Proactive by Design

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

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October 17, 2016
File: 21.005679.00

Mr. Kevin Schroeder
Kevin.schroeder@nrgenergy.com
Huntley Power LLC
Tonawanda, NY 14150

Re: Existing CCR Landfill Run-on & Run-off Control Plan
Huntley Generating Station Ash Landfill
Tonawanda, New York

Dear Mr. Schroeder:

GZA GeoEnvironmental of New York (GZA) presents this Initial Run-On and Run-Off Control System Plan to Huntley Power LLC (Huntley) for the existing coal combustion residuals (CCR) landfill located at the Huntley Power facility in Tonawanda, New York (Site). This Initial Run-On and Run-Off Control System Plan 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)), owners/operators of CCR units must prepare an initial run-on and run-off control system plan to document how the control systems have been designed and constructed to meet the applicable requirements of the CCR Rule and supported by engineering calculations.

In accordance with §257.81, the owner or operator and 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 water 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 Cells A, C and D. The remaining landfill cells at the Site are already closed and therefore are not addressed in this run-on and run-off control system plan. Portions of the side slopes of Cells A and D have previously been closed with a final cover system and only the upper tier of each cell remain open and active. An area designated as future Cell B, located between Cells A and C, was never constructed. The limits of the active cells included in this closure plan are shown on the attached figures.

The Huntley facility's CCR landfill is currently permitted (ID#9-14648-00089/00002) with the New York State Department of Environmental Conservation (NYSDEC) to accept CCR and associated waste generated from the Huntley Power facility through January 3, 2023.

2.0 RUN-ON CONTROL SYSTEM

The run-on control system for the Huntley Landfill consists of perimeter roads, ditches and grading 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. Thus, there is no appreciable opportunity for storm water run-on to the active cells. As shown in Figure 2, surface grades around the Site are sloped towards River Road and the associated Town of Tonawanda Storm water collection system. Cell A is comprised of an "Active" portion and a "Closed" portion. As shown in Figure 3, the Active Cell A elevation grades are higher than the Closed Cell A elevation grades and other surrounding grades. The Closed Cell A and other surrounding features are lower in elevation and therefore do not present a potential for stormwater run-on. Shown in Figure 4, Cell D is also higher in elevation from the surrounding features and does not present a potential for stormwater run-on.

Shown in Figure 4, Cell C is bounded by an on-Site perimeter road and ditches along the north and south sides, a berm along the west side, and the ground surface slopes away from the disposal area along the east side. Perimeter ditches intercept the minimal run-on from the roadway embankments. Storm water run-on around the cell will flow west along the Perimeter Road and into surface body discharge points. Therefore, in-place run-on control systems prevent the flow of stormwater onto the active portion of the CCR unit.

3.0 RUN-OFF CONTROL SYSTEM

Surface storm water (i.e., contact water) generated from within the active cells of the landfill are collected and conveyed in a manner that does not allow contact water to discharge to an off-site surface water body. Stormwater that is mixed with contact water is to be considered contact water. Run-off control system for the Active Cell Landfills will consist of separation of clean stormwater from contact with water from the CCR. Contact water is rainfall that interacts with the CCR on the active landfill and is to remain within the confines of the active landfill (not to comingle with the storm water). The contact water will percolate into the CCR waste and become leachate. The Huntley landfills are designed to transfer the leachate to the Town of Tonawanda sanitary sewer system for eventual treatment. The closed portions of the landfill are equipped with the sufficient cover (vegetated 6-inches topsoil, 18-inched barrier protection soil, geomembrane over CCR) and therefore stormwater from closed sections is allowed to discharge off of the site, as it has not been in contact with the exposed CCR ash.

Contact water generated from the 25-year, 24-hour storm is collected, controlled and conveyed via temporary berms to small storage areas in various sub-areas of the active portions of the landfill. Calculations and management of stormwater run-off from the active portion of the Cells are further described in the following sections.

4.0 HYDROLOGIC & HYDRAULIC CALCULATIONS

The inputs for this analysis were based on the information gathered by GZA, upon reviewing historical drawings and other design documents made available to GZA by NRG Energy. The computer software HEC-HMS (v.3.5) developed by US Army Corps of Engineers Hydrologic Engineering Center was utilized by GZA for the analysis.

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 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. A design storm of 3.97 inches was used to develop a rainfall distribution. 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	2.04
5-year	2.74
10-year	3.27
25-year	**3.97**
50-year	4.5
100-year	5.03

4.2 HEC-HMS ANALYSIS

The Active Cell A and the Active Cells C and D were analyzed as two independent hydrologic systems in HEC-HMS. The setup for the two landfill models are included in Attachment A. A summary of the hydrologic elements used for the analysis and the outputs are given below.

4.2.1 Inputs and Outputs for Active Cell A

Active Cell A consists of three sub-basins which contain the contact storm water within 1.5-foot high earthen berms around the cell. The berm dimensions are provided in Attachment A and the available storage between the berm and the landfill is provided in Table 2. Cell A has not been recently utilized and has heavy vegetation growth, therefore a Curve Number of 74 was used for the runoff potential. The Active Cell A parameters are identified below in Table 2. The parameters from Table 2 and the specified hyetograph were ran 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 Elevation at Maximum Storage Volume (ft, IGLD 1955)
SB-1 Berm	635.5
SB-2 Berm	630.0
SB-3 Berm	649.5

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

HEC-HMS Model	Subbasin	Drainage Area		Runoff Potential (SCS Curve Number)*	Watershed Lag Time (min)	Storage Capacity (cu.ft.)
		(sq mi)	Acres			
Active Cell A	SB-1	0.001210	0.77	74	5.6	4,777
	SB-2	0.003025	1.94	74	5.9	12,860
	SB-3	0.001017	0.65	74	2	4,680

Table 3: HEC-HMS Watershed Ouputs – Active Cell A

HEC-HMS Model	Subbasin	Peak Discharge (cfs)	Time of Peak	Total Direct Runoff (in)	Total Runoff Volume (cu.ft.)
Active Cell A	SB-1	0.7	12:30	1.57	4,415
	SB-2	1.7	12:30	1.57	11,032
	SB-3	0.6	12:30	1.57	3,710

The total contact water runoff from the Site is approximately 33% of the total precipitation from the 25-year, 24-hour storm. The storage volume that is provided by the 1.5-foot berms provide appear to be sufficient to contain the contact water runoff on site, allowing it to percolate into the existing leachate collection system.

4.2.2 Inputs and Outputs for Active Cell C and D

Active Cells C and D were divided into four sub-basins ("SB"). Similarly, contact runoff are contained on-site using small earthen "training" berms and perimeter ditches/storage areas at topographic low points around the north, south and west sides. Those storage areas are shown on Figure 4. Runoff from SB-1 discharges into a ditch along the north side of the cell. Contact water from SB-2 is contained within berms on top of the CCR landfill (elevation 638) within the northeast corner of Cell C. Any overflow from SB-2 discharges down the side slope and is captured in the SB-1 ditch. Contact water from SB-3 is contained within berms at the top of the CCR landfill (elevation 637) within the southeast corner of Cell C. Overflow from SB- 3 discharges down the side slope, travels along the south ditch and is captured in SB-4 ditch/storage area in the southwest corner of the landfill. Runoff from SB-4 discharges into the ditch along the southwest side of the cell. Dimensions of the ditches are provided in Attachment A. Table 4 summarized the available storage within each Subbasin. Cell C and D surface is exposed ash and therefore a SCS Curve Number of 80 was used for estimating the runoff potential. The Active Cell C and

D parameters are identified below in Table 4. The parameters from Table 4 and the specified hyetograph are ran through the HEC-HMS model. Outputs from the model are then summarized in Table 5. The total volume in cubic feet is calculated from the total direct runoff over the Subbasin area.

Key elevations are as follows:

Subbasin Storage Area	Top Elevation at Maximum Storage Volume (ft, IGLD 1955)
SB-1 Ditch	605.0
SB-2 Berm	638.0
SB-3 Berm	637.0
SB-4 Ditch	598.0

Table 4: HEC-HMS Watershed Input – Active Cells C&D

HEC-HMS Model	Subbasin	Drainage Area		Runoff Potential (SCS Curve Number)	Watershed Lag Time (min)	Storage Capacity (cft)
		(sq mi)	(Acres)			
Active Cell C&D	SB-1	0.003954	2.53	80	4.8	18,750
	SB-2	0.004622	2.96	80	3.7	25,906
	SB-3	0.001861	1.19	80	5.6	7,924
	SB-4	0.005407	3.46	80	6.7	30,800

Table 5: HEC-HMS Watershed Output – Active Cell C&D

HEC-HMS Model	Subbasin	Peak Discharge (cfs)	Time of Peak	Total Direct Runoff (in)	Total Volume (cft)
Active Cell C&D	SB-1	2.8	12:30	2.02	18,555
	SB-2	3.2	12:30	2.02	21,689
	SB-3	1.3	12:30	2.02	8,735
	SB-4	3.8	12:30	2.02	25,968

The total runoff from the Site is approximately 51% of the total precipitation from the 25-year, 24-hour storm event. The volume that is provided by the perimeter ditches and berms provides enough storage for the total direct runoff.

5.0 RESULTS

The results for the Active Cells A, C, & D are summarized in Table 6 and 7 below. The table below compares the storage capacity for each Subbasins and the volume of storage needed from the 25year, 24hour storm event.

Table 6: Active Cell A Storage

HEC-HMS Model	Subbasin	Storage Capacity (cft)	Storage Needed (cft)	Excess Storage Capacity (cft)	Water Elevation
Active Cell A	SB-1	4,777	4,415	362	635.4
	SB-2	12,863	11,032	1,831	629.82
	SB-3	4,680	3,710	970	649.3

Table 7: Active Cell C & D Storage

HEC-HMS Model	Subbasin	Storage Capacity (cft)	Storage Needed (cft)	Excess Storage Capacity (cfs)	Water Elevation
Active Cell C&D	SB-1	18,750	18,555	195	604.98
	SB-2	25,906	21,689	4,217	637.75
	SB-3	7,924	8,735	(-811)	(638.0)
	SB-4	30,800	25,968	4,832	597.58

The storage capacity of the Active Cell A has the storage within the 1.5-ft berms to safely contain the contact water from the 25-yr, 24-hr storm event. The storage capacity of the Active Cell C&D SB-3 does not have the full ability to contain the contact water from the 25-year, 24-hour storm, however, the overflow from Active Cell C&D SB-3 will travel into the Active Cell C&D SB-4. The Active Cell C&D SB-4 does have the extra storage to contain the overflow from the Active Cell C&D SB-3. The results indicated that the Active Cells have the ability to safely prevent run-off from the active portion of the CCR unit. The contact water is collected and controls the water volume resulting from the 25-year, 24-hour storm.

Attachment A

Cell A

HEC-HMS Basin Model [Cell A]

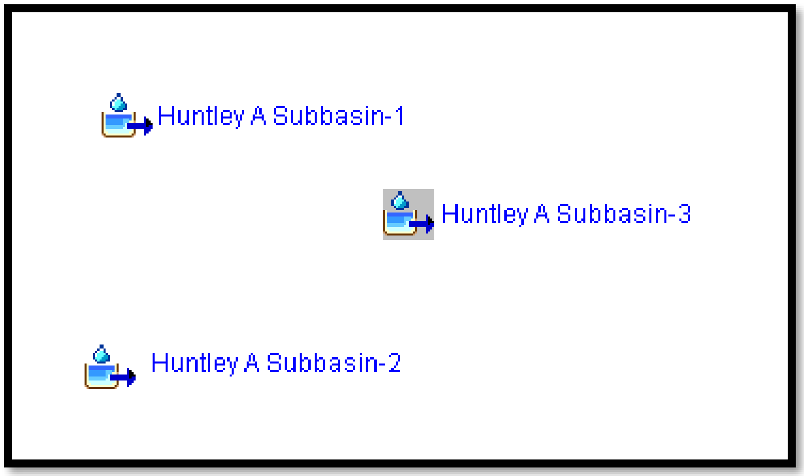
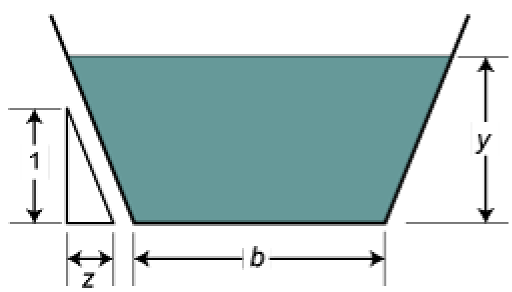


Table A-1: Cell A Subbasin Storage Calculations

HEC-HMS Model	Subbasin	b (ft)	y (ft)	z	Length	Containment Volume (cf)
Active Cell A	SB-1	20	1.5	3	130	4,777
	SB-2	20	1.5	3	350	12,863
	SB-3	2	1.5	3	480	4,680



Cell C&D

HEC-HMS Basin Model [Cell C&D]

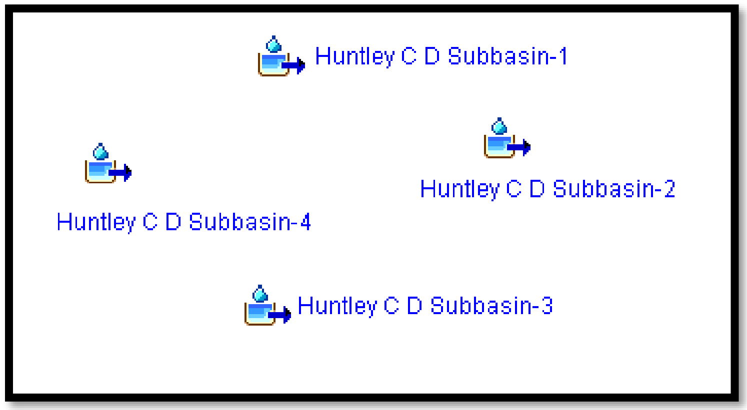


Table A-2: Cell C&D Subbasin 1&4 Storage Calculations

HEC-HMS Model	Subbasin	b (ft)	y (ft)	z	Length	Volume (cf)
Active Cell C & D	SB-1	16	3	3	250	18,750
	SB-4	10	4	3	350	30,800

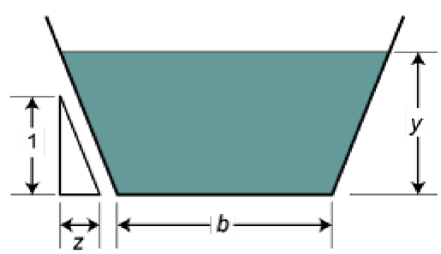


Table #: Cell C&D Subbasin 2&3 Storage Calculations

Active Cell C & D Subbasin 2	
Elevation (ft)	Planimeter (sq-ft)
635	285
636	2,338
637	6,544
638	16,739
Total	25,906

Active Cell C & D Subbasin 3	
Elevation (ft)	Planimeter (sq-ft)
635	600
636	2,843
637	4,481
Total	7,924

PROFESSIONAL ENGINEER CERTIFICATION

The undersigned registered professional engineer is familiar with the requirements of §257.81(c) *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 - Huntley 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 17, 2016
PE Registration State: New York
PE Registration Number: 081139-1

Professional Engineer Seal:

We trust this information satisfies your needs for this project.

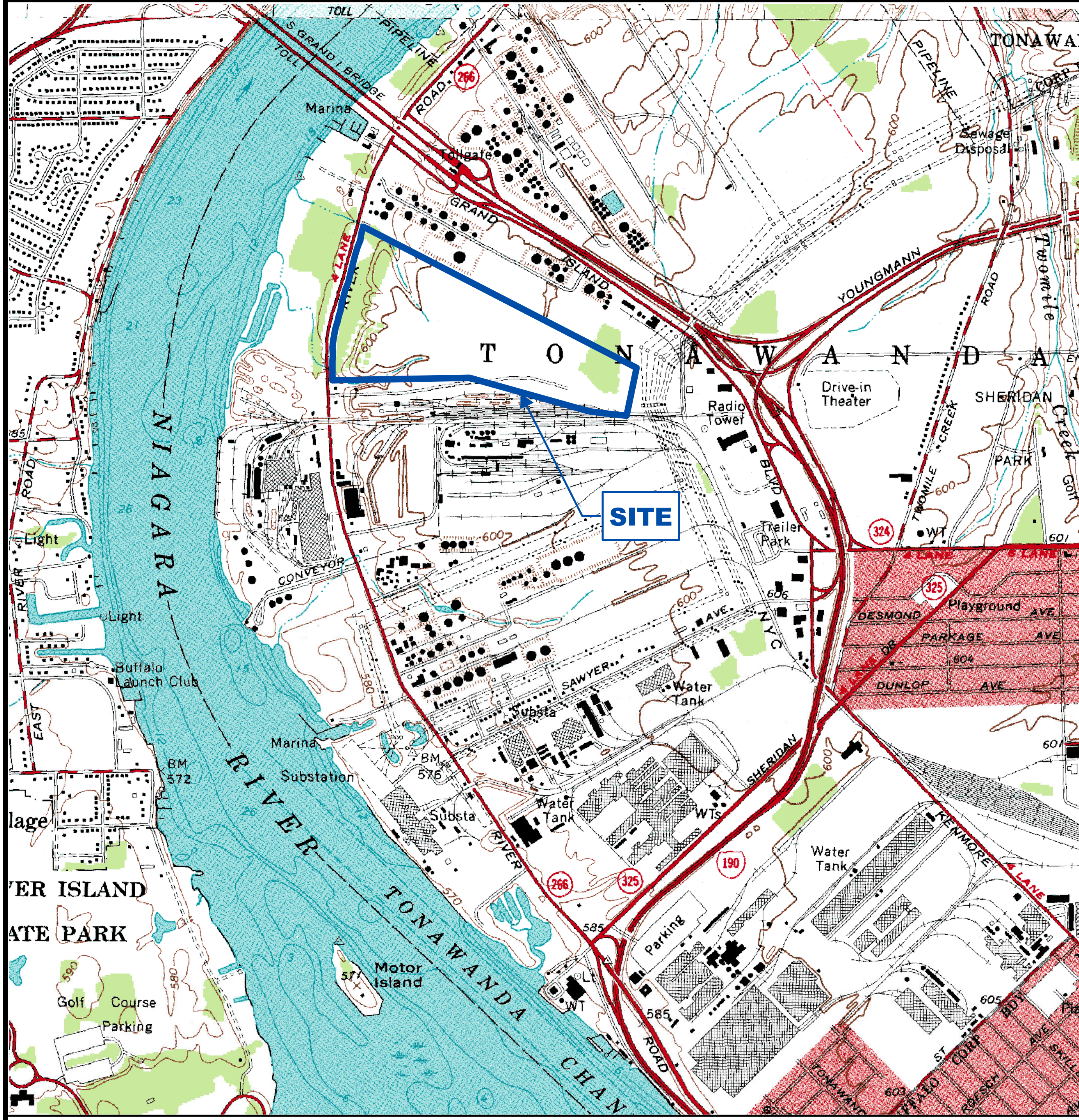
Sincerely,

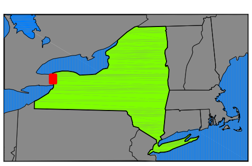
GZA GEOENVIRONMENTAL OF NEW YORK

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

Bart A. Klettke, P.E.
Principal

Attachments: Figure 1 - Site Location Map
Figure 2 - Area Topography
Figure 3 – Huntley Active Cell A
Figure 4 – Huntley Active Cells C and D





SOURCE:

BASE MAP FROM THE FOLLOWING USGS QUADRANGLE MAP:

BUFFALO NW, N.Y. - ONT. (1965)

0 1,000 2,000 4,000

SCALE IN FEET

N E S W

DIGITAL TOPOGRAPHIC MAPS PROVIDED BY USGSSTORE.GOV

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

HUNTLEY POWER LLC
3500 RIVER ROAD
TONAWANDA, NY

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
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PREPARED FOR:
NRG ENERGY

SITE LOCATION MAP

PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIG
DESIGNED BY: DJT	DRAWN BY: KLK	SCALE: 1 in = 2,000 ft	1
DATE: 10/12/2016	PROJECT NO. 21.0056797.00	REVISION NO.	SHEET NO. 1 OF 4

LEGEND

- APPROXIMATE PROPSERTY BOUNDARY
- APPROXIMATE SURFACE WATER FLOW
- APPROXIMATE SURFACE CONTORUS
- APPROXIMATE ACTIVE CELL BOUNDARIES

SOURCE

1) THIS MAP CONTAINS THE ESRI ArcGIS ONLINE WORLD IMAGERY MAP SERVICE, PUBLISHED DECEMBER 12, 2009 BY ESRI ARCIMS SERVICES AND UPDATED OFTEN. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.

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2) THE USE OF AERIAL PHOTOGRAPHY CAN OFTEN MAKE BUILDINGS AND OTHER SITE FEATURES APPEAR TO BE OVERLAPPING AND DISTORTED WHEN OVERLAID WITH ACTUAL SITE FEATURES.

3) THE APPROXIMATE LOCATION OF THE SITE BOUNDARY WAS OBTAINEDTHROUGH THE NEW YORK STATE ONLINE GIS CLEARING HOURSE MAPPING TOOL. THE PROGRAM NOTES THAT ALL PROPERTY BOUNDARIES ARE NOT SURVEYED AND ARE ONLY APPROXIMATE REPRESENTATIONS OF ACTUAL BOUNDARIES.

0 250 500 1,000
SCALE IN FEET

NO.	ISSUE / DESCRIPTION	BY	DATE
XX	XXXX	XX	XX

HUNTLEY POWER LLC
3500 RIVER ROAD
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AREA TOPOGRAPHY

PREPARED BY:
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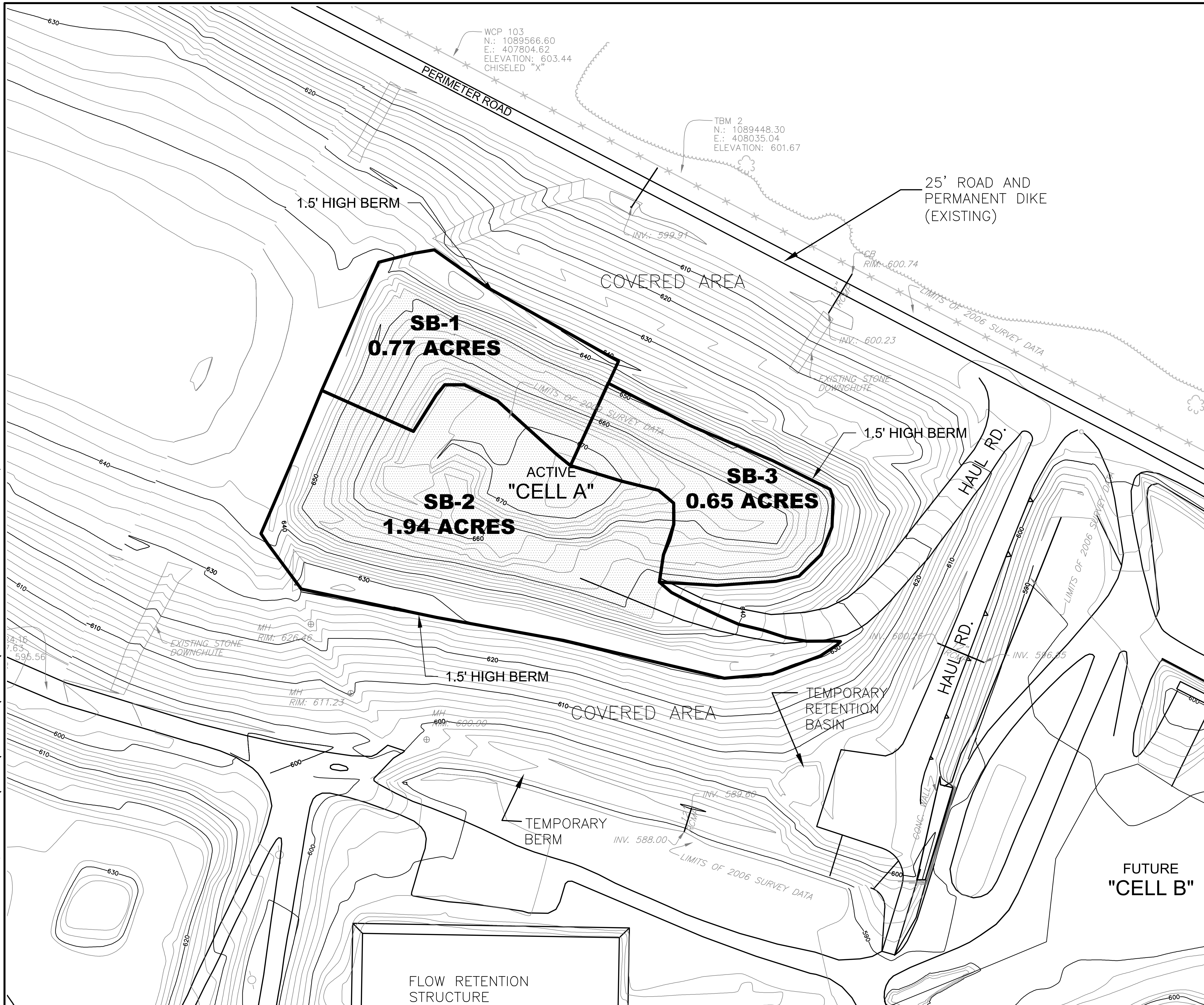
PREPARED FOR:
NRG ENERGY

PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIG
DESIGNED BY: DJT	DRAWN BY: KLK	SCALE: 1 " = 500 FEET	2
DATE: 10/13/2016	PROJECT NO. 21.0056797.00	REVISION NO.	SHEET NO. 2 OF 4

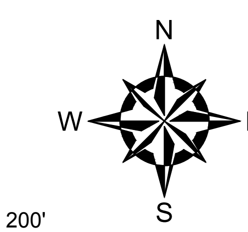


LEGEND:

- ACTIVE AREA
- 650 — 10' CONTOUR INTERVAL (MAJOR)
- 652 — 2' CONTOUR INTERVAL (MINOR)
- CULVERT
- BRUSH ROW

NOTES:

1. BASE MAP WAS OBTAINED FROM DRAWING 151229-DUN-SITE PLAN.dwg PROVIDED BY NRG ENGERGY.
2. ALL ELEVATIONS REFER TO THE VERTICAL DATUM OF IGLD 1955.



0 50' 100' 200'

SCALE IN FEET 1" = 100'

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HUNTLEY POWER LLC
3500 RIVER ROAD
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ACTIVE CELL A

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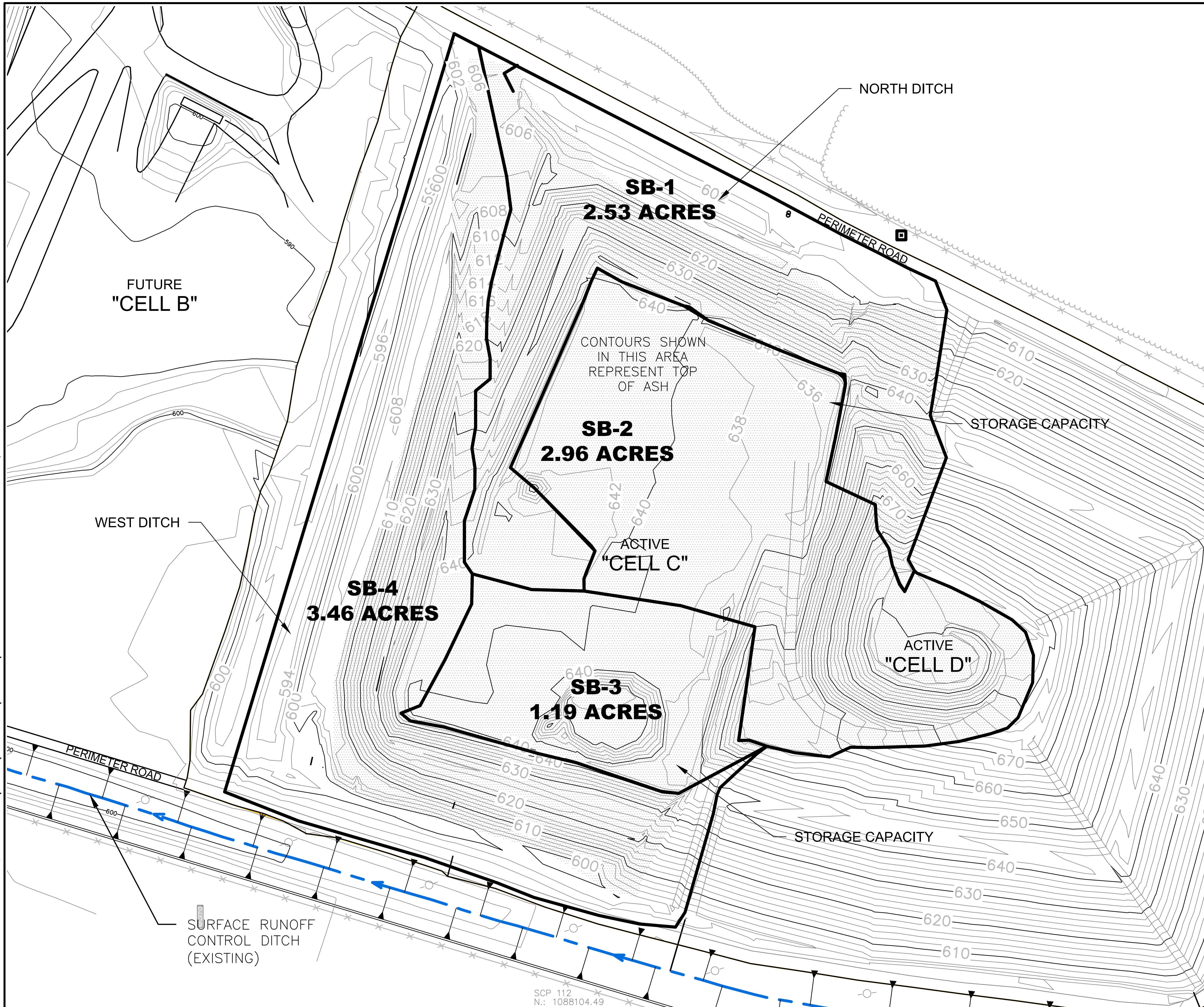
PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIG
DESIGNED BY: DJT	DRAWN BY: KLK	SCALE: see above	3
DATE: OCTOBER, 2016	PROJECT NO. 21.0056797.00	REVISION NO.	SHEET NO. 3 OF 4



LEGEND:

- ACTIVE AREA
- 10' CONTOUR INTERVAL (MAJOR)
- 2' CONTOUR INTERVAL (MINOR)
- SURFACE RUNOFF CONTROL DITCH
- STORAGE DRAINAGE PIPE
- MANHOLE
- CULVERT
- UTILITY POLE
- BRUSH ROW
- CONTROL POINT

NOTES:

1. BASE MAP WAS OBTAINED FROM DRAWING 151229-DUN-SITE PLAN.dwg PROVIDED BY NRG ENGERGY.
2. ALL ELEVATIONS REFER TO THE VERTICAL DATUM OF IGLD 1955.

NO.	ISSUE/DESCRIPTION	BY	DATE

HUNTLEY POWER LLC
3500 RIVER ROAD
TONAWANDA, NY

ACTIVE CELL C & D

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PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIG
DESIGNED BY: DJT	DRAWN BY: KLK	SCALE: see above	4
DATE: OCTOBER, 2016	PROJECT NO. 21.0056797.00	REVISION NO.	SHEET NO. 4 OF 4