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October 15, 2021
File: 21.0056984.00

Mr. George Streit
george.streit@nrgenergy.com
Dunkirk Power LLC
106 Point Drive North
Dunkirk, NY 14150

Re: Five Year Plan Review for CCR Landfill Run-On and Run-Off Control System
Dunkirk Power CCR Landfill
Van Buren Road
Pomfret, New York

Dear Mr. Streit:

GZA GeoEnvironmental of New York (GZA) presents this five-year plan review for the Run-On and Run-Off Control System Plan to Dunkirk Power LLC (Dunkirk) for the existing coal combustion residuals (CCR) landfill located at the Dunkirk Power facility in Pomfret, New York (Site). This Run-On and Run-Off Control System Plan review is required by the United States Environmental Protection Agencies (USEPAs) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, as presented in the Federal Register Volume 80 No 74 dated April 17, 2015. In accordance with the CCR Rule (40 CFR §257.81(c)(4)), owners/operators of CCR units must prepare periodic run-on and run-off control system plans required by paragraph 40 CFR §257.81(c)(1) every five years. The initial Run-On and Run-Off Control System Plan was completed with a report issued on October 17, 2016. The information in this report is subject to the Limitations in **Attachment 1**.

In accordance with §257.81, the owner or operator of an existing CCR landfill must design, construct, operate and maintain the landfill in accordance with 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-hr, 25-year storm; and

- A run-off control system from the active portion of the CCR unit to collect and control at least the stormwater volume resulting from a 24-hr, 25-year storm. The run-off from the active portion of the CCR unit must be handled in accordance with surface water requirements under §257.3-3.

1.0 Site Background

The active CCR landfill cells for the Site are identified as Phase 2, Cells A and B-1. The Site landfill cells identified as Phase 1, Cells A and B (excluding a small portion of the northern Phase 1 Cells A and B) and the eastern portion of Phase 2, Cell A have a final cover system and are considered closed and therefore are not addressed in this run-on and run-off control system plan review. According to the Site Operator, the constructed cell designated as Phase

2, Cell B-2, located adjacent to the west of Phase 2, Cell B-1, has never received CCR waste. However, this cell is connected to the Site landfill leachate collection system and is permitted (ID#9-0658-00021/00008) with the New York State Department of Environmental Conservation (NYSDEC) to accept CCR and other associated wastes generated from the Dunkirk Power facility through May 22, 2021. We note the recently expired permit is currently undergoing the renewal process with NYSDEC for another 10-year period. A Site location map for the Dunkirk CCR landfill is attached as **Figure 1.**

The Dunkirk landfill is operated to limit the mixing of contact water (i.e., stormwater from active CCR cells) and stormwater from closed portions of the CCR landfill. The active portions of the landfill were regraded and covered in 2019 with a grassy 12-inch layer of clean soil temporary cover over the exposed CCR waste material, thereby reducing the potential for contact water generation. Stormwater emanating from closed portions of the landfill is directed to surface water body discharge points by perimeter berms and ditches. Surface water runoff from the active CCR areas is collected within the active areas and contained and managed as landfill leachate. Through site grading activities, and the creation of small berms, contact water is directed down the side slopes to the lower points where a perimeter ditch and/or berm is created at the topographic low point. Here, the contact water is allowed to infiltrate to the subsurface and become part of the leachate that is eventually pumped to the settling pond located on the southern portion of the property, beyond the landfill. Discharge from the leachate settling ponds is done in accordance with the facility's NYSDEC SPDES permit.

2.0 RUN-ON CONTROL SYSTEM

The run-on control system for the Dunkirk Landfill consists of perimeter roads, ditches and grading that is sloped away from the disposal area to prevent and minimize stormwater run-on. As a practical matter, the majority of the active portions of the landfill (i.e., designated "SB" areas) are at high points and surrounded by closed, covered cell areas and perimeter access roads. Thus, there is no appreciable opportunity for stormwater run-on to the active cells. **Figure 2** shows the general surface topography around the Site. Groundwater generally flows away from the Site and eventually to Lake Erie. The CCR Landfill is comprised of a portion of Phase 2 Cell A and a portion of Phase 2 Cell B. As shown in **Figure 3**, the Active portions of CCR Phase 2 Cells A&B are bounded by an access roadway and a ditch along the north side, an intermediate berm along the west side adjacent to the unused Phase 2 Cell B2, and the ground surface slopes away from the disposal area along the east and south sides. Perimeter ditches intercept whatever run-on may be generated from the roadway embankments. Stormwater around the cell will flow west or south along the access roadway and into surface body discharge points. The Run-on control systems are in place to prevent the flow of stormwater onto the active portion of the CCR unit.

3.0 RUN-OFF CONTROL SYSTEM

Contact water generated from the design storm is collected and conveyed in a manner that does not allow contact water to discharge to an offsite surface water body outside of the CCR landfill. Storm water that is mixed with contact water is to be considered contact water. Because the active portions of the landfill have been previously covered with a temporary cover system (12 inches of grass-covered soil placed in 2019) all of the previously exposed CCR waste has been covered and therefore contact water is not expected to be generated from surface water runoff at the Site. Regardless, stormwater generated from the 25-year, 24-hour storm of the active cells will be conveyed into the perimeter ditches between the landfill and the access road/berm, which has enough storage capacity, where it is allowed to percolate into the landfill and to be managed as leachate. These ditches

act as temporary storage areas for the generated stormwater. In certain cases, the 25-year runoff from the active areas cannot be fully contained in the specific, small storage ditches. Under those instances, excess storm water shall be collected in the adjacent, un-used cell B-2 located to the west of the Active Cells which is connected to the active leachate transfer system. GZA's revised calculations and management of stormwater run-off from the active portion of the Cells are further described in Section 4.

4.0 HYDROLOGIC & HYDRAULIC CALCULATIONS

The inputs for this analysis were based on the information gathered by GZA, upon reviewing historical site drawings, updated topography, and other design documents made available to GZA by NRG Energy. The computer software HEC-HMS (v.4.8) developed by US Army Corps of Engineers Hydrologic Engineering Center was utilized for the analysis. The landfill contours were an amalgam of surface contours from various mapping from 2017 and 2018. GZA performed some cursory ground-truthing of the surface topography but did not attempt to independently verify these topographic surveys conducted by others.

GZA re-delineated the landfill and updated the contributing drainage area of each subbasin based on the revised topographic maps provided by NRG. All elevations refer to the vertical datum of IGLD 1955 to be consistent with previous design drawings and documents, unless otherwise noted.

4.1 25-YEAR 24-HOUR DESIGN STORM

The 25-year 24-hour storm is required for the run-off analysis for the CCR landfills. The 25-year 24-hour design storm was obtained by GZA from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Volume 10 precipitation frequency (PF) estimates. Table 1 provides the precipitation frequency estimates for the 2-, 5-, 10-, 25-, 50-, and 100-year 24-hour storm event. Similar to 2016 plan review, a design storm of 4.43 inches was used to develop a rainfall distribution (we note that the 2016 design storm rainfall was determined to be 4.42 inches). The Natural Resources Conservation Service (NRCS), standard rainfall distribution type III curve was used in this analysis to develop the Site's hyetograph.

Table 1: NOAA Atlas 14 Rainfall Depths

Recurrence Interval	24 Hours Rainfall depth (in)
2-year	2.43
5-year	3.10
10-year	3.66
25-year	**4.43**
50-year	5.00
100-year	5.61

4.2 HEC-HMS ANALYSIS

The Active Phase 2 Cell A and B (including Cell B-1 and B-2) were analyzed by GZA as one hydrologic system in HEC-HMS. The setup for the landfill model is included in **Attachment 2**. A summary of the hydrologic elements used for the analysis and the outputs are given below.

4.2.1 Inputs and Outputs for Active Phase 2 Cell A&B

Cell A and B has not been recently utilized and latest topographic maps provided by NRG indicated slight change in overall landscape and therefore re-delineation of the cell was similar to 2016 plan review. Active Phase 2 Cell A&B consists of three Subbasins which contains the contact stormwater within ditches around the north and west sides. The berm storage capacity is provided in **Attachment 2** and the available drainage area of each subbasin is provided in Table 2. Runoff from SB-1 discharges to a drainage channel along the north side at the toe of the slope. SB-2 contact stormwater discharges to a drainage channel along the western Active Cell boundary. Stormwater runoff from SB-3 discharges into a drainage channel at the southern end of an un-used cell identified as Phase 2 Cell B-2 as shown on **Figure 3**. Any excess runoff will potentially travel along the side slopes and flow into the unused Phase 2 Cell B-2. A runoff Curve Number (CN) of 74 was used since the landfill developed a vegetated cover in good condition. SB-1 and SB-3 contributing drainage area changed slightly compared to 2016 hydrological plan based on the updated topographic maps. SB-2 contributing drainage area increased significantly as it contains the un-used cell as part of the subbasin. This ensures the un-used cell has enough storage capacity to contain stormwater runoff from the active portions of the landfill and the design storm.

The Active Phase 2 Cell A&B parameters are identified below in **Table 2**. The input parameters from **Table 2** and the specified hyetograph were run through the HEC-HMS model. Outputs from the model are summarized in **Table 3**. The total volume in cubic feet is calculated from the total direct runoff over the sub-basin area.

Key elevations are as follows:

Subbasin Storage Area	Top Elev. at Maximum Storage Volume (ft, IGLD 1955)
SB-1 Berm	632.0
SB-2 Berm	632.0
SB-3 Berm	634.0

Table 2: HEC-HMS Watershed Input – Active Phase 2 Cell A&B

HEC-HMS Model	Subbasin	Drainage Area		Runoff Potential (SCS Curve Number)*	Watershed Lag Time (min)	Storage Capacity (cu.ft.)
		(sq mi)	(Acre)			
Active Phase 2 Cell A&B	SB-1	0.007434	4.76	74	4.0	15,847
	SB-2	0.014711	9.41	74	7.2	318,629
	SB-3	0.010733	6.87	74	3.3	16,086

*For the hydrologic analysis a curve runoff number (CN) of 74 was used for vegetated landfill slopes.

Table 3: HEC-HMS Watershed Outputs – Active Phase 2 Cell A&B

HEC-HMS Model	Subbasin	Peak Discharge (cfs)	Time of Peak (hr:mmhrs:min)	Total Direct Runoff (in)	Total Runoff Volume (cu.ft.)
Active Phase 2 Cell A&B	SB-1	5.3	12:30	1.91	32,989
	SB-2	10.2	12:30	1.91	65,276
	SB-3	7.6	12:30	1.91	47,627

The total runoff from the Site is approximately 43% of the total precipitation from the 25 year, 24hour storm event.

5.0 RESULTS

A comparison of available and required storage capacity for the Active Phase 2 Cells A & B are summarized in **Table 4** below. The table below compares the storage capacity for each Subbasins, the available storage within the Sedimentation Basin, and the volume of storage needed from the 25-year, 24-hour storm event.

Table 4: Cell A&B Available and Required Storage Capacity

HEC-HMS Model	Subbasin	Storage Capacity (cu.ft.)	Storage Needed (cu.ft.)	Storage Difference (cu.ft.)
Active Phase 2 Cell A&B	SB-1	15,847	32,989	(-17,142)
	SB-2	318,629	65,276	253,353
	SB-3	16,086	47,627	(-31,541)

The results indicated that storage capacity within the relatively limited drainage channels do not have the storage capacity to fully collect and control the generated stormwater from the 25-year, 24-hour storm. However, overflow from the drainage channels will drain into the un-used Phase 2 Cell B-2, located west of the Active Cells where it will be totally contained in the leachate collection system and managed by the leachate settling pond. The storage capacity within the un-used cell has the capacity of approximately 318,629 cu. ft., based on provided documents. The un-used Phase 2 Cell B-2 has the capacity to store the storage difference needed for the 25-year, 24-hour storm. The active cells A&B have the capacity to safely prevent run-off from the active portions of the CCR unit to the surrounding landscape. Stormwater runoff is collected and contained within active and un-used portions of the landfill.

PROFESSIONAL ENGINEER CERTIFICATION

The undersigned registered professional engineer is familiar with the requirements of §257.81(c)(4) periodic review for *Run-on and run-off controls for CCR landfills*. The undersigned registered professional engineer attests that this CCR Landfill Plan has been prepared in accordance with good engineering practice, including consideration of applicable state regulatory requirements and meets the requirements of §257.81(c), and that this plan is adequate for the NRG - Dunkirk Power. This certification was prepared as required by §257.81(c)(5).

Name of Professional Engineer: Daniel J. Troy, P.E.
Company: GZA GEOENVIRONMENTAL OF NEW YORK

Signature: _____
Date: October 15, 2021
PE Registration State: New York
PE Registration Number: 081139-1
Professional Engineer Seal:

We trust this information satisfies your needs for this project.

Sincerely,

GZA GEOENVIRONMENTAL OF NEW YORK

Daniel J. Troy, P.E.
Senior Project Manager

Firas M. Rababaa
Engineer I

Bart A. Klettke, P.E.
Principal

Peter H. Baril, P.E.
Consultant Reviewer

Attachments: Attachment 1 – Limitations
Attachment 2 – HEC-HMS Basin Model [Cells A&B]
Figure 1 - Site Location Map
Figure 2 - Area Topography
Figure 3 - Active Phase 2 Cells A and B

ATTACHMENT 1 - LIMITATIONS

USE OF REPORT

1. GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of the Client for the stated purpose(s) and location(s) identified in the Report. Use of this Report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. Our findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Report and/or proposal, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).

3. The interpretations and conclusions presented in the Report were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of the described services. The work described in this report was carried out in accordance with the agreed upon Terms and Conditions of Engagement.

4. GZA's flood evaluation was performed in accordance with generally accepted practices of qualified professionals performing the same type of services at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made. The findings of the risk characterization are dependent on numerous assumptions and uncertainties inherent in the risk assessment process. The findings of the flood evaluation are not an absolute characterization of actual risks, but rather serve to highlight potential sources of risk at the site(s).

5. Unless specifically stated otherwise, the flood evaluations performed by GZA and associated results and conclusions are based upon evaluation of historic data, trends, references, and guidance with respect to the current climate and sea level conditions. Future climate change may result in alterations to inputs which influence flooding at the site (*e.g*. rainfall totals, storm intensities, mean sea level, *etc*.). Such changes may have implications on the estimated flood elevations, wave heights, flood frequencies and/or other parameters contained in this report.

RELIANCE ON INFORMATION FROM OTHERS

6. In conducting our work, GZA has relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Any inconsistencies in this information which we have noted are discussed in the Report.

COMPLIANCE WITH CODES AND REGULATIONS

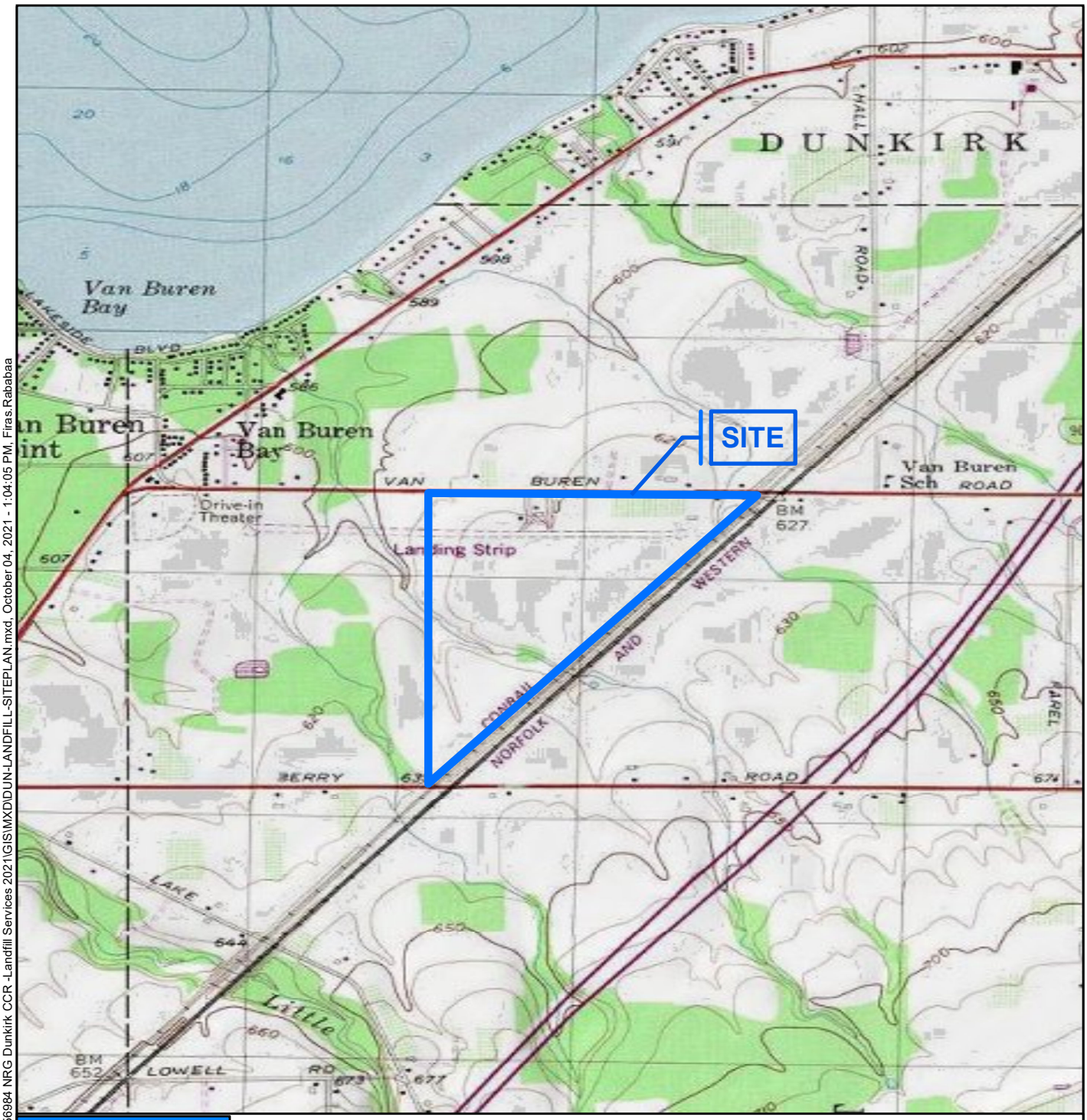
7. We used reasonable care in identifying and interpreting applicable codes and regulations necessary to execute our scope of work. These codes and regulations are subject to various, and possibly contradictory, interpretations. Interpretations with codes and regulations by other parties are beyond our control.

ADDITIONAL INFORMATION

8. In the event that the Client or others authorized to use this report obtain information on conditions at the site(s) not contained in this report, such information shall be brought to GZA's attention forthwith. GZA will evaluate such information and, on the basis of this evaluation, may modify the opinions stated in this report.

ADDITIONAL SERVICES

9. GZA recommends that we be retained to provide services during any future investigations, design, implementation activities, construction, and/or property development/ redevelopment at the Site. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.



NOTE:

1. DIGITAL TOPOGRAPHIC MAPS PROVIDED BY USGSSTORE.GOV

2. CONTOUR ELEVATIONS REFERENCE NAVD 88, CONTOURS ARE SHOWN IN FEET AT 10' INTERVALS.

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SCALE IN FEET

NO.	ISSUE / DESCRIPTION	BY	DATE

5-YR Plan Review for CCR Landfill Run-on/Run-off Control Plan
NRG DUNKIRK PLANT
DUNKIRK, NEW YORK

SITE LOCATION MAP

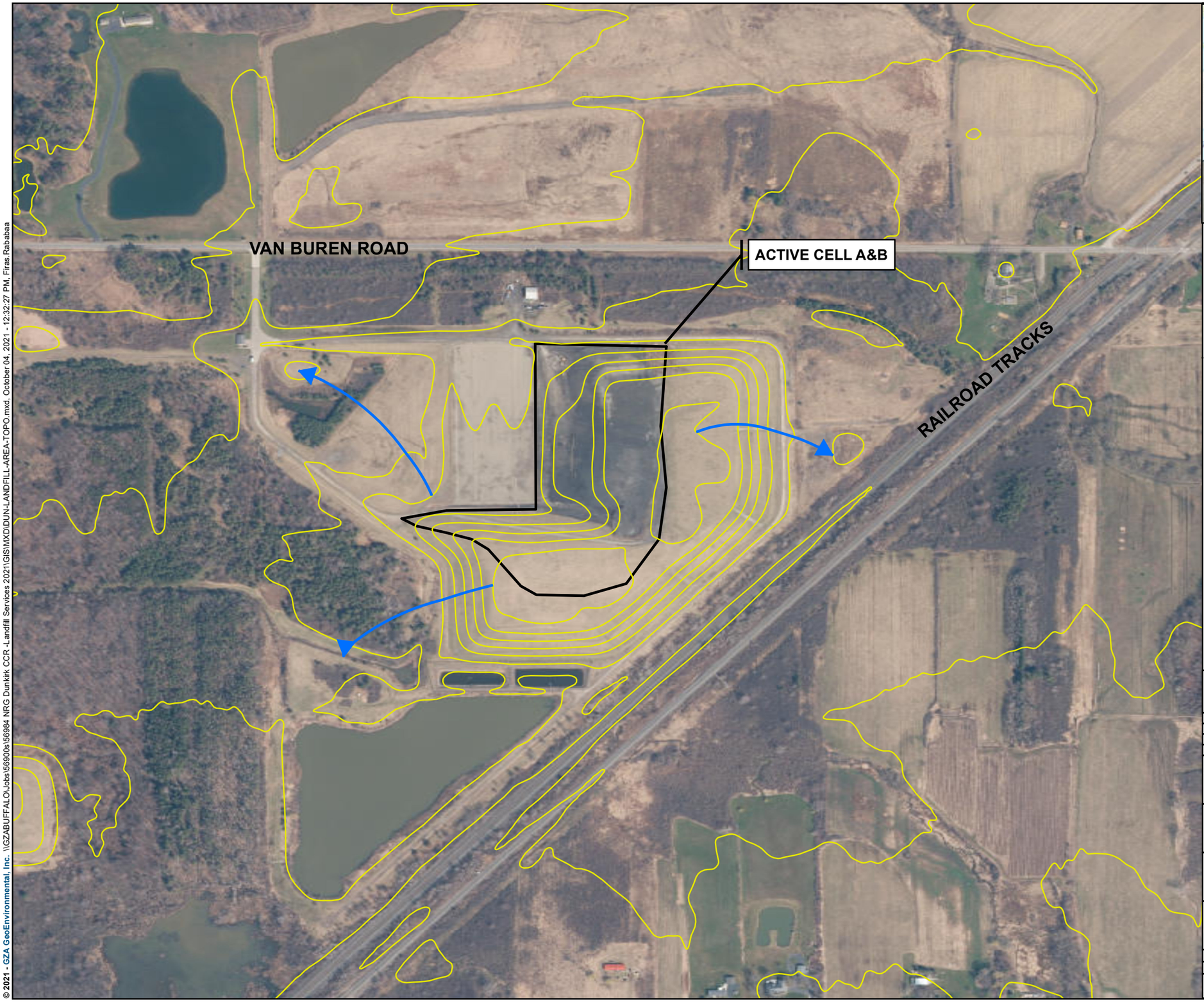
PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

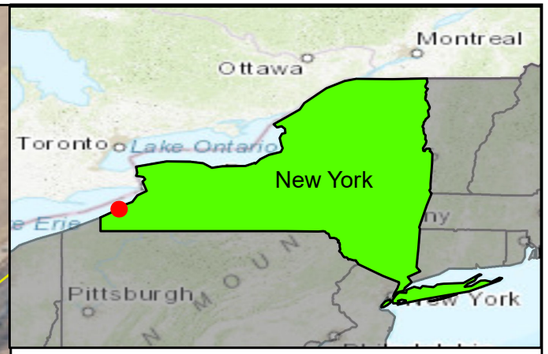
PREPARED FOR:
DUNKIRK POWER, LLC
106 POINT DRIVE NORTH
DUNKIRK, NY 14048

PROJ MGR:	DJT	REVIEWED BY:	BAK	CHECKED BY:	DJT
DESIGNED BY:	DJT	DRAWN BY:	FMR	SCALE:	AS SHOWN
DATE:	SEPTEMBER 2021	PROJECT NO:	21.0056984.00	REVISION NO:	

FIGURE 1

SHEET NO: 01 OF 03





Legend

- APPROXIMATE FLOW PATH
- APPROXIMATE SURFACE CONTOURS
- APPROXIMATE ACTIVE CELL BOUNDARY

N
W E
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0 250 500 1,000
SCALE IN FEET

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID,

NO.	ISSUE / DESCRIPTION	BY	DATE
XX	XXXX	XX	XXX

5-YR PLAN REVIEW FOR CCR LANDFILL RUN-ON/RUN-OFF CONTROL PLAN
NRG DUNKIRK PLANT
DUNKIRK, NEW YORK

AREA TOPOGRAPHY

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
DUNKIRK POWER, LLC
106 POINT DRIVE NORTH
DUNKIRK, NEW YORK

PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE 2
DESIGNED BY: DJT	DRAWN BY: FMR	SCALE: AS SHOWN	
DATE: SEPTEMBER 2021	PROJECT NO: 21.0056984.00	REVISION NO:	SHEET NO: 02 OF 03

STORAGE CAPACITY

SB-1 DITCH

PHASE 2
CELL "B-2"

SB-1
4.76 ACRES

PHASE 2
CELL "A"

PHASE 2
CELL "B-1"

SB-2
9.41 ACRES

PHASE 2
CELL "A"

SURFACE RUNOFF
CONTROL DITCH

INTERMEDIATE
EXISTING
BERM

STATION BASIN
(EXISTING)

EXISTING ACESS
ROAD

UN-USED CELL

SB-3 NORTH
DITCH

HAUL ROAD

HAUL ROAD

SB-3
6.87 ACRES

EXISTING UPPER HAUL ROAD

PHASE 1
CELL "A" & "B"

SURFACE RUNOFF
CONTROL DITCH

PHASE 1
CELL "A"

PHASE 1
CELL "B"

FINAL
COVER

SEDIMENTATION
BASIN

SEDIMENTATION
BASIN

MH13

MH4

MH5

630 640 650 660 670 680

LEGEND:

- ACTIVE CELL AREA
- 650 — 10' CONTOUR INTERVAL (MAJOR)
- 652 — 2' CONTOUR INTERVAL (MINOR)
- SURFACE RUNOFF CONTROL DITCH
- DITCH
- MH 10 — MANHOLE
- CULVERT
- SLOPE DOWN
- BRUSH ROW
- UTILITY POLE
- UUV — UNKNOWN UTILITY VALVE
- SCP 000/WCP 000 — CONTROL POINT

NOTES:

1. BASE MAP WAS OBTAINED FROM DRAWINGS PROVIDED BY NRG ENERGY
2. ALL ELEVATIONS REFER TO THE VERTICAL DATUM OF IGLD 1955.

N W E S

0 100' 200' 400' 600'

SCALE IN FEET 1" = 100'

NO.	ISSUE/DESCRIPTION	BY	DATE

DUNKIRK POWER LLC
106 POINT DRIVE NORTH
DUNKIRK, NY 14048

ACTIVE CELLS A & B

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
NRG ENERGY LLC

PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE 3
DESIGNED BY: FMR	DRAWN BY: FMR	SCALE: 200	
DATE: SEP 2021	PROJECT NO. 21.0056984.00	REVISION NO.	SHEET NO. 3 OF 3

GZA-\\GZABUFFALO\Jobs\56900s\56984 NRG Dunkirk CCR -Landfill Services 2021\Dunkirk documents\CAD Files\2020-DUN-COMPOSITE - Standard\xve-DKRK-00 Progression Map.dwg [Layout1] October 04, 2021 - 2:12pm Firas.Rababaa