. Ft.	0.00 Cu. Yd.	120611.04 Cu. Yd.	120611.04 Cu. Yd.<Fill>
Totals			645677.37 Sq. Ft.	0.00 Cu. Yd.	120611.04 Cu. Yd.	120611.04 Cu. Yd.<Fill>

LEGEND

- LANDFILL REGISTRATION BOUNDARY
- EXISTING GRADE CONTOUR - 5 FT INTERVAL
- EXISTING GRADE CONTOUR - 25 FT INTERVAL
- CAPPED AREA
- ACTIVE CCR DISPOSAL/DISTURBED AREA
- RUN-OFF COLLECTION AREA

NOTE(S)

1. FORMER SOUTH RUN-OFF COLLECTION AREA CAPACITY ESTIMATE IS BASED ON RUN-OFF ACCUMULATION UP TO ELEVATION OF 380 FT-MSL AND INITIAL ASSUMED WATER ELEVATION OF 371.4 FT-MSL (BASED ON JANUARY 2016 SURVEY).
2. EFFECTIVE CAPACITY OF THE FORMER SOUTH RUN-OFF COLLECTION AREA (3,256,000 FT^3) DOES NOT INCLUDE ACCUMULATION OF RUN-OFF IN THE SOUTH TREATMENT POND.

0 150 300
1" = 300' FEET

CLIENT
LUMINANT GENERATION COMPANY

PROJECT
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL
RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN UPDATE

TITLE
FORMER SOUTH RUN-OFF COLLECTION AREA CONTAINMENT CAPACITY

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-01
DESIGNED	AJD
PREPARED	AJD
REVIEWED	PJB
APPROVED	PJB

PROJECT NO.	CONTROL	REV.	APPENDIX
21465177		0	C-2

1 in

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

APPENDIX D

Run-off Volume Calculations

APPENDIX D1

LUMINANT GENERATION COMPANY, LLC
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL - CURRENT CONDITIONS
RUN-OFF CALCULATIONS - SOUTH RUN-OFF COLLECTION AREA

Definitions

Run-off from active landfill areas: storm water that comes into contact with waste
Run-off from capped landfill areas: storm water that falls outside of an active waste management area and does not come into contact with waste

Assumptions

1) SROCA Watershed Area is as shown in Appendix B
2) Active Area Run-off volume based on a 25-year, 24-hr storm
3) Assume exposed fly and bed ash, and partially reclaimed area exist in SROCA
4) Storm water runoff volumes are estimated using the Curve Number method as described in USDA's Urban Hydrology for Small Water Sheds (TR-55)

Area that Generates Run-off

From Appendix B:

SROCA – Exposed Ash Area:	111	acres
SROCA – Exposed Ash Area:	4,835,160	sf
SROCA – Capped Area:	35	acres
SROCA – Capped Area:	1,524,600	sf
SROCA – Partially Reclaimed Area:	54	acres
SROCA – Partially Reclaimed Area:	2,352,240	sf

Design Rainfall

25-Yr, 24-Hr Storm (NOAA Atlas 14): 8.02 in

Curve Numbers

Assumptions:

- For exposed fly and bed ash, use CN = 94
- For capped area, use CN = 66
- For partially reclaimed area, use CN = 72

Calculate Weighted Curve Number for SROCA Watershed

Description	Area (sf)	CN	Area X CN
Exposed Fly and Bed Ash	111	94	10,434
Capped Area	35	66	2,310
Partially Reclaimed Area	54	72	3,888
	200		16,632

Weighted Curve Number = (Sum of CN X A) /(Total Area)
Weighted Curve Number = 83.2

APPENDIX D1

LUMINANT GENERATION COMPANY, LLC
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL - CURRENT CONDITIONS
RUN-OFF CALCULATIONS - SOUTH RUN-OFF COLLECTION AREA

Calculate Run-Off Volume Using TR-55 Procedures

1) Calculate Potential Retention of Water (S). Assume this represents water adsorbed by ash and protective cover (non free water)

S = (1000/CNW)-10

where: S = Potential Retention of Water, inches
CN = Curve Number for Site

S = 2.03 inches

2) Calculate Depth of Runoff (Q)

Q = [(P-0.2S)^2]/[P-0.8S)]

where: Q = Depth of run-off generated, inches
S = Potential Retention of Water, inches
P = Design rainfall, inches

Q = 6.02 inches

3) Calculate Volume of Run-off from Watershed

V = Q X A

where: Q = depth of run-off generated, ft
A = Total Area, sf

Q = 6.02 inches
Q = 0.50 feet
Area = 8,712,000 sf

Watershed Run-off Volume: 4,367,156 cf

4) Calculate Volume of Precipitation on SROCA

V= surface area (sf) X design storm precipitation (ft)

SROCA Surface Area = 1,929,319 sf
25-Yr, 24-Hr Storm (NOAA Atlas 14) 8.02 in
25-Yr, 24-Hr Storm (NOAA Atlas 14) 0.67 ft

Volume of Precip on SROCA: 1,289,428 cf

Total Volume to SROCA: 5,656,584 cf

APPENDIX D2

LUMINANT GENERATION COMPANY, LLC
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL - CURRENT CONDITIONS
RUN-OFF CALCULATIONS - FORMER SOUTH RUN-OFF COLLECTION AREA

Definitions

Run-off from active landfill areas:	storm water that comes into contact with waste
Run-off from capped landfill areas:	storm water that falls outside of an active waste management area and does not come into contact with waste

Assumptions

1) FSROCA Watershed Area is as shown in Appendix B
2) Active Area Run-off volume based on a 25-year, 24-hr storm
3) Assume exposed fly and bed ash, and partially reclaimed area exist in FSROCA
4) Storm water runoff volumes are estimated using the Curve Number method as described in USDA's Urban Hydrology for Small Water Sheds (TR-55)

Area that Generates Run-off

FSROCA – Exposed Ash Area:	41	acres
FSROCA – Exposed Ash Area:	1,785,960	sf
FSROCA – Partially reclaimed area:	80	acres
FSROCA – Partially reclaimed area:	3,484,800	sf

Design Rainfall

25-Yr, 24-Hr Storm (NOAA Atlas 14): 8.02 in

Curve Numbers

Assumptions:

- For exposed fly and bed ash, use CN = 94
- For partially reclaimed area, use CN = 72

Calculate Weighted Curve Number for SROCA Watershed

Description	Area (sf)	CN	Area X CN
Exposed Fly and Bed Ash	41	94	3,854
Partially Reclaimed Area	80	72	5,760
	121		9,614

Weighted Curve Number = (Sum of CN X A) /(Total Area)

Weighted Curve Number = 79.5

APPENDIX D2

LUMINANT GENERATION COMPANY, LLC
MARTIN LAKE STEAM ELECTRIC STATION
A1 AREA LANDFILL - CURRENT CONDITIONS
RUN-OFF CALCULATIONS - FORMER SOUTH RUN-OFF COLLECTION AREA

Calculate Run-Off Volume Using TR-55 Procedures

1) Calculate Potential Retention of Water (S). Assume this represents water adsorbed by ash and protective cover (non free water)

S = (1000/CNW)-10

where: S = Potential Retention of Water, inches
CN = Curve Number for Site

S = 2.59 inches

2) Calculate Depth of Runoff (Q)

Q = [(P-0.2S)^2]/[P-0.8S)]

where: Q = Depth of run-off generated, inches
S = Potential Retention of Water, inches
P = Design rainfall, inches

Q = 5.58 inches

3) Calculate Volume of Run-off from Watershed

V = Q X A

where: Q = depth of run-off generated, ft
A = Total Area, sf

Q = 5.58 inches
Q = 0.46 feet
Area = 5,270,760 sf

Watershed Run-off Volume: 2,450,812 cf

4) Calculate Volume of Precipitation on FSROCA

V= surface area (sf) X design storm precipitation (ft)

FSROCA Surface Area = 260,880 sf
25-Yr, 24-Hr Storm (NOAA Atlas 14) 8.02 in
25-Yr, 24-Hr Storm (NOAA Atlas 14) 0.67 ft

Volume of Precip on FSROCA: 174,355 cf

Total Volume to FSROCA: 2,625,167 cf

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