TOWN OF CARMEL
PLANNING BOARD

60 McAlpin Avenue
Mahopac, New York 10541
Tel. (845) 628-1500 – Ext.190
www.ci.carmel.ny.us

CRAIG PAEPRER
Chairman

ANTHONY GIANNICO
Vice Chairman

BOARD MEMBERS
RAYMOND COTE
ROBERT FRENKEL
VICTORIA CAUSA
JOHN NUCULOVIC
NICHOLAS BALZANO

MICHAEL CARNAZZA
Director of Code Enforcement

RICHARD FRANZETTI, P.E.,BCEE
Town Engineer

PATRICK CLEARY, AICP,CEP,PP,LEED AP
Town Planner

PLANNING BOARD AGENDA
DECEMBER 14, 2023– 7:00 P.M.

PUBLIC HEARING

		TAX MAP #	PUB. HEARING	MAP DATE	COMMENTS
1.	Carmel Fire Department – 94 Gleneida Ave	44.14-1-24	12/14/23	12/1/23	Waiver of Site Plan Application

SITE PLAN

		TAX MAP #	PUB. HEARING	MAP DATE	COMMENTS
2.	Diamond Point Development – 4 Baldwin Place Rd	86.10-1-2 & 3		9/29/23	Site Plan
3.	Union Energy Center, LLC – 24 Miller Rd	86.11-1-14		12/4/23	Site Plan/Subdivision
4.	Serino, Americo – 205 East Lake Blvd	65.17-1-6		11/27/23	Special Site Plan (Boathouse)

MISCELLANEOUS

5. Minutes – 10/12/23, 10/25/23 & 11/09/23

INSITE
ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

December 1, 2023

Town of Carmel Planning Board
60 McAlpin Avenue
Mahopac, New York 10541

RE: Carmel Fire Department
94 Gleneida Avenue
Town of Carmel
TM# 44.14-1-24

Dear Chairman Paeprer and Members of the Board:

Please find enclosed five (5) copies of the following documents in support of minor proposed improvements for the above referenced project:

- Site Plans prepared by Insite Engineering, Surveying, and Landscape Architecture P.C. last revised December 1, 2023.
- Filed Map #1597 titled “Subdivision Plat of Property Prepared for Carmel Fire Department, Inc.” dated June 22, 1977 prepared by Burgess & Behr, P.C.
- Filed Map #1090 D titled “Easement Map No 5 Carmel Sewer District No 2” last revised December 14, 1966 prepared by Burgess & Behr.
- Filed Map #1090 U titled “Easement Map No 23 Carmel Sewer District No 2” last revised November 2, 1966 prepared by Burgess & Behr.

With respect to the comments received by the Director of Code Enforcement, Michael Carnazza, dated November 7, 2023 we offer the following:

- The shed will act as storage for items such as a table, lawn chairs and similar items to support the member’s gathering space.

With respect to the comments received by the Patrick Cleary, AICP, dated November 9, 2023 we offer the following:

- Based on our research, there does not appear to be a separate easement description filed for the sewer easement. File Maps #1597, #1090 D and #1090 U do not indicate restrictions as to what can be built over the easement; therefore it is believed the proposed improvements are permitted. The applicant understands that the proposed improvements would have to be removed or relocated if repair to the Town sewer line would be required in the future.
- No outdoor lighting is proposed.
- The three walled structure will be stick built with T1-11 siding with stain to match existing site features and an asphalt shingle roof. This information has been added to Drawing D-1.

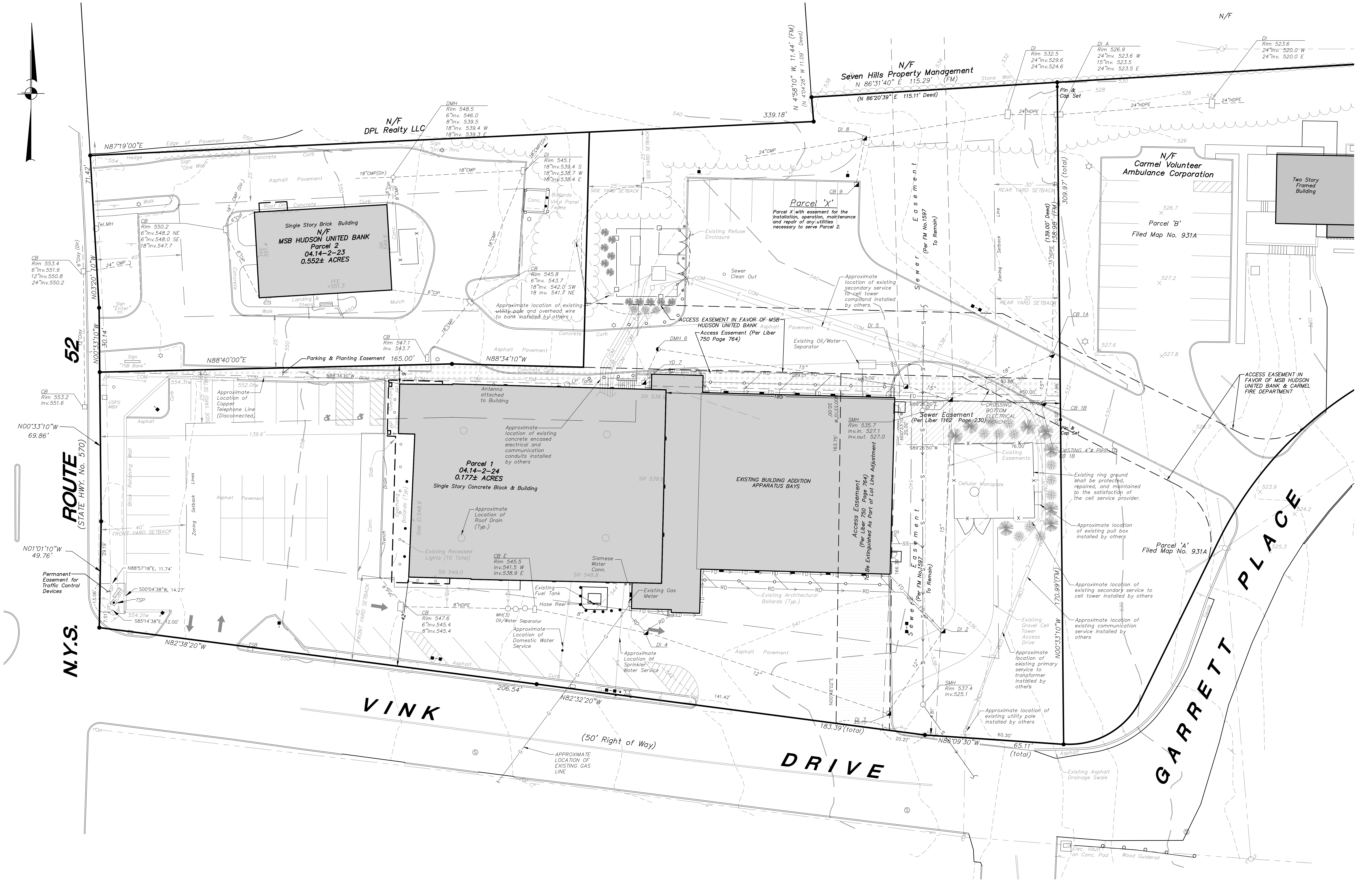
We respectfully request this project be placed on the December 14, 2023 Planning Board meeting for the discussion of the attached material. Should you have any questions or comments regarding this information, please feel free to contact our office.

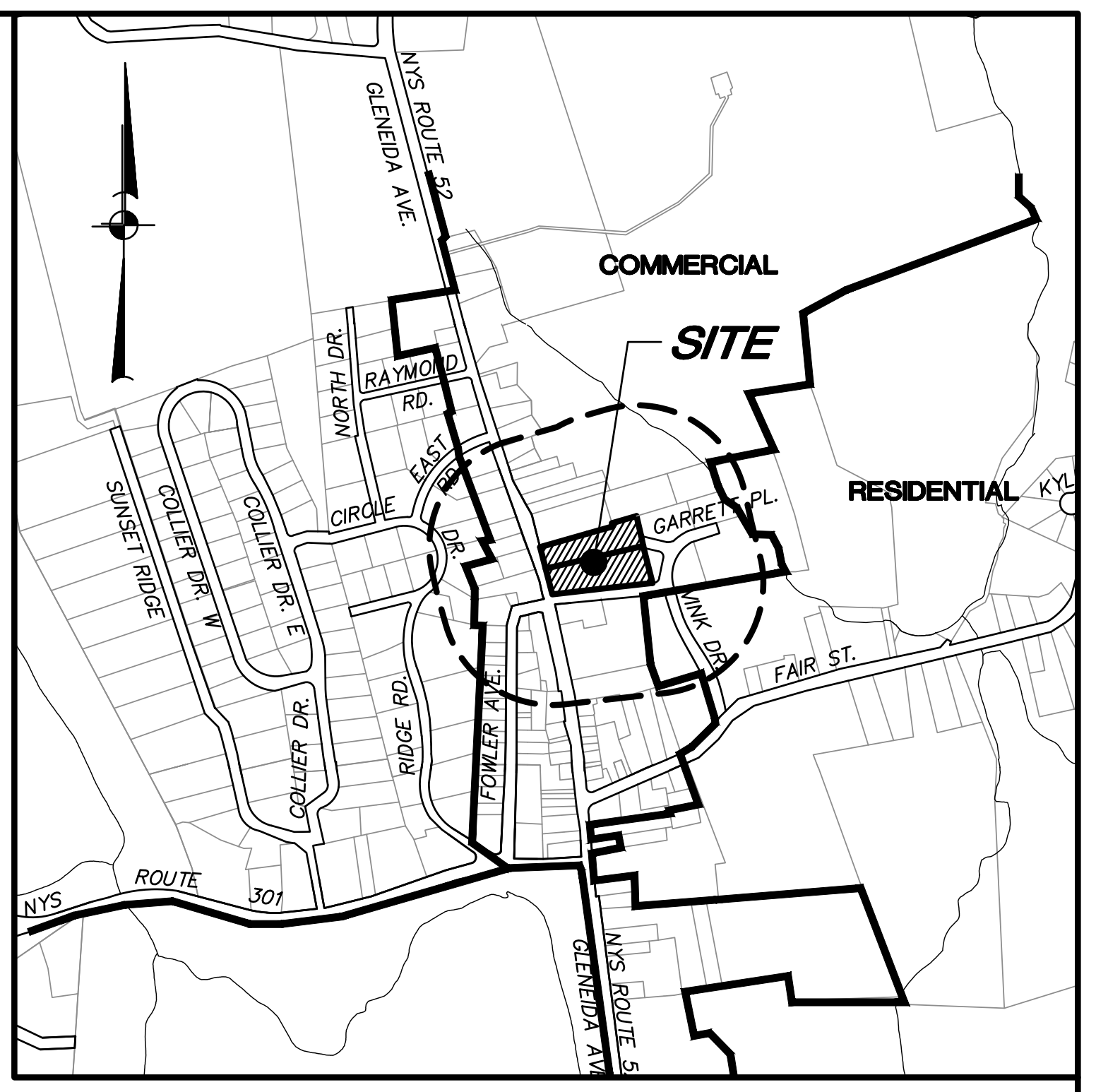
Very truly yours,

INSITE ENGINEERING, SURVEYING & LANDSCAPE ARCHITECTURE, P.C.

By: ______________________________
John M. Watson, PE
Principal Engineer

JMW/kmg
Enclosures
Cc: Michael Hengel / Carmel Fire Department





LOCATION MAP SCALE: 1" = 800'±

OWNER/APPLICANT:

CARMEL FIRE DEPARTMENT, INC.
94 GLENEIDA AVENUE
CARMEL, NY 10512

SITE DATA:

Zone:	Commercial
Total Acreage	2.2 AC
Tax Map No.:	44.14-1-24

GENERAL NOTES:

1. Location map boundary information shown hereon is taken from the Putnam County Tax Map.
2. Property boundary, site features and existing topography shown hereon is based upon fieldwork performed by Insite Engineering, Surveying & Landscape Architecture, P.C. completed December 13, 2019. Elevations shown hereon are in NAVD88. The contour interval is 2'.
3. Recently completed work shown hereon taken from design drawings from Insite Engineering, Surveying, and Landscape Architecture P.C. dated April 29, 2021.

LEGEND

- EXISTING PROPERTY LINE
- EXISTING EASEMENT
- EXISTING STONE WALL
- EXISTING CHAIN LINK FENCE
- EXISTING STOCKADE FENCE
- EXISTING CONCRETE CURB
- EXISTING DROP IN CONCRETE CURB
- TSB EXISTING TRAFFIC SIGNAL BOX
- EXISTING SIGN
- EXISTING UNDERGROUND DRAINAGE PIPE
- RD APPROXIMATE LOCATION OF EXISTING ROOF DRAIN
- COM APPROXIMATE LOCATION OF EXISTING UNDERGROUND COMMUNICATION LINE
- e APPROXIMATE LOCATION OF EXISTING UNDERGROUND ELECTRIC LINE
- WS APPROXIMATE LOCATION OF EXISTING UNDERGROUND WATER SERVICE LINE
- EXISTING CATCH BASIN
- MH EXISTING MANHOLE
- EXISTING POST MOUNTED LIGHT
- EXISTING RECESSED LIGHT
- WV EXISTING WATER VALVE
- CO EXISTING CLEAN OUT
- EXISTING UTILITY POLE
- 100 EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR
- 698.6 × EXISTING SPOT GRADE
- EXISTING HEDGE ROW
- EXISTING TREELINE
- EXISTING LIGHT POLE
- EXISTING LANDSCAPING
- FD EXISTING FOOTING DRAIN
- RD EXISTING ROOF DRAIN
- EXISTING CHAIN LINK FENCE

ADJOINER MAP SCALE: 1" = 400'±

500' ADJOINERS:

TOWN OF CARMEL:

1. Rodolfo A Roque
2. Susan P Alm
3. Marcel Carrillo
4. Louis Sclafani
5. Joyce McGlasson
6. Rick Montes
7. Edward M Schaffer
8. Rt 52 Housing Devel Fund Co
9. DPL Realty, LLC
10. Seven Hills Property Mgmt
11 Michael Yodice
12 Carmel Vol Ambulance Corp
13. John Mitchell
14. Hugo Hayes LLC
15. Harman Holdings Ltd
16. Harman Holdings Ltd
17. Main Woodland Trail
18. United States Postal Service
19. Ranric Enterprises Corp
20. 17 Fair St, LLC
21. Wenco Properties Corp
22. Mt Carmel Baptist Church
23. Kelley Cemetery Inc
24. 90 Gleneida Ave Corp
25. Mt Carmel Baptist Church
26. Wayne Ryder
27. Robert H Hall
28. Peter Fellbusch
29. Robert Hall
30. Carmel Board of Fire Commission
31. Longview Realty Corp
32. Maria J Casti
33. Mary T Kipp
34. Augusto Sacchetti
35. Marlon Ramlogan
36. Kevin D O'Donnell
37. JRP Associates LLC
38. Ermes Fernandez
39. David Chau
40. Yocasta Dass
41. Allan J Eyring
42. Michelle Hicks
43. BND Fowler Property, LLC
44. David Radovich
45. Fowler Ave Corp
46. William Rippey.
47. Richard McGlasson
48. 91 Gleneida LLC
49. 91 Gleneida LLC
50. Josephine Alessi
51. Eleanor Vidalis
52. James P McGuire
53. P & R Estate Corp
54. 99 Gleneida Avenue LLC
55. Carla D Taylor
56. Philip F Ford
57. Wayne Ryder
58. 105 Gleneida Ave Corp.

ALTERATION OF THIS DOCUMENT, UNLESS UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, IS A VIOLATION OF SECTION 7209 OF ARTICLE 145 OF THE EDUCATION LAW.

GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 inch = 20 ft.

NO.	DATE	REVISION	BY
1	12/1/23	GENERAL REVISIONS	KMG

INSITE
ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

3 Garrett Place
Carmel, NY 10512
(845) 225-9690
(845) 225-9717 fax
www.insite-eng.com

PROJECT:
CARMEL FIRE DEPARTMENT
MEMBERS SEATING AREA
94 GLENEIDA AVENUE, CARMEL, PUTNAM COUNTY, NEW YORK

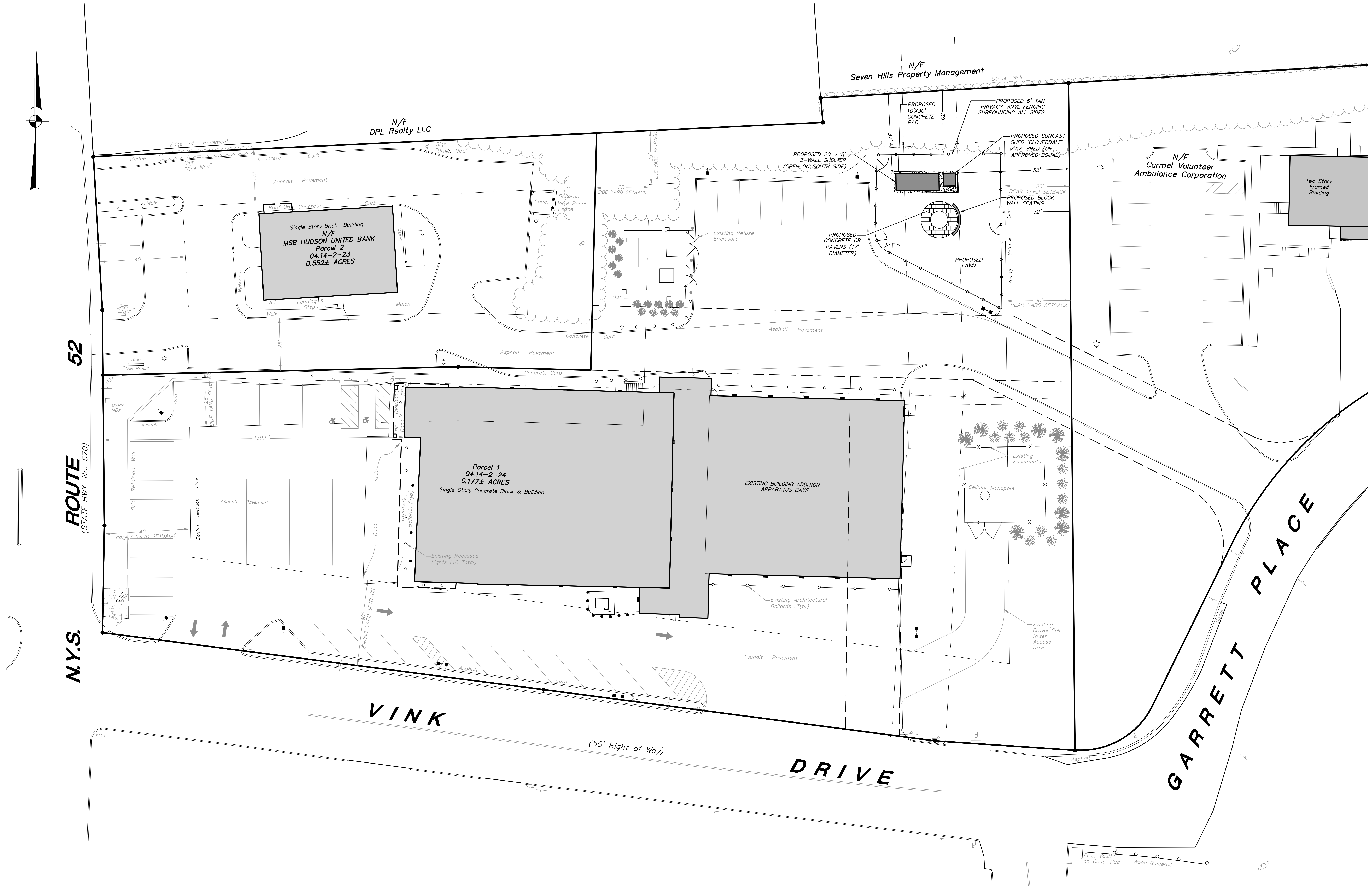
DRAWING:
EXISTING CONDITIONS
& REMOVALS PLAN

STATE OF NEW YORK
JOHN M. WATSON
No. 77950
LICENSED PROFESSIONAL ENGINEER

PROJECT NUMBER	19135.100	PROJECT MANAGER	J.M.W.
DATE	10-31-23	DRAWN BY	C.B.Z.
SCALE	1" = 20'	CHECKED BY	K.M.G.

DRAWING NO. EX-1

SHEET 1 / 5



LEGEND

━━━	EXISTING PROPERTY LINE
— — —	EXISTING EASEMENT
⬭⬭⬭	EXISTING STONE WALL
—X—	EXISTING CHAIN LINK FENCE
—□—	EXISTING STOCKADE FENCE
═══	EXISTING CONCRETE CURB
═╲_╱═	EXISTING DROP IN CONCRETE CURB
—o—	EXISTING SIGN
⌓⌓⌓	EXISTING HEDGE ROW
◡◡◡	EXISTING TREELINE
☼	EXISTING POST MOUNTED LIGHT
○	EXISTING RECESSED LIGHT
⚲	EXISTING UTILITY POLE
■	EXISTING LIGHT POLE
✳	EXISTING LANDSCAPING
—X—	EXISTING CHAIN LINK FENCE
—o—o—	PROPOSED VINYL FENCE
■	PROPOSED STRUCTURE

C ZONE REQUIREMENTS:

	Required/Permitted:	Existing:	Proposed:
Minimum Lot Area:	40,000 SF	94,830 SF	94,830 SF
Minimum Lot Width:	200'	261'±	261'±
Minimum Lot Depth:	200'	450'±	450'±
Minimum Road Frontage:	100'	574.7'±	574.7'±
Minimum Yard Setbacks:			
Front:	40'	42'±	41'±
Side:	25'	8.9'±*	8.9'±*
Rear:	30'	185'±	53'±
Maximum Building Height:	35'	Less Than 35'	Less Than 35'
Minimum Building Floor Area	5,000 SF	>5,000 SF±	26,900 SF±
Maximum Building Coverage:	30%	15%±**	22%±**

* Pre-existing nonconforming condition
** Includes a 775 sf allocation for structures within the cellular tower facility.
*** The applicant was granted a variance for a driveway less than 24' (§ 145-42 D) by the Town of Carmel Zoning Board of Appeals on August 27, 2020. The variance was granted for a 20' driveway.

GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 inch = 20 ft.

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NO.	DATE	REVISION	BY
1	12/1/23	GENERAL REVISIONS	KMG

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ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

3 Garrett Place
Carmel, NY 10512
(845) 225-9690
(845) 225-9717 fax
www.insite-eng.com

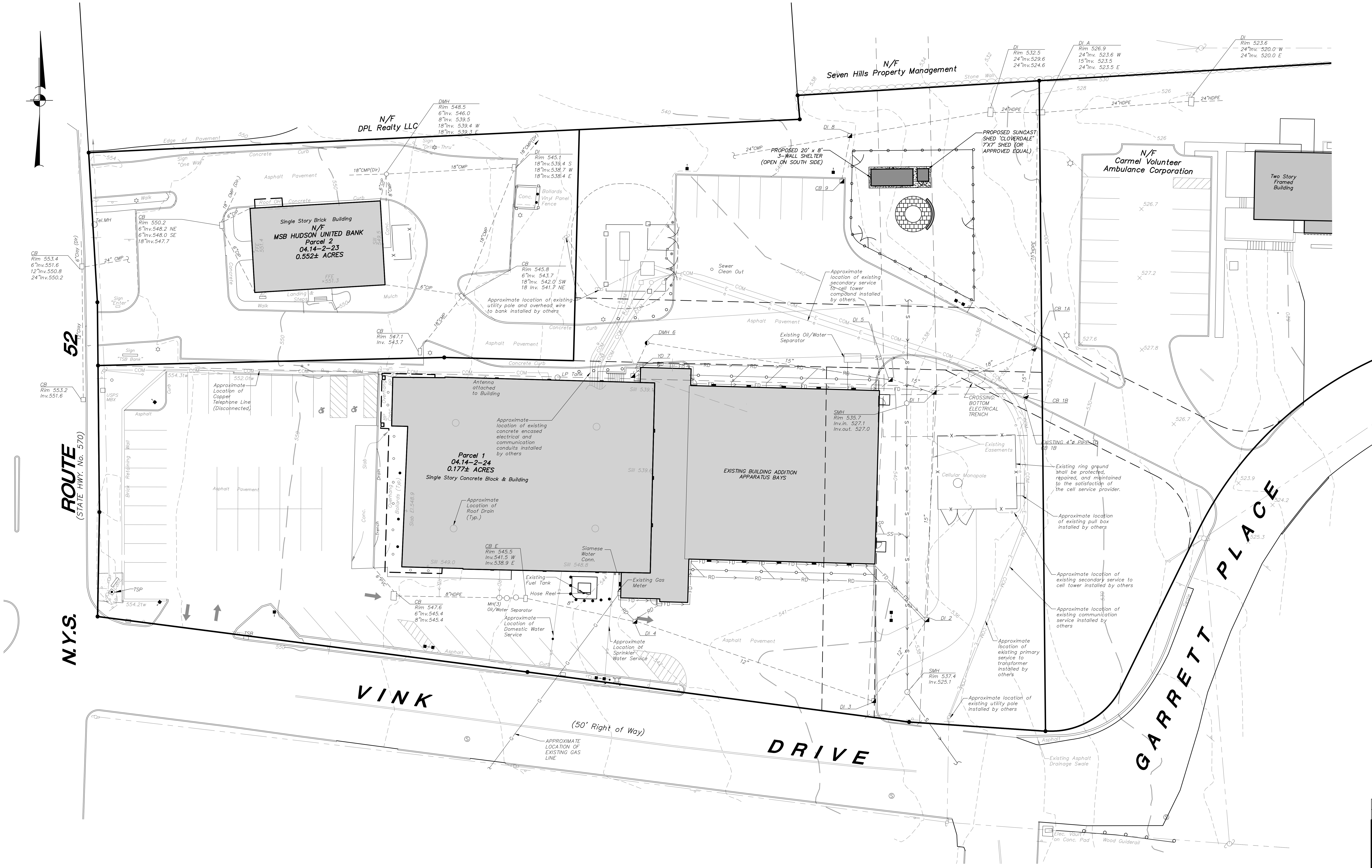
PROJECT:
CARMEL FIRE DEPARTMENT
MEMBERS SEATING AREA
94 GLENEIDA AVENUE, CARMEL, PUTNAM COUNTY, NEW YORK

DRAWING:
LAYOUT AND
LANDSCAPE PLAN

JOHN M. WATSON
No. 77950

PROJECT NUMBER	19135.100	PROJECT MANAGER	J.M.W.
DATE	10-31-23	DRAWN BY	C.B.Z.
SCALE	1" = 20'	CHECKED BY	K.M.G.

DRAWING NO. SP-1
SHEET 2 / 5



LEGEND

	EXISTING PROPERTY LINE
	EXISTING EASEMENT
	EXISTING STONE WALL
X	EXISTING CHAIN LINK FENCE
□	EXISTING STOCKADE FENCE
	EXISTING CONCRETE CURB
	EXISTING DROP IN CONCRETE CURB
□ TSB	EXISTING TRAFFIC SIGNAL BOX
	EXISTING SIGN
	EXISTING UNDERGROUND DRAINAGE PIPE
CB	EXISTING CATCH BASIN
○ MH	EXISTING MANHOLE (type unidentified)
☼	EXISTING POST MOUNTED LIGHT
○	EXISTING RECESSED LIGHT
● WV	EXISTING WATER VALVE
○ CO	EXISTING CLEAN OUT
	EXISTING UTILITY POLE
100	EXISTING 10' CONTOUR
	EXISTING 2' CONTOUR
698.6 ×	EXISTING SPOT GRADE
○	PROPOSED VINYL FENCE
■	PROPOSED STRUCTURE

GRAPHIC SCALE
0 10 20 40
(IN FEET)
1 inch = 20 ft.

NO.	DATE	REVISION	BY
1	12/1/23	GENERAL REVISIONS	KMG

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PROJECT:
CARMEL FIRE DEPARTMENT
MEMBERS SEATING AREA
94 GLENEIDA AVENUE, CARMEL, PUTNAM COUNTY, NEW YORK

DRAWING:
GRADING AND
UTILITIES PLAN

JOHN M. WATSON
No. 77950

PROJECT NUMBER	19135.100	PROJECT MANAGER	J.M.W.
DATE	10-31-23	DRAWN BY	C.B.Z.
SCALE	1" = 20'	CHECKED BY	K.M.G.

DRAWING NO. SP-2
SHEET 3 / 5

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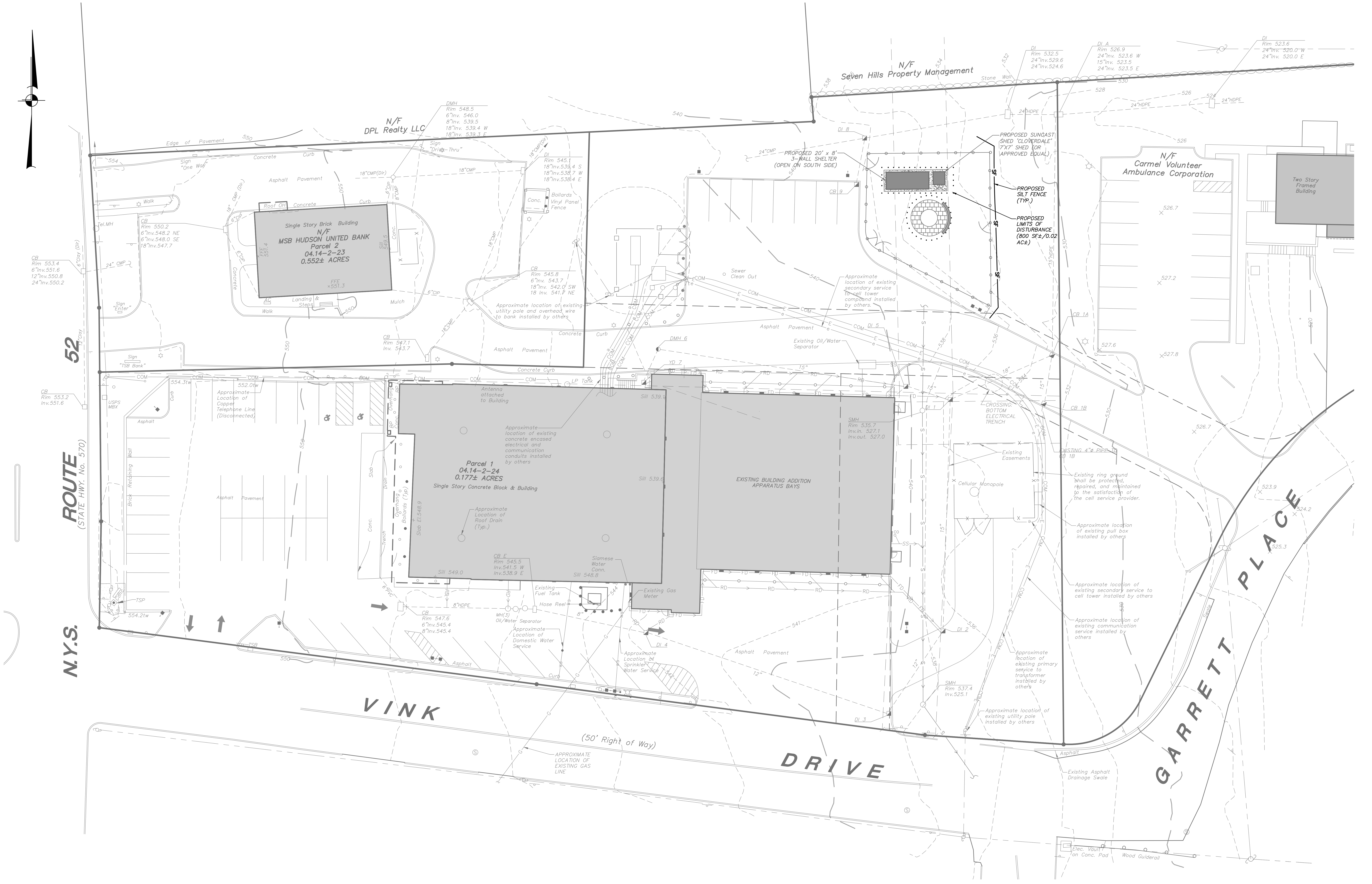

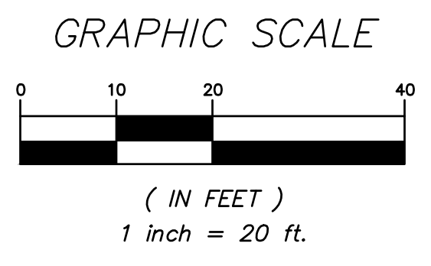

LEGEND

━━━	EXISTING PROPERTY LINE
— — —	EXISTING EASEMENT
⬭⬭⬭	EXISTING STONE WALL
—X—	EXISTING CHAIN LINK FENCE
—☐—	EXISTING STOCKADE FENCE
═══	EXISTING CONCRETE CURB
═╲_╱═	EXISTING DROP IN CONCRETE CURB
☐ TSB	EXISTING TRAFFIC SIGNAL BOX
—o—	EXISTING SIGN
— — —	EXISTING UNDERGROUND DRAINAGE PIPE
CB	EXISTING CATCH BASIN
○ MH	EXISTING MANHOLE (type unidentified)
☼	EXISTING POST MOUNTED LIGHT
○	EXISTING RECESSED LIGHT
● WV	EXISTING WATER VALVE
○ CO	EXISTING CLEAN OUT
⚲	EXISTING UTILITY POLE
—100—	EXISTING 10' CONTOUR
— — —	EXISTING 2' CONTOUR
698.6 ×	EXISTING SPOT GRADE
—SF—	PROPOSED SILT FENCE
• • • •	PROPOSED LIMITS OF DISTURBANCE

EROSION & SEDIMENT CONTROL NOTES:

1. The owner's field representative (O.F.R.) will be responsible for the implementation and maintenance of erosion and sediment control measures on this site prior to and during construction.

2. All construction activities involving the removal or disposition of soil are to be provided with appropriate protective measures to minimize erosion and contain sediment disposition within. Minimum soil erosion and sediment control measures shall be implemented as shown on the plans and shall be installed in accordance with "New York Standards and Specifications For Erosion and Sediment Control," latest edition.

3. Wherever feasible, natural vegetation should be retained and protected. Disturbance shall be minimized in the areas required to perform construction. No more than 5 acres of unprotected soil shall be exposed at any one time.

4. When land is exposed during development, the exposure shall be kept to the shortest practical period of time. In the areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures must be initiated by the end of the next business day and completed within seven (7) days from the date the current soil disturbance activity ceased. Disturbance shall be minimized to the areas required to perform construction.

5. Silt fence shall be installed as shown on the plans prior to beginning any clearing, grubbing or earthwork.

6. All topsoil to be stripped from the area being developed shall be stockpiled and immediately seeded for temporary stabilization. Ryegrass (annual or perennial) at a rate of 30 lbs. per acre shall be used for temporary seeding in spring, summer or early fall. 'Aristook' Winter Rye (cereal rye) shall be used for temporary seeding in late fall and winter.

7. Any disturbed areas not subject to further disturbance or construction traffic, permanent or temporary, shall have soil stabilization measures initiated for permanent vegetation cover in combination with a suitable mulch within 1 business day of final grading. All seeded areas to receive a minimum 4" topsoil (from stockpile area) and be seeded and mulched as follows:
   - Seed mixture to be planted between March 21 and May 20, or between August 15 and October 15 or as directed by project representative at a rate of 100 pounds per acre in the following proportions:

Kentucky Bluegrass	20%
Creeping Red Fescue	40%
Perennial Ryegrass	20%
Annual Ryegrass	20%

   - Mulch: Salt hay or small grain straw applied at a rate of 90 lbs./1000 S.F. or 2 tons/acre, to be applied and anchored according to "New York Standards and Specification For Erosion and Sediment Control," latest edition.

8. Grass seed mix may be applied by either mechanical or hydroseeding methods. Seeding shall be performed in accordance with the current edition of the "NYSDOT Standard Specification, Construction and Materials, Section 610–3.02, Method No. 1". Hydroseeding shall be performed using materials and methods as approved by the site engineer.

9. Cut or fill slopes steeper than 3:1 shall be stabilized immediately after grading with Curlex I Single Net Erosion Control Blanket, or approved equal.

10. Paved roadways shall be kept clean at all times.

11. The site shall at all times be graded and maintained such that all stormwater runoff is diverted to soil erosion and sediment control facilities.

12. All storm drainage outlets shall be stabilized, as required, before the discharge points become operational.

13. Stormwater from disturbed areas must be passed through erosion control barriers before discharge beyond disturbed areas or discharged into other drainage systems.

14. Erosion and sediment control measures shall be inspected and maintained on a daily basis by the O.F.R. to insure that channels, temporary and permanent ditches and pipes are clear of debris, that embankments and berms have not been breached and that all straw bales and silt fences are intact. Any failure of erosion and sediment control measures shall be immediately repaired by the contractor and inspected for approval by the O.F.R. and/or site engineer.

15. Dust shall be controlled by sprinkling or other approved methods as necessary, or as directed by the O.F.R.

16. Cut and fills shall not endanger adjoining property, nor divert water onto the property of others.

17. All fills shall be placed and compacted in 6" lifts to provide stability of material and to prevent settlement.

18. The O.F.R. shall inspect downstream conditions for evidence of sedimentation on a weekly basis and after rainstorms.

19. As warranted by field conditions, special additional erosion and sediment control measures, as specified by the site engineer and/or the Town Engineer shall be installed by the contractor.

20. Erosion and sediment control measures shall remain in place until all disturbed areas are suitably stabilized.

ALTERATION OF THIS DOCUMENT, UNLESS UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, IS A VIOLATION OF SECTION 7209 OF ARTICLE 145 OF THE EDUCATION LAW.

NO.	DATE	REVISION	BY
1	12/1/23	GENERAL REVISIONS	KMG

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PROJECT:
CARMEL FIRE DEPARTMENT
MEMBERS SEATING AREA
94 GLENEIDA AVENUE, CARMEL, PUTNAM COUNTY, NEW YORK

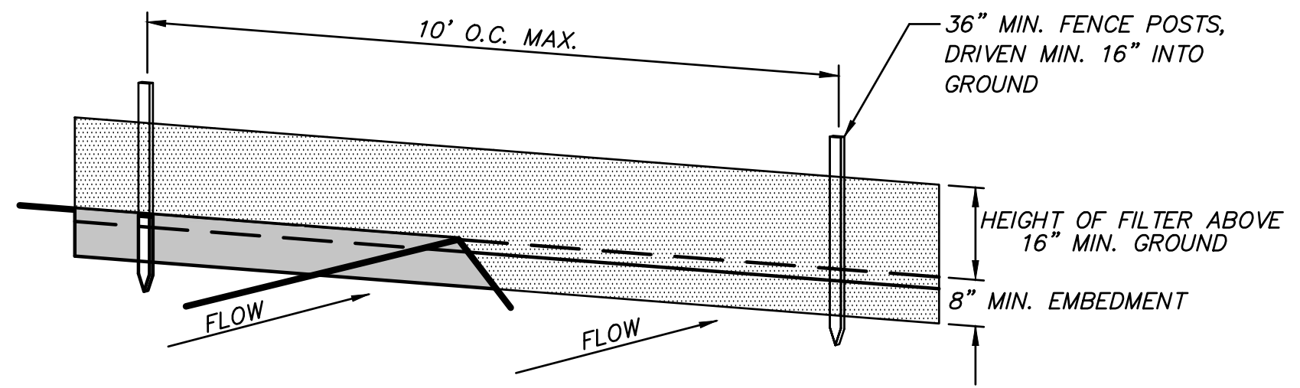
DRAWING:
EROSION AND
SEDIMENT CONTROL
PLAN

JOHN M. WATSON
No. 77950

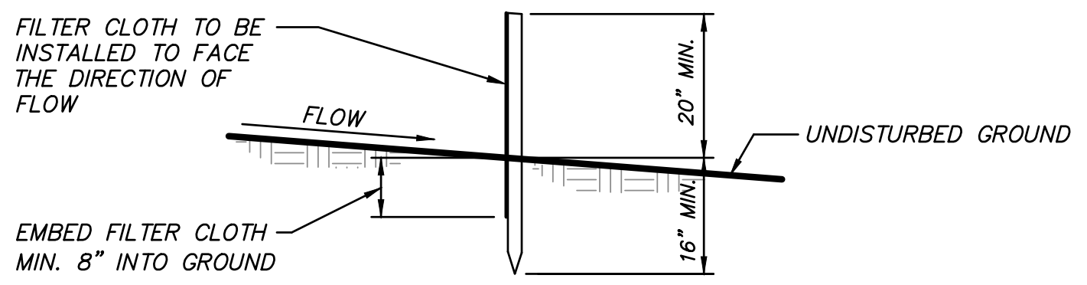
PROJECT NUMBER	19135.100	PROJECT MANAGER	J.M.W.
DATE	10-31-23	DRAWN BY	C.B.Z.
SCALE	1" = 20'	CHECKED BY	K.M.G.

DRAWING NO. SP-3

SHEET 4 / 5



PERSPECTIVE VIEW



SECTION

CONSTRUCTION NOTES FOR FABRICATED SILT FENCE

1. FILTER CLOTH TO BE FASTENED SECURELY TO POSTS AT TOP AND MID SECTION.
2. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED.
3. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

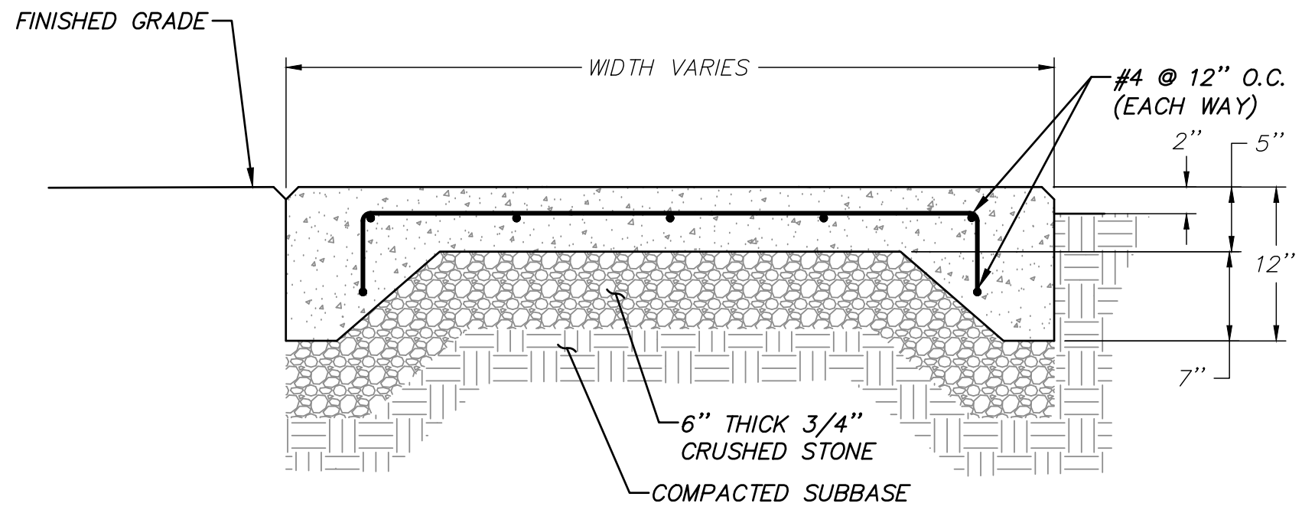
POSTS: STEEL EITHER T OR U TYPE OR 2" HARDWOOD

FILTER CLOTH: FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUAL

PREFABRICATED UNIT: GEOFAB, ENVIROFENCE, OR APPROVED EQUAL

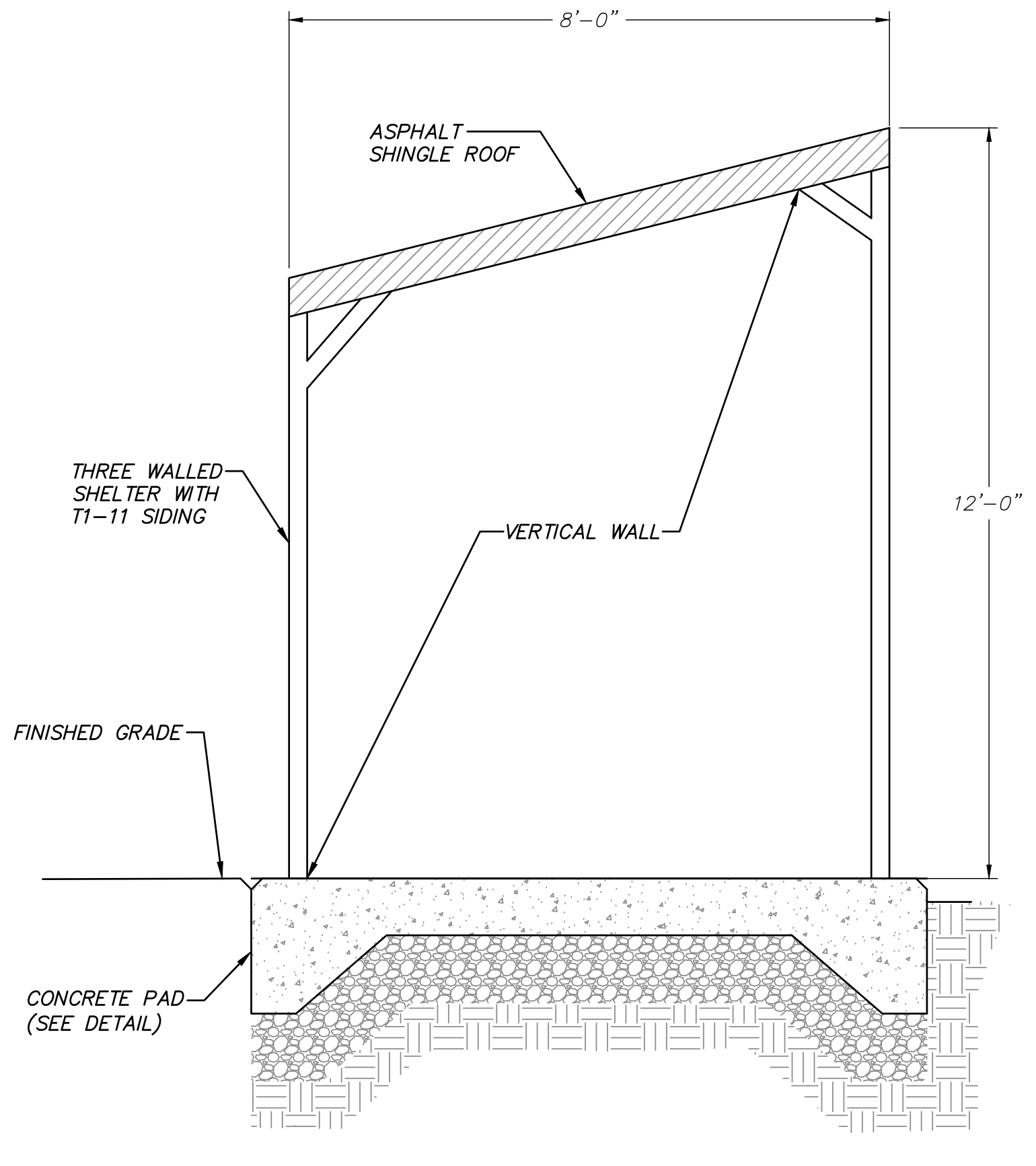
SILT FENCE DETAIL

(N.T.S.)



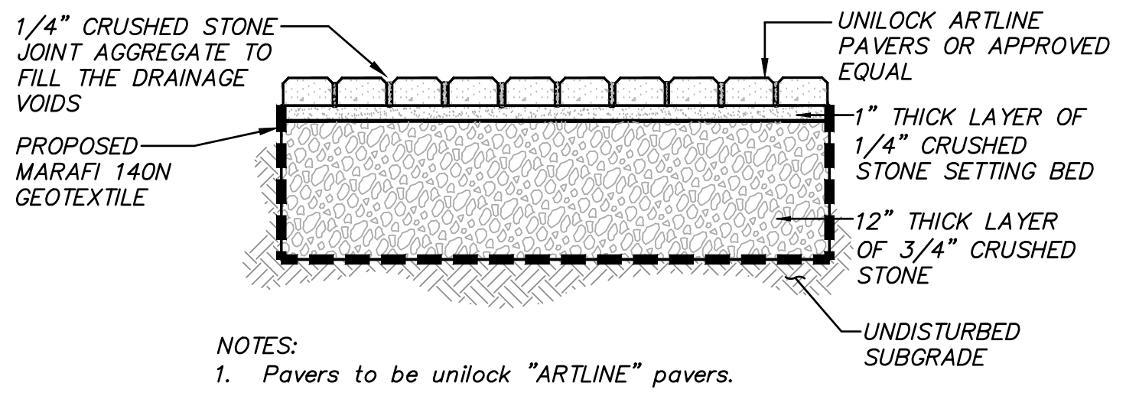
CONCRETE PAD DETAIL

(N.T.S.)



3 WALL SHELTER DETAIL

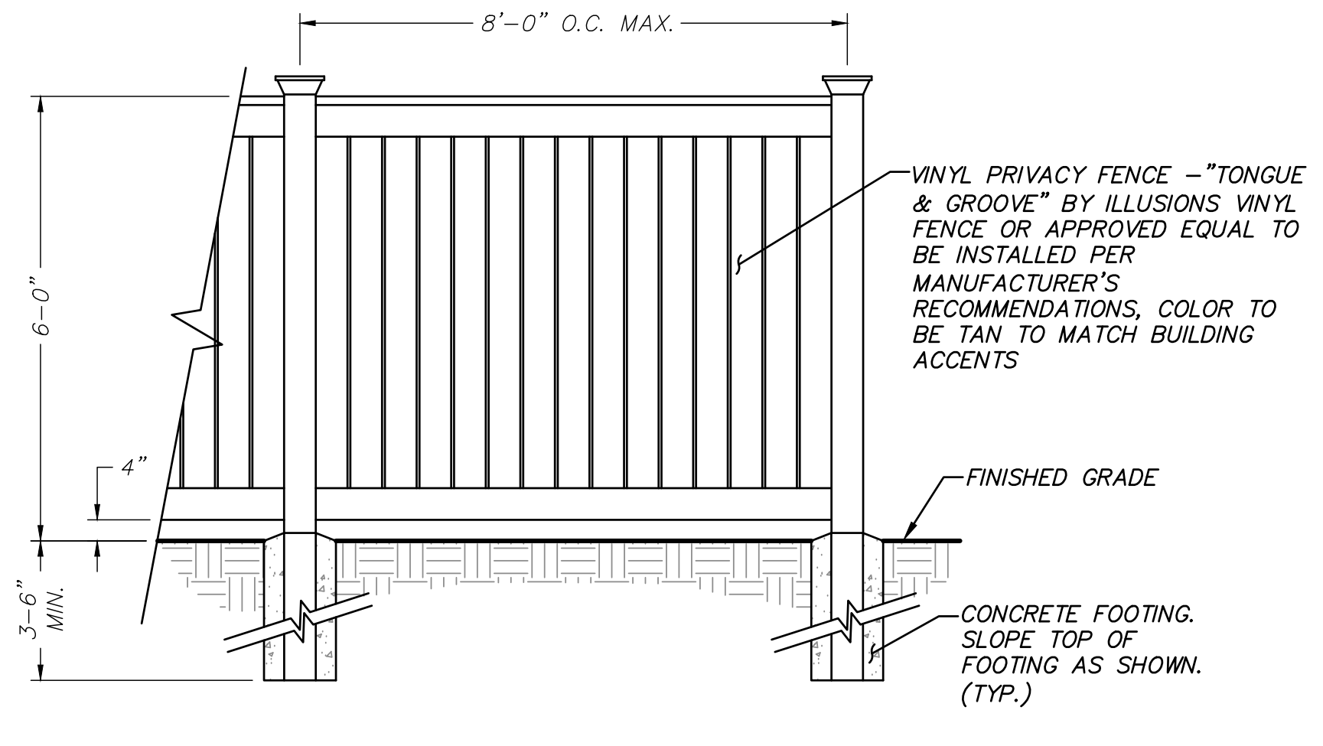
(N.T.S.)



NOTES:
1. Pavers to be unilock "ARTLINE" pavers.
2. Paver finish and color to be as approved by owner.
3. Joint aggregate color to be coordinated with paver color.
4. Utilize pastic, metal or concrete edge restraint at edge of pavers

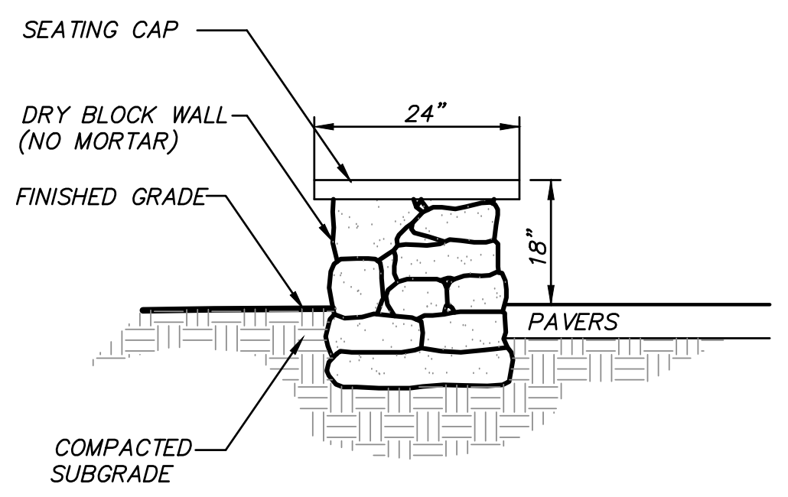
PAVERS DETAIL

(N.T.S.)



VINYL PRIVACY FENCE DETAIL

(N.T.S.)



STONEWALL DETAIL

(N.T.S.)

1	12/1/23	GENERAL REVISIONS	KMG
NO.	DATE	REVISION	BY

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PROJECT:

CARMEL FIRE DEPARTMENT
MEMBERS SEATING AREA

94 GLENEIDA AVENUE, CARMEL, PUTNAM COUNTY, NEW YORK

DRAWING:

DETAILS

JOHN M. WATSON
No. 77950

PROJECT NUMBER	19135.100	PROJECT MANAGER	J.M.W.
DATE	10-31-23	DRAWN BY	J.F.R.
SCALE	AS NOTED	CHECKED BY	K.M.G.

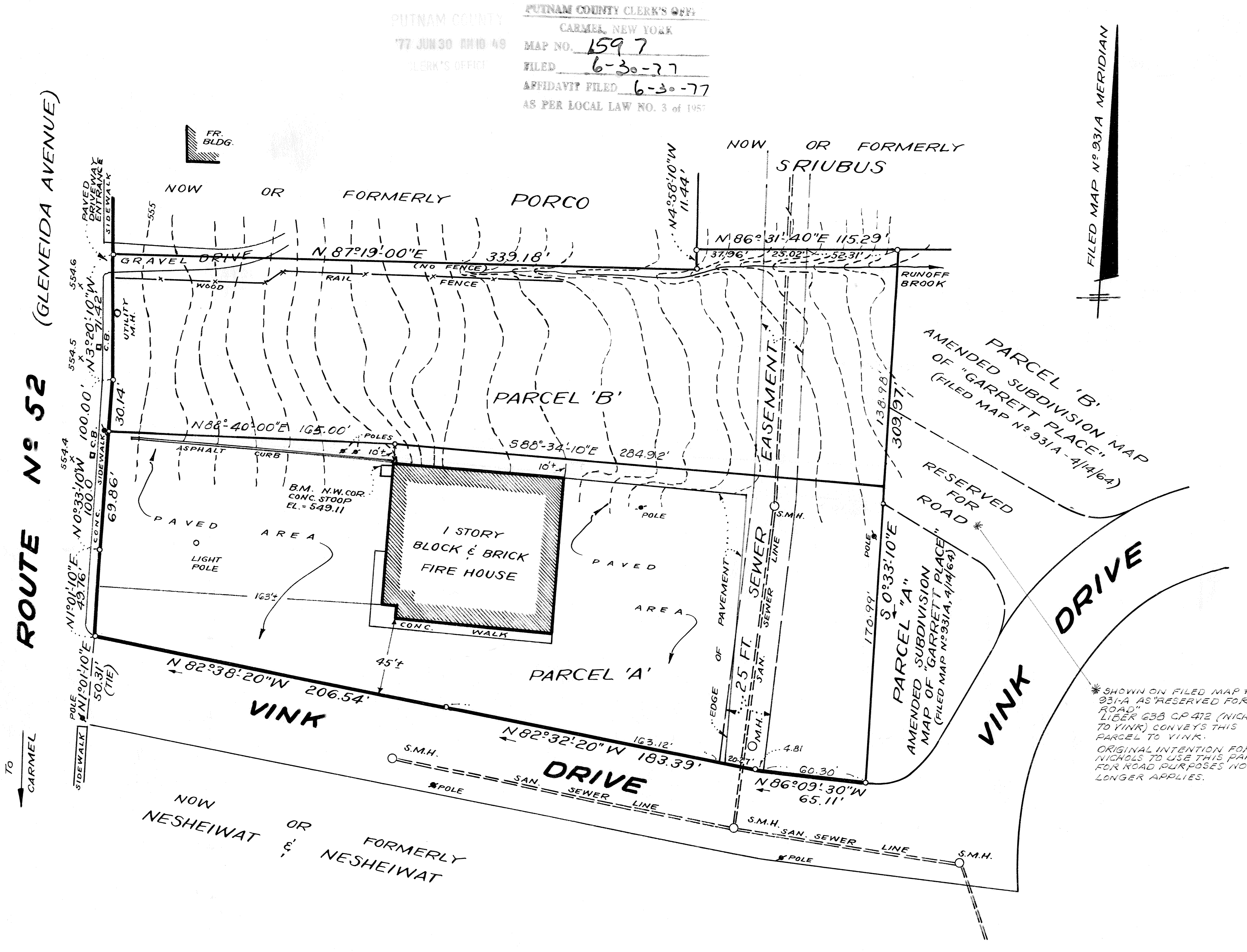
DRAWING NO.
D-1

SHEET
5/5

1597

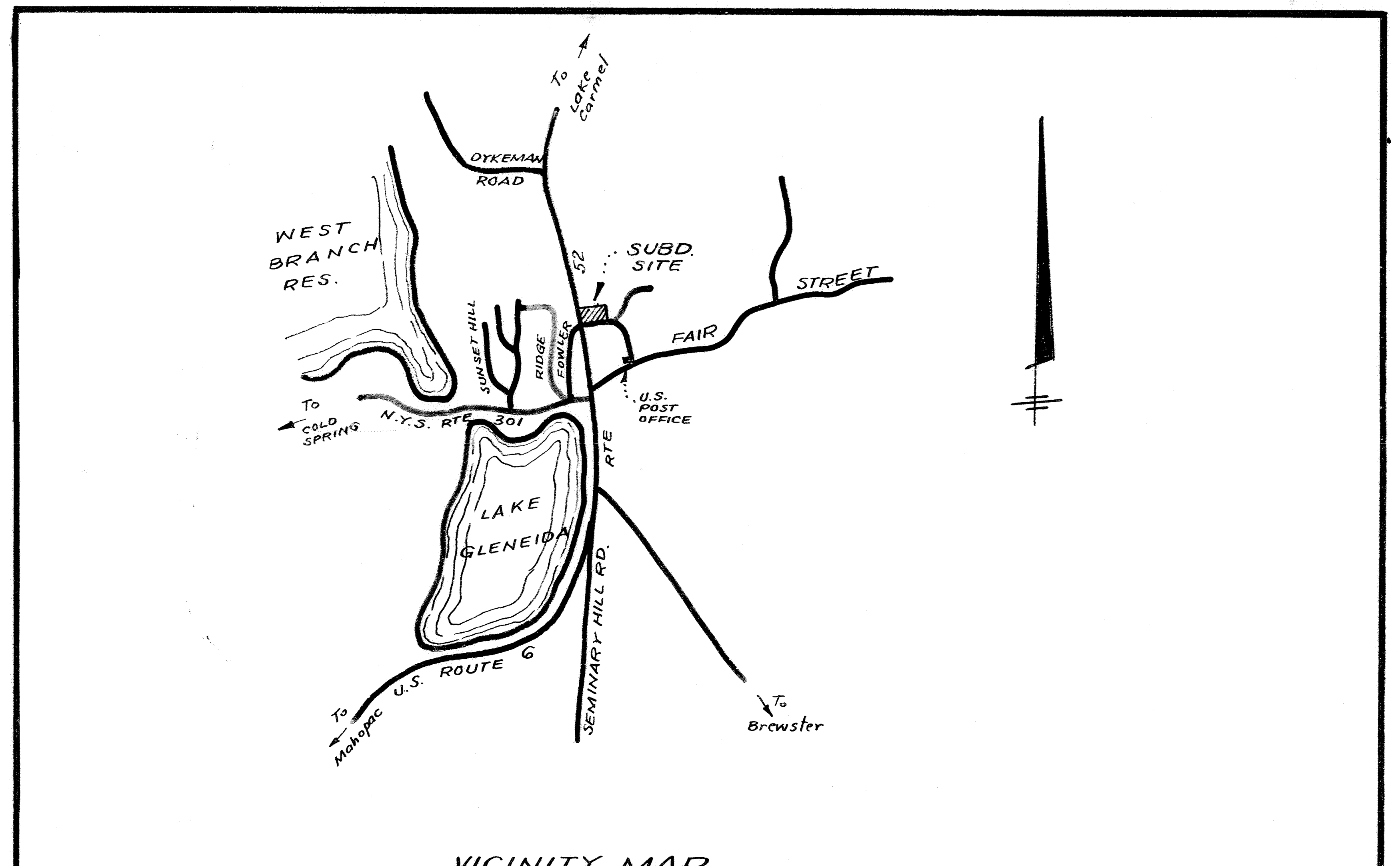
PUTNAM COUNTY
'77 JUN 30 AM 10 49
CLERK'S OFFICE

PUTNAM COUNTY CLERK'S OFF.
CARMEL, NEW YORK
MAP NO. 1597
FILED 6-30-77
AFFIDAVIT FILED 6-30-77
AS PER LOCAL LAW NO. 3 of 1957

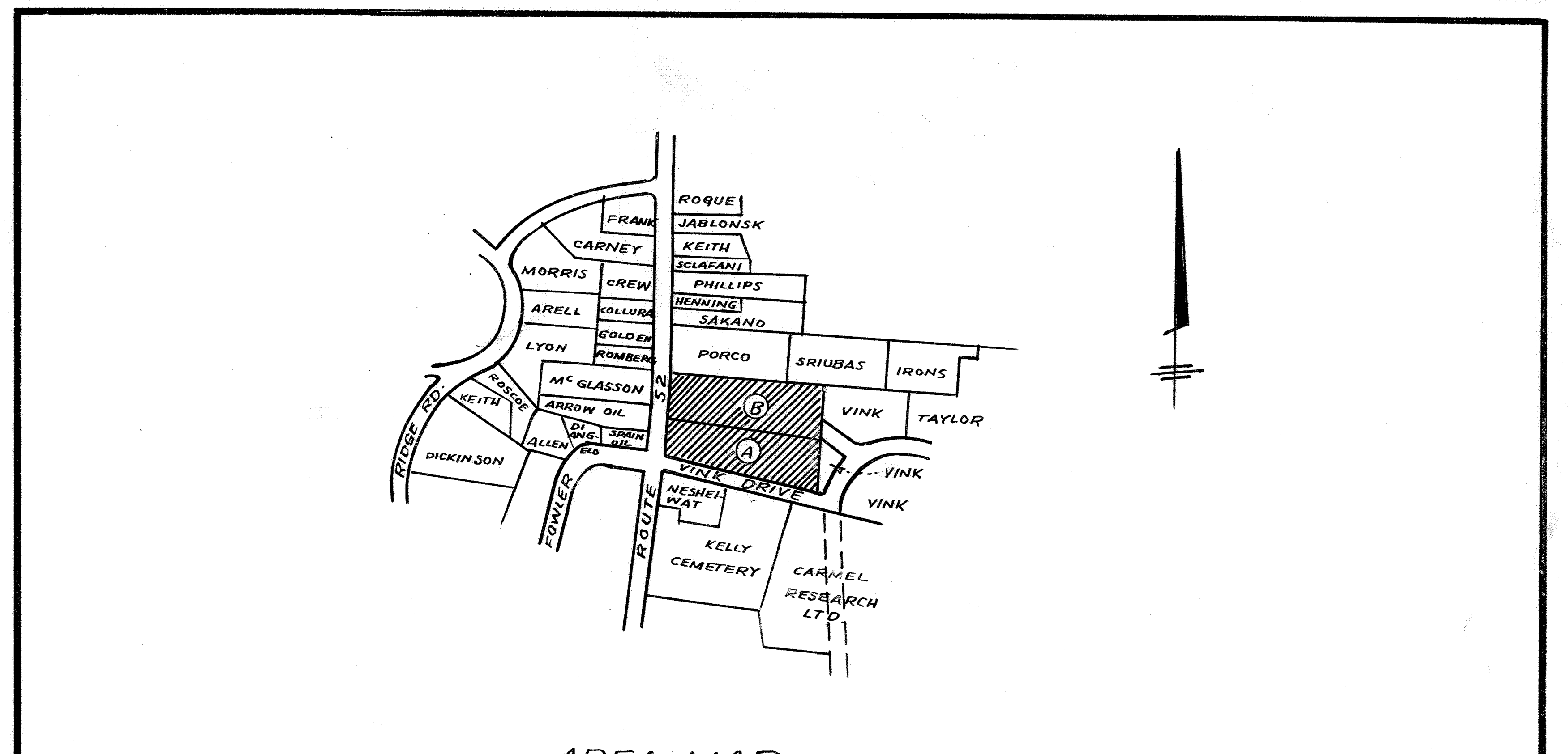


* SHOWN ON FILED MAP # 931-A AS "RESERVED FOR ROAD"
"LIBER 638 CP 472 (NICHOLS TO VINK) CONVEYS THIS PARCEL TO VINK.

ORIGINAL INTENTION FOR NICHOLS TO USE THIS PARCEL FOR ROAD PURPOSES NO LONGER APPLIES.



VICINITY MAP
1"=2000'±



AREA MAP
SCALE: 1"=400'

NOTES

1. SEWER EASEMENTS SHOWN HEREON AS PER EASEMENT MAPS 5 & 23, CARMEL SEWER DISTRICT No 2.
2. SUBSURFACE FEATURES, IF ANY, NOT SHOWN.
3. ALL CERTIFICATIONS ARE VALID FOR THIS MAP AND COPIES THEREOF ONLY IF SAID MAP OR COPIES BEAR THE IMPRESSED SEAL OF THE SURVEYOR WHOSE SIGNATURE APPEARS HEREON.
4. IT IS HEREBY CERTIFIED THAT THIS SURVEY WAS PREPARED IN ACCORDANCE WITH THE EXISTING CODE OF PRACTICE FOR LAND SURVEYS ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS.
5. THIS PLAT CONSTITUTES A MINOR SUBDIVISION.

PARCEL 'A' = 1.545 ACRES

PARCEL 'B' = 1.184 ACRES

Approved by Resolution of the Planning Board of the
Town of Carmel, New York on the 1 day
of June 1977, subject to all require-
ments and conditions of said Resolution. Any change,
erasure, modification or revision of this Plat, as
approved, shall void this approval.
Signed this 15 day of June, 1977, by
Daniel M. Howell
Chairman
Secretary

SUBDIVISION PLAT
OF PROPERTY
PREPARED FOR

CARMEL FIRE DEPARTMENT, INC.

TOWN OF CARMEL **PUTNAM COUNTY, N.Y.**
SCALE: 1 INCH = 40 FEET

FEBRUARY 28, 1977.
REVISED ON APRIL 14, 1977.
REVISED ON APRIL 23, 1977.
CERTIFICATION ADDED 6/22/77

I CERTIFY THAT THIS PLAT WAS MADE FROM AN ACTUAL SURVEY OF THE PROPERTY.
SURVEY COMPLETED ON JANUARY 25, 1974
TOPOGRAPHY COMPLETED ON FEB. 3, 1977.

Gerald H. Behr
BURGESS & BEHR, P.C.
PROFESSIONAL ENGINEERING & LAND SURVEYING
R.D. 8 HORSEPOUND ROAD CARMEL, N.Y.

APPROVAL: TOWN OF CARMEL

APPROVED BY RESOLUTION OF THE PLANNING BOARD OF THE TOWN OF CARMEL, NEW YORK, ON THE DAY OF , 1977, SUBJECT TO ALL REQUIREMENTS AND CONDITIONS OF SAID RESOLUTION. ANY CHANGE, ERASURE, MODIFICATION OR REVISION OF THIS PLAT, AS APPROVED, SHALL VOID THIS APPROVAL.
SIGNED THIS DAY OF , 1977 BY

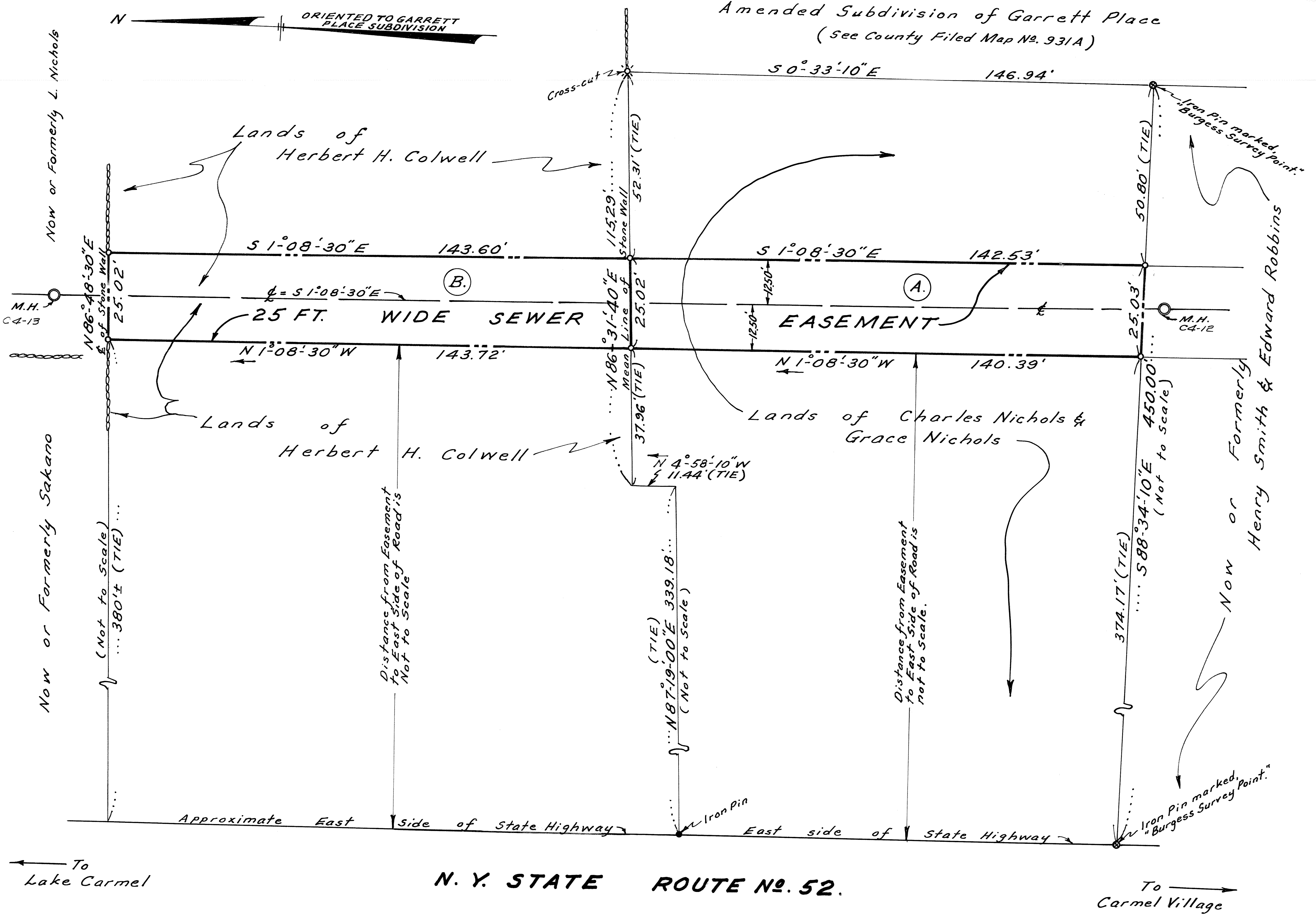
________________ CHAIRMAN

________________ SECRETARY

CERTIFIED TO: THE TITLE GUARANTEE COMPANY.
#MR1-041P

495 F.B. 253
463
C-16

1597



PUTNAM COUNTY CLERK'S OFFICE
CARMEL, NEW YORK
MAP NO. 1090 D
FILED 5-15-67
AFFIDAVIT FILED —
AS PER LOCAL LAW NO. 1 of 7

EASEMENT MAP No. 5
CARMEL SEWER DISTRICT No. 2
(CONTRACT No. 5)

TOWN OF CARMEL
Scale: 1 Inch = 20 Feet

PUTNAM COUNTY, N.Y.
December 10, 1965.
Revised Dec. 14, 1966.

Easement-"A"~Through Lands of Charles Nichols and Grace Nichols.

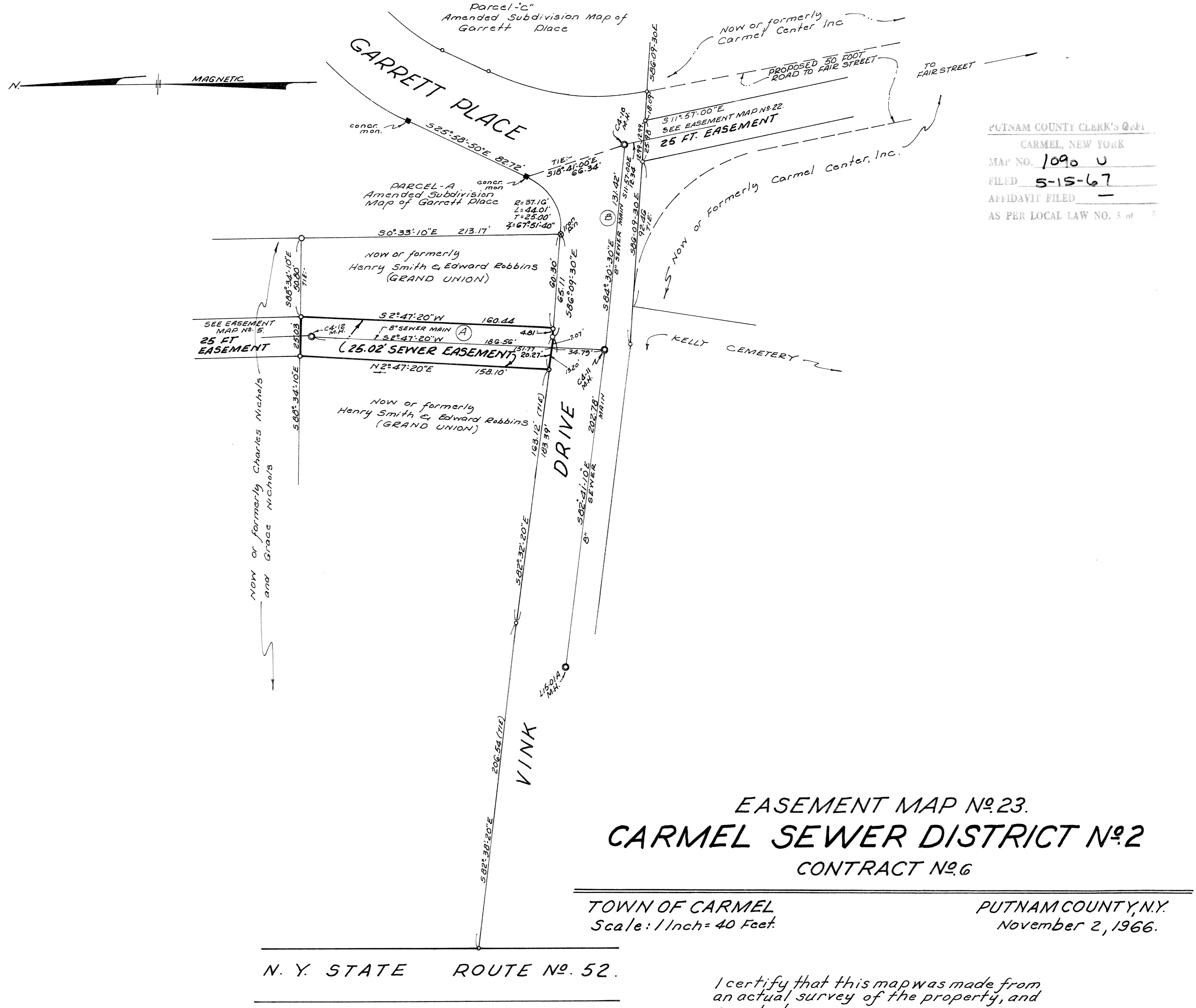
Easement-"B"~Through Lands of Herbert H. Colwell.

I certify that this map was made from an actual survey of the property. *
Survey completed on December 8, 1965.
Map completed on Decemberber 10, 1965.

BURGESS & BEHR
Professional Engineering & Land Surveying
70 Gleneida Avenue
Carmel, N.Y.

* Survey confined to Easement only.

778
Carmel Village



EASEMENT MAP No 23.

CARMEL SEWER DISTRICT No 2

CONTRACT No 6

TOWN OF CARMEL
Scale: 1 Inch = 40 Feet.

PUTNAM COUNTY, N.Y.
November 2, 1966.

I certify that this map was made from an actual survey of the property, and as noted.
Survey completed on October 20, 1966.
Map completed on November 2, 1966.

Wm H. Behr
BURGESS & BEHR
Professional Engineering & Land Surveying
128 Gleneida Avenue, Carmel, N.Y.-10512.

Easement-"A" ~ Through Lands of Henry Smith and Edward Robbins. (Grand Union)

Easement-"B" ~ Through Lands of Town of Carmel, Vink Drive & Garrett Place. (Formerly Vink).

NOTE: This easement map based on subdivision of Garrett Place Meridian. See County Filed Map No 931 A.

PUTNAM COUNTY CLERK'S OFFICE
CARMEL, NEW YORK
MAP NO. 1090 U
FILED 5-15-67
AFFIDAVIT FILED —
AS PER LOCAL LAW NO. 3 of

778
Carmel Village

INSITE
ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

December 4, 2023

Town of Carmel Planning Board
60 McAlpin Avenue
Mahopac, New York 10541

RE: Diamond Point Development
4 Baldwin Place Road
Town of Carmel
TM#'s: 86.10-1-2&3

Dear Chairman Paeprer and Members of the Board:

It is understood that the Board must direct the Town Planner to provide a draft resolution for conditional Site Plan Approval. We are requesting an appearance before the Board at your December 14, 2023 meeting to request that the draft resolution be provided for the Board's consideration at the January 11, 2024 meeting.

It should be noted that the required period of 45 days for a Board decision on a resolution, from the closing of the public hearing, elapsed on November 26. Previous to the expiration, the applicant provided a letter granting an extension of that period to the December 14 meeting. A new letter has been provided to the Town Planner and Code Enforcement Director, further extending the 45-day period to the aforementioned January 11, 2024 meeting. The letter is also enclosed herewith.

Should you have any questions or comments regarding this information, please feel free to contact our office.

Very truly yours,

INSITE ENGINEERING, SURVEYING & LANDSCAPE ARCHITECTURE, P.C.

By: ______________________________
Richard D. Williams, PE
Senior Principal Engineer

RDW/adt

Enclosures
cc: (All via email only)
Aaron Sommer
Jason Sommer
Jennifer Grey, Esq
Scott Stinard
John Anastasiou, AIA

DIAMOND
POINT
DEVELOPMENT

November 29, 2023

Electronic Delivery: mgc@ci.carmel.ny.us

Michael Carnazza
Director of Code Enforcement
Building Inspector
Town of Carmel
60 McAlpin Ave.
Mahopac, N.Y. 10541

Re: 102 US-6, Mahopac, NY 10541 – Extension on Public Hearing

Mr. Carnazza,

Diamond Point Development, LLC submits this letter pursuant to Town of Carmel Zoning Code Section 156-61.F to address the 45-day period within which the Planning Board is required to vote on the pending application following the close of the public hearing. The public hearing on the pending application was closed on October 12, 2023.

Under the Town Code, the Board was required to vote on the application no later than November 26, 2023 (45 days after October 12, 2023). Therefore, in a letter dated November 8, 2023, we provided consent to extend the 45 day period to December 14, 2023. We understand that the board needs to direct the Town Planner to prepare a resolution, and that due to the upcoming holidays, the Board's next regularly scheduled meeting after December 14, 2023 is January 11, 2024. Therefore, Diamond Point Development hereby consents to an extension of the 45-day period to, and inclusive of, January 11, 2024.

Regards,

Aaron Sommer

Aaron Sommer
Principal
Diamond Point Development

INSITE
ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

December 4, 2023

Town of Carmel Planning Board
60 McAlpin Avenue
Mahopac, New York 10541

RE: Union Energy Center, LLC Site Plan
24 Miller Road
Mahopac, NY 10541
TM#'s: 86.11-1-14

Dear Chairman Paeprer and Members of the Board:

Please find enclosed the following plans and documents in support of an application for site plan approval for the above referenced project:

- Site Plan Set, last revised December 4, 2023.
- Wetland Functional Assessment, by VHB, Inc, dated December 1, 2023.
- Example Emergency Response Plan.
- Considerations for ESS Fire Safety, by ConEd & NYSERDA, dated February 9, 2017.
- Sara Rubin, "Air Quality Testing Showed No Hazards to Human Health Amid Battery Fire in Moss Landing." Monterey County Weekly, dated September 30, 2022.
- News 12, "Lithium-ion batteries removed from Warwick storage site following 2 fires," dated July 3, 2023.
- Sample Generator Specification Sheet.
- Revised Decommissioning Plan, dated December 1, 2023.
- Union Energy PILOT Proposal, dated December 1, 2023.
- Tax Estimate.

In response to comments received from Director of Code Enforcement, Michael Carnazza, dated November 7, 2023, we offer the below responses:

1. This comment is acknowledged.

2. This comment is acknowledged. The applicant requests a referral to the Town of Carmel ECB to present the project.

3. The applicant continues to seek any further input from the fire department. As previously indicated the following provisions have been made to satisfy their requests.

    a. The installation of a Knox Box, which we now show on drawing SP-1.1.

    b. That the driveway meet the requirements for a fire apparatus road. The driveway meets the requirements for width, and offers two turnaround circles that meet fire code specification for dead-end driveways. The only departure from the code is on the maximum slope. The driveway alignment and grading have been revised to reduce the maximum slope from 15% to 12%. To reduce it further to 10% would increase our total area of disturbance, and our disturbance within the NYSDEC wetland adjacent area. However, the fire code empowers the local fire code official to vary the 10% maximum. The applicant has followed up with MVFD for their approval of a 12% slope on the driveway instead of 10%.

c. Fire Department connections, if any are required, will be located in an area with clear access for hose and apparatus.

d. That the Fire Department be consulted and alerted to any other on-site fire safety features.

4. This comment was previously addressed.

In response to open comments received from Town Engineer Richard Franzetti, PE, dated October 31, 2023, we offer the following responses:

General Comments

1. The required referrals are acknowledged. The applicant requests a referral to the Town of Carmel ECB to present the project.
2. The required permits are acknowledged.
3. A Stormwater Pollution Prevention Plan (SWPPP) will be provided with a future submission.
4. The requirement for a stormwater maintenance agreement is acknowledged and will be provided with a future submission.
5. The requirement for a performance bond is acknowledged and will be provided with a future submission.

Detailed Comments

1. A Vehicle Maneuvering Plan.
    a. Sight distances are provided on drawing SP-1.1. They have been added to the Maneuvering plan on drawing SP-4.1.
    b. Driveway profiles will be provided with a future submission.
2. Layout and Landscape Plans
    a. A Photometric Plan is provided on drawing SP-4.2.
3. Grading and Utilities Plans
    a. Rims and inverts will be provided with a future submission.
    b. Hydraulic calculations and pipe sizes will be provided with a future submission.

c. A note has been added to drawing SP-2.1 that all utilities other than transmission lines are to be buried.

4. Erosion and Sediment Control Plan

    a. Rims and inverts will be provided with a future submission.

    b. A SWPPP will be provided with a future submission.

In response to open comments received from Town Planner, Patrick Cleary, AICP, dated November 9, 2023, we offer the following responses. Comments not addressed here were previously satisfied:

3. Generally, the anticipated visits by the previously mentioned 1-3 maintenance workers could occur about once a week. However, sometimes maintenance will require more workers and may happen more or less frequently depending on the facility's needs.

10. The Wetland Functional Assessment is enclosed herewith.

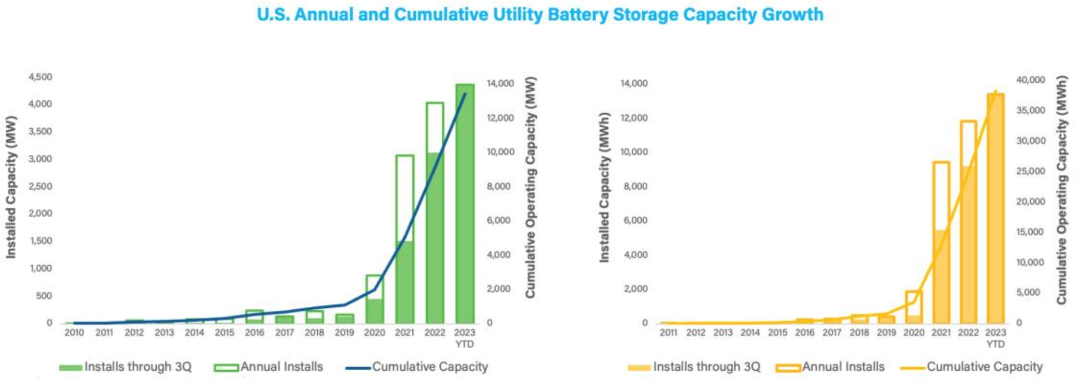
11. The proposed selective clearing would only involve cutting overgrown grass and brush, and pruning of some shrubbery along the frontage. No trees are proposed to be removed for this purpose.

12. A Photometric Plan is provided on drawing SP-4.2.

In response to questions raised by the Board at the November 9, 2023 meeting, the applicant offers the following responses:

1. Regarding energy reliability benefits for Putnam County, battery projects tend to improve reliability, cost, and emissions in the areas closest to where they are located. Furthermore, while the grid is interconnected and there is no question that it will help downstate NY, it's worth noting that the transmission line we are located on actually runs east to west. See the dark blue line along the project pictured below. Orange and Brown lines show other transmission lines in the area. As noted previously, there is only 2 megawatts of grid-scale generation in all of Putnam County. (Response provided by East Point Energy.)

2. Regarding the pace of adoption of BESS projects in the US, they are widespread, rigorously tested, and growing rapidly. According to the American Clean Power Association, 2142 megawatts of grid-scale battery storage were deployed in the US in Q3 2023 alone, roughly 18x the amount of this project. As of Q3 2023, there was approximately 14,000 megawatts of grid-scale battery storage deployed across the country. By the time this project is constructed, the amount of grid-scale BESS will likely have increased by several times. (Response provided by East Point Energy.)



Credit: American Clean Power Association.

3. Typically, Emergency Response Plans (ERP) are created closer to construction once the equipment is selected, and more detailed conversations are had with the Fire Department. At this stage, we are likely at least a year away before the specific equipment is chosen. However, in the interim we have enclosed a generic ERP from one of our trade organizations. (Response provided by East Point Energy.)

4. Regarding the generator, a specific model has not yet been selected, but we have enclosed a cut sheet of one that is similar to the one that will likely be selected for the project. Decibel levels for the generator vary based on the exact model, but will generally be in the area of 100 db measured adjacent to the generator. It should be noted that other than brief periods of regular maintenance, the generator will only be running at a subset of power outages. Any regular startup of the generator for maintenance purposes can be scheduled for midday hours to minimize impacts. It should also be noted that the generator has been centrally located on the site, which will also minimize impacts. Additionally, if there is an outage on the subject property there is most likely an outage on the neighboring properties. In which case many of those neighbors would be running their own generators simultaneously. (Response provided by East Point Energy.)

5. The enclosed updated Decommissioning Plan for the applicant’s proposal related to the decommissioning bond.

6. In the event of a NYSEG power outage that is not resolved by the time the batteries designated for auxiliary functions (e.g. HVAC) run out, then the generator will be turned on. The energy will flow from the generator to the project level substation, where a switch will allow the energy to flow via the powerline to the batteries. The generator will be used to run the essential functions of the system, but not to charge the entire system back up to full capacity. (Response provided by East Point Energy.)

7. Under normal operating conditions, lithium-ion BESS do not release any flammable or toxic off-gasses or emissions. However, during thermal runaway, the system can pose risks due to gas buildup. Enclosures can incorporate exhaust ventilation systems to prevent dangerous accumulation of explosive gases. In cases where BESS fires have occurred, real-time air monitoring measurements have indicated no air quality concerns or toxic gases at surrounding properties. See the enclosed articles regarding two such incidences. This is largely a result of the low-toxicity of the gases and their tendency to dissipate upwards very quickly. See the enclosed study conducted on behalf NYSERDA and ConEd. Noted in the study, researchers found that other than initial ignition of the batteries, the off-gasses from the lithium-ion batteries were materially less harmful than a plastics fire and considered to be on par with a burning sofa on a per kilogram basis. There is also an expectation from many in the battery industry that the Governor's interagency battery fire safety working group will release their preliminary findings before the end of the year. While the results have not yet been released, it is our understanding that the results will bolster the argument that harmful gases are a very low-risk to surrounding areas. (Response provided by East Point Energy.)

8. See the enclosed Pilot Proposal and Tax Estimate as discussed.

9. Relative to potential runoff during or subsequent to a fire, a BESS container typically contains the following materials: battery modules (in this case, lithium-iron phosphate), metal racking/supports, plastics, insulation, electrical components (such as printed circuit boards), and an HVAC system (refrigerants and liquid coolants). Therefore, the major constituents of a BESS container are similar to that of a modern vehicle. A vehicle has a metal support frame, plastics, insulation, printed circuit boards (and other electronics), a lead acid battery, and an HVAC system. The refrigerants and liquid coolants are typically common R134 refrigerant that you find in vehicles and the coolants are a 50/50 solution of ethylene glycol and water, also a very common liquid coolant used in vehicles. These materials are regulated and will have Safety Data Sheets (SDS) that can be shared with the fire service. Therefore, in many ways, a LFP BESS container can be looked upon similarly to a vehicle fire and the runoff from it would be akin to that. (Response provided by East Point Energy.)

10. Relative to the anticipated protocol for notifying the surrounding community in the event of a fire, typically Fire Departments/AHJ's either have a Public Information Officer and/or the Fire Chief would be making the call as to notifying neighbors. It should be addressed by the unified command players (Fire Dept, BESS Subject Matter Expert [SME], Town Officials, and Project Owner/Operator). Many localities have emergency alert systems and there is social media that can be utilized. The sample Emergency Response Plan (ERP) that is provided with our responses includes information on the command structure of emergency events and the notification structure. These structures are a collaboration between the AHJ and the BESS owner/operator (and their SME) and would be decided in advance. It could mention the trigger mechanisms as to when/how a notification is sent out. The key here is, all of this can be coordinated ahead of time and included in the ERP. (Response provided by East Point Energy.)

It should also be noted that we were in receipt of a letter from the NYS Office of New York City Watershed Inspector General, dated November 14, 2023. The applicant would cite the extensive degree of pre-application due diligence, documentation, and studies that have been provided to the Board, as lead agency. Additionally, the applicant continues to advance the wetland analysis, mitigation measures, stormwater management practices, and erosion controls. The project will be permitted by a number of outside agencies, including the NYCDEP, NYSDEC and Army Corps of Engineers. Given this context a Type I designation under SEQR is likely unwarranted.

Please place the project on the December 14, 2023 Planning Board agenda for discussion of the project with the Board. Should you have any questions or comments regarding this information, please feel free to contact our office.

Very truly yours,

INSITE ENGINEERING, SURVEYING & LANDSCAPE ARCHITECTURE, P.C.

By: ______________________________
Jeffrey J. Contelmo, PE
Senior Principal Engineer

JJC/adt

Enclosures
cc: (All via email only)
Scott Connuck
Compton Donohue
Frank Smith, Esq
William Shilling, Esq
Mahopac Volunteer Fire Dept

WETLAND FUNCTION-VALUE AND IMPACT REPORT

Union Energy Center Project

24 Miller Road, Parcel No. 86.11-1-14
Town of Carmel, Putnam County New York

PREPARED FOR

Union Energy Center, LLC
200 Garrett Street, Suite J
Charlottesville, VA 22902

PREPARED BY

vhb

100 Great Meadow Road
Suite 200
Wethersfield, Connecticut 06109-2377

December 1, 2023

Table of Contents

Images

Tables

Figures

Appendices

1

Introduction

This Wetland Function-Value Impact Report was prepared in support of a Town of Carmel Planning Board submittal for the proposed battery storage and electrical utility development Project (herein referred to as the 'Project') located at 24 Miller Road (Parcel No. 86.11-1-14) in the Town of Carmel, Putnam County New York (Figure 1). The proposed Project consists of the construction of two battery storage enclosures, two electrical substations, one bridge crossing, stormwater management measures, utilities, and associated parking lots and driveways.

A formal wetland and watercourse delineation was completed by VHB on May 14, 17, and 18, 2021, which resulted in the verification of wetlands onsite as documented in a Wetland and Watercourse Delineation Report, dated July 12, 2021 (Appendix A). Additionally, the NYSDEC validated the delineation on November 21, 2023, as shown in Appendix B. As shown in the accompanying Planning Board submittal, the Project proposes to disturb ±3,000[1] square feet (±0.06) acres of regulated wetlands and ±27,200[2] acres of the regulated 100-ft Adjacent Area for the construction of the bridge crossing off Miller Road.

Therefore, the purpose of this report is to assess the current conditions of wetland and Adjacent Area resources onsite, their function and values, and the effects of the proposed Project on these resources.

---

[1] These impact areas were derived from an Environmental Assessment Form completed by Insite Engineering, Surveying and Landscape Architecture, signed August 28, 2023, and the Planning Board plan set submission dated October 30, 2023, also prepared by Insite.

2

Site Description and Setting

The ±93-acre Project site is located at 24 Miller Road (Parcel No. 86.11-1-14) in the Town of Carmel, Putnam County, New York. The Project site is bound to the north by the Putnam Trailway Empire State Trail and commercial properties, to the east by residential properties, Silver Gate Road and forested, undeveloped land, to the south by residential properties and Lounsbury Drive, and to the west by Miller Road (Figure 2). Topography onsite ranges from 680ft to 605ft (NAVD88). A ridge is located in the center of the site which slopes downgradient steeply to the west, and gradually to the southeast. A stream channel is located in the western portion of the site parallel to Miller Road and flows from north to south, and multiple stone walls are present throughout the site. While the site is primarily undeveloped, an electrical transmission Right-of-Way (ROW) easement is located along the eastern boundary of the site, where multiple transmission structures are present. Based on a review of historic aerial imagery, the site has remained undeveloped since at least the 1950s.

2.1 - Current Landscape Ecological Setting

The Project site is located in the Hudson Highlands of New York, in the Hudson Valley, ±90 miles to the west of the Hudson River. The surrounding ecological neighborhood is suburban, with residential, commercial, and light industrial development interspersed within contiguous forested areas.

As shown in Table 1 below, based on a review of current aerial imagery ±93% of the site is covered by a mature forest that continues offsite. Herbaceous and shrub vegetation is limited to wetland areas onsite with surface water present, where mature canopy trees aren’t dominant, and sunlight can penetrate down to the forest floor. There are no cultivation or pasture uses on site, and all aquatic vegetation is limited to wetlands onsite. There is no asphalt or impervious cover currently onsite.

Table 1: Project Site Flora Percent Cover

Forest Canopy Trees	Shrubs and Herbaceous	Cultivated or Pasture	Aquatic	Other
93%	7%	N/A	N/A	<1%

3

Wetland Function and Values Assessment

Wetland classifications used to identify the type of wetland(s) occurring on the Project site are based on guidance from the U.S. Fish and Wildlife Service (USFWS) (Cowardin et.al. 1979).

Biophysical elements such as a wetland’s landscape position, geology, hydrology, substrate, and vegetation determine the wetland functions and to what capacity they are performed. Due to the differing biophysical characteristics between on-site wetlands, the functions the wetlands provide and the capacity to perform those functions vary. To better understand these differences, a description of the assessed wetland functional values was completed based on the United States Army Corps of Engineers (USACE) Highway Methodology Workbook (1993) and its supplement workbook. This method requires a description of each of the wetland communities as well as indicating the functions they provide. The thirteen (13) functions and values that have been recognized include:

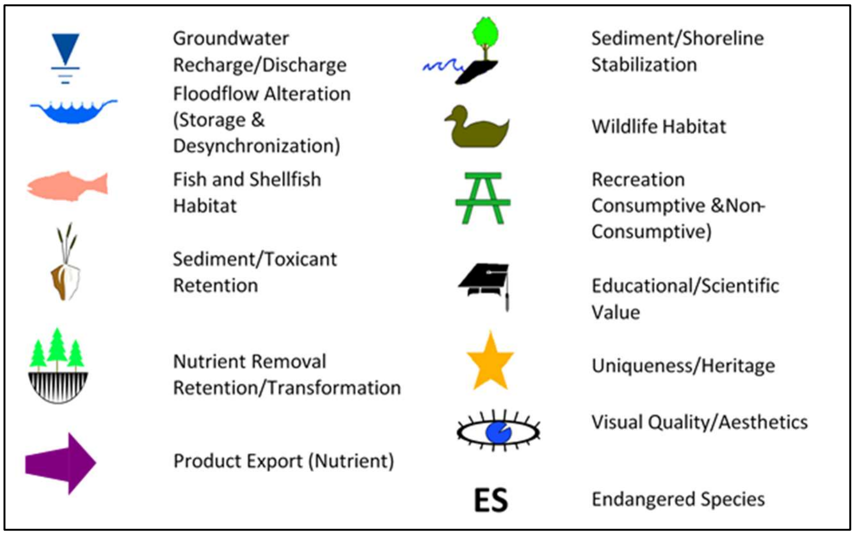


Image 1 - Wetland Function and Values Categories

Wetland resource areas on the Project site, further discussed and documented in the attached Wetland and Watercourse Delineation Report, consist of ±43 acres of palustrine forested (Cowardin, 1979: PFO), scrub-shrub (Cowardin, 1979: PSS) and emergent wetlands (Cowardin, 1979: PEM). There is an established 100-ft Adjacent Area buffer regulated by the New York State Department of Environmental Conservation (NYSDEC) and the Town of Carmel, which is depicted on the attached Wetland Validation Map (Drawing WV-1), dated November 11, 2023 (Appendix B). Three watercourse systems were identified within wetlands on the Project site.

3.2 - Wetlands 1, 2, 3 and 4

Wetlands 1, 2 3, and 4 are naturally occurring sloped wetlands that are located within sloped forested areas of the Project site. These wetlands are not proposed to be impacted by the proposed Project design, however, a basic function-value assessment for these wetlands is included below.

Based on the USACE's 13 functions and values provided above:

1. Groundwater Recharge/Discharge – Wetlands 1, 2, 3, and 4 are gently sloped wetlands that drain downgradient to the southeast corner of the site. Gradual infiltration to support groundwater recharge is anticipated within Wetlands 1, 2, 3, and 4 and in the southeastern portions of Wetlands 1 and 2 where topographic grade begins to flatten, groundwater discharge is anticipated along the delineated Streams 1 and 3.

2. Floodflow Alteration – There are no Federal Emergency Management Agency (FEMA) identified floodplains present within the Project site, and due to the sloped nature of these wetlands, surface runoff is anticipated to flow through these wetlands to downgradient areas on and offsite. It is anticipated that these wetlands provide minimal flood storage functions for the surrounding vicinity.

3. Fish and Shellfish Habitat – Wetlands 4 and 3 do not have stream channels associated with them, so it is anticipated suitable fish or shellfish are not found here due to their stagnant nature. Wetlands 1 and 2 do have streams present, but the onsite wetlands are at their associated stream's headwaters, and it is not anticipated fish or shellfish are using these channels as migratory pathways due to their hydrologic isolation. Therefore, this category of function and value does not apply to these wetlands.

4. Sediment/Toxicant Retention; Nutrient Removal; Product Transport – As these wetlands are located within mature forested, scrub-shrub, and herbaceous vegetated portions of the Project site and are located on sloped topography, it is anticipated that the wetlands have the capacity to trap and remove pollutants, transport nutrients, and improve the overall water quality to downgradient environments.

5. Sediment/Shoreline Stabilization – As no shoreline or major stream channel is located within these wetlands, this function does not apply to these wetlands.

6. Wildlife Habitat – The wildlife habitat function of these wetlands is suitable for many terrestrial, avian, and aquatic species due to the diversity of vegetation present, isolated nature from heavily trafficked roadways, and lack of recreational activity within or adjacent to them. Short and long-term use of these wetlands and their directly adjacent uplands as breeding, foraging, and shelter habitats likely occurs. Larger mammals including deer, bears, or coyotes are anticipated to traverse through the site using the onsite ROW, which extends offsite to Cronton Falls Reservoir to the east, which could serve as ideal foraging habitat for many large mammals and raptor bird species.

7. Recreation Consumption – There are no authorized public recreational uses onsite, but unauthorized local ATV trails are present. Fishing is not anticipated within any of these wetlands, as fish/shellfish support is not anticipated, and any streams present would be too small for any boating activities. There is no fence prohibiting hikers from accessing the site from the Putnam Trailway Empire State Trail, but all hiking use would be unauthorized.

8. Educational/Scientific Value; Uniqueness/Heritage – Based on a review of historic aerial imagery, as these wetlands are anticipated to have been onsite long-term, they could be

used as quality "outdoor classrooms. A Phase 1B Archaeological Field Reconnaissance Survey Report was prepared by Hudson Cultural Services in August 2023 documenting that low uniqueness/heritage value was provided onsite.

9. Endangered Species – Based on a 2021 Natural Heritage Review, no rare or state-listed animals/plants or significant natural communities are within the Project site (Appendix C). Based on a July 20, 2023, U.S Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) review, habitat for the endangered Northern Long-eared Bat (*Myotis septentrionalis*), Indiana Bat (*Myotis sodalist*), and the threatened Bog turtle (*Glyptemys muhlenbergii*) are anticipated to be onsite. Based on the USFWS's Fact Sheets for these species:

Northern Long-eared Bat

> *"…northern long-eared bats roost singly or in colonies underneath bark, in cavities or crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds."*

Indiana Bat

> *"The Indiana bat is a small, insectivorous, migratory bat that hibernates colonially in caves and mines in the winter…and require forests for foraging and roosting… Maternity habitat ranges from areas that are completely forested to highly fragmented forest… In summer, most reproductive females occupy roost sites in forested areas under the exfoliating bark of dead or dying trees that retain large, thick slabs of peeling bark. Primary roosts usually receive direct sunlight for more than half the day. Roost trees are often within canopy gaps in a forest, in a fenceline, or along a wooded edge. Habitats in which maternity roosts occur include riparian zones, bottomland and floodplain habitats, wooded wetlands and upland communities. Indiana bats typically forage in semi-open to closed forested habitats with open understory, forest edges, and riparian areas."*

Due to the presence of a mature forest with a dense canopy, bat roosting habitat is not anticipated within these wetlands as light struggles to penetrate the canopy. Within the utility ROW in Wetland 2, the lack of canopy cover could provide roosting and foraging habitat, but it would be limited to the ROW. No structures, caves or mines are located within any of these wetlands, so hibernation habitat is not anticipated.

Bog Turtle

> *"Bog turtles are one of the smallest turtle species in the world, and the smallest in North America. Adults are no more than 4.5 inch long… Bog turtles occupy shallow wetland habitats. They are semi-aquatic, meaning sometimes they like to spend time in the water and sometimes they like to be on land or on top of hummocky vegetation above the water. The wetlands they occupy tend to be open-canopy herbaceous sedge bogs, fens or wet meadows, meaning there aren't a lot of trees present that shade out plants that bog turtles like, such as the tussock sedges that form hummocks used for basking and nesting, shrubby cinquefoil, poison sumac, grass-of-parnassus, and cattail, among many other plant species… Bog turtles generally retreat into more densely vegetated areas (different areas than what they typically use during spring and summer months), under*

> *the roots of trees or shrubs, rock walls, or even muskrat burrows to hibernate from mid-September through mid-April (depending on latitude).*"

Due to the presence of a mature forest with a dense canopy, bat roosting habitat is not anticipated within these wetlands as light struggles to penetrate the canopy. Within the utility ROW, the lack of canopy cover could provide roosting and foraging habitat.

Based on this brief assessment, Wetlands 1, 2, 3, and 4 are considered to be Medium-quality wetlands.

3.3 – Wetland 5

Wetland No. 5 is naturally occurring and located in the western portion of the Project site. This wetland is associated with multiple stream channels that flow through the site from north to south. These streams are conveyed from offsite to the north through culvert piping, converge on site, and continue to flow offsite as a single natural channel to the south. This wetland complex is also located at the toe-of-slope associated with the onsite ridge. This wetland is also located at the onsite ridge's toe-of-slope and is primarily a scrub-shrub herbaceous within and adjacent to the stream channels and forested along the channel fringes.

As these wetlands are proposed to be impacted by the proposed Project design, a function-value assessment has been prepared below. Based on the USACE's 13 functions and values provided above:

10. <u>Groundwater Recharge/Discharge</u> – It is anticipated that groundwater discharge occurs within Wetland 5, but due to its toe-of-slope location and the presence of several stream channels within the wetland, groundwater recharge is likely minimal.

    Based on a review of aerial imagery and site visits during various seasons, the streams within Wetland 5 are perennial, and the surrounding wetland displays standing water throughout the year as well. During the 2021 delineation effort, a high water table was observed within Wetland 5, and soils included saturated sandy loams. Groundwater discharge (e.g., seeps) is anticipated to be a source of saturation to Wetland 5, in addition to stormwater runoff from the surrounding impervious developed areas along Miller Road.

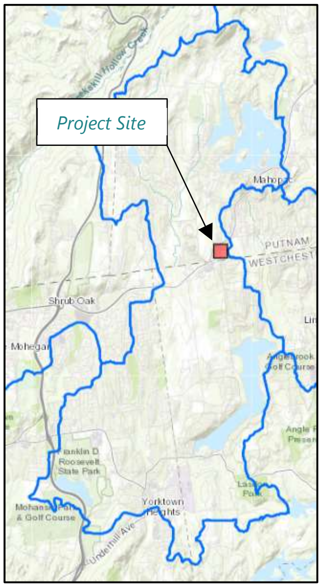


Image 2 – HUC 12 Watersheds

11. <u>Floodflow Alteration</u> – No FEMA-identified floodplain is present within the Project site, but Wetland 5 is located within a concave environment bound by the upgradient Miller Road to the west and the onsite ridge's toe-of-slope to the east. Since water is conveyed onsite via culverted pipes and stormwater runoff from the surrounding developed area, and is conveyed offsite as a single constricted stream, it is anticipated that Wetland 5 provides flood water desynchronization (collection, storage, gradual release) during flooding events for its surrounding neighborhood. However, as identified by the NYSDEC Hudson Valley Natural Resource Mapper (See Image 1), the Project site's HUC12 watershed is primarily vegetated with minimal

impervious cover[3] present, and therefore the Project site's function for flood desynchronization is not isolated and rare but is common and widespread throughout this watershed. Additionally, the site is located in the northern portion of the watershed and does not provide flood desynchronization functions for the surrounding region like the southern portion of the watershed would.

12. Fish and Shellfish Habitat – Wetland 5 is associated with multiple stream channels that flow from the north via culverted pipes and road crossings. These perennial stream channels range from three to six feet in width, flow is retained through the winter season, and shade cover is provided by canopy trees and scrub-shrub vegetation. To the west and north of Wetland 5 are various commercial and industrial properties and Miller Road and Route 6. It is anticipated that Wetland 5 collects stormwater runoff from these areas. Based on a review of the NYSDEC Hudson Valley Natural Resource Mapper, the Project site steam is not identified as a trout-supporting (stock, migration) watercourse, a Known Important Area for Migratory Fish, a Known Important Coldwater Stream Habitat, or a Fishing Access location. No fish or shellfish were observed within Wetland 5 during past site visits.

    Therefore, while fair water quality is anticipated onsite, the stream channels are less than 50ft in width and are not identified as fish or shellfish-supporting water features. Suitability for the presence of fish and shellfish on site is low.

13. Sediment/Toxicant Retention; Nutrient Removal; Product Transport – Wetland 5 is located within a groundwater discharge area and has multiple stream channels that converge into a single, well-defined, meandering channel onsite. Sediment/toxicants that are brought onsite may be trapped within the scrub-shrub and forested vegetation within and adjacent to Wetland 5, but due to the continuous flow of water to the south, long-term retention is limited. Therefore, toxicant/nutrient removal functions within Wetland 5 are anticipated to be poor, but product transport is anticipated to be high. It is anticipated that any product transported offsite is retained and cleaned through infiltration processes ±0.5 miles to the south of the Project site, where the stream channel disperses into a larger wetland complex.

14. Sediment/Shoreline Stabilization – Wetland 5 provides stream channel stabilization to the various channels present. Dense forest and scrub-shrub vegetation throughout the wetland and stream channels protect against erosion scouring, and the well-defined stream channels divide the channels from the adjacent wetlands that vary in width. This varying width further provides erosion protection, reducing velocities of runoff before flowing into the streams.

15. Wildlife Habitat – Wetland 5 is located between the developed Miller Road and the undeveloped remainder of the Project site. Upstream wildlife connectivity is relatively poor due to the presence of Route 6, developed commercial, residential, and industrial properties, culverted pipes, and impervious riparian buffers. Downstream connectivity is anticipated to be fair as the onsite streams converge and flow offsite as a single stream channel, which has a forested riparian buffer. However, based on a review of aerial imagery, the offsite riparian buffer is limited by developed residential neighborhoods, limiting the ease of access for wildlife to traverse north to the Project site. Wildlife access from the east is unprohibited and ideal for traversing.

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[3] The NYSDEC Hudson Valley Natural Resource Mapper was used on November 20, 2023, and identified the HUC12 watershed (No. 02030101030, Muscoot River) to be 52.7 acres of canopy cover and 8.4 acres of impervious cover as of 2016.

Dense vegetation within Wetland 5 provides shade relief, foraging, and shelter habitat for avian and small mammal species. Songbirds and small mammals including squirrels, rodents, raccoons, and skunks could utilize this wetland for shelter and foraging habitat, but larger mammals including deer, bears, or coyotes are not anticipated to utilize this wetland for long-term habitat due to its proximity to developed residential, commercial and industrial properties. The adjacent forested upland may provide a suitable habitat for large mammals, however.

16. Recreation Consumption – Fishing and hunting are not permitted within the Project site and the onsite streams are too small for boating activities. Due to the dense vegetation present within Wetland 5, it is not anticipated that local hikers will traverse the wetland as part of their use of the Putnam Trailway Empire State Trail, but there is no fence prohibiting foot access. Additionally, a small parking area is located at the northernmost point of the site, where the public could hike through the Project site to Wetland 5, although it would be unauthorized use of the property.

17. Educational/Scientific Value; Uniqueness/Heritage - A Phase 1B Archeological Report was prepared for the Project site in August 2023 by Hudson Cultural Services, which resulted in no archaeological deposits from 277 shovel test pits. No additional cultural resources investigations were recommended. Additionally, no authorized recreational activities occur on site, however, locals do use the site for ATVing and hunting activities, which are not authorized by the property owner. There are no significant educational features on site that are not found in adjacent forested areas (i.e., stone structures, foundations, etc.). While no school is located within ±0.5 miles of the Project site, the Project site and Wetland 5 could provide an educational "outdoor classroom" function if authorized by the property owner.

18. Endangered Species – Based on a 2021 NYSDEC Natural Heritage Review, no rare or state-listed animals or plants, or significant natural communities are within the Project site (Appendix C). Based on a July 20, 2023, U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) review (Appendix C), habitat for the endangered Northern Long-eared Bat (*Myotis septentrionalis*), Indiana Bat (*Myotis sodalist*), and the threatened Bog turtle (*Glyptemys muhlenbergii*) are anticipated to be onsite. Based on the USFWS's Fact Sheets for these species:

    Northern Long-eared Bat

    > *"…northern long-eared bats roost singly or in colonies underneath bark, in cavities or crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds."*

    Indiana Bat

    > *"The Indiana bat is a small, insectivorous, migratory bat that hibernates colonially in caves and mines in the winter…and require forests for foraging and roosting… Maternity habitat ranges from areas that are completely forested to highly fragmented forest… In summer, most reproductive females occupy roost sites in forested areas under the*

> *exfoliating bark of dead or dying trees that retain large, thick slabs of peeling bark. Primary roosts usually receive direct sunlight for more than half the day. Roost trees are often within canopy gaps in a forest, in a fenceline, or along a wooded edge. Habitats in which maternity roosts occur include riparian zones, bottomland and floodplain habitats, wooded wetlands and upland communities. Indiana bats typically forage in semi-open to closed forested habitats with open understory, forest edges, and riparian areas."*

No structures are located within or directly adjacent to Wetland 5, and the forested canopy cover provides shade throughout the day. The shrub-shrub portions of Wetland 5 could provide rooting habitat in dead or dying trees in the area, but these scrub-shrub areas are limited and narrow, with dense forested canopy trees being the primary cover within this wetland. While no caves or mines are located within or adjacent to Wetland 5, the stream channels within Wetland 5 could provide suitable foraging swooping corridors for bats. However, as the stream flows naturally offsite to the south, this swooping corridor habitat is available within the surrounding vicinity as well as onsite.

As stated by the NYSDEC (See Appendix C), to avoid any potential impacts to bat species habitat, any tree clearing must be completed between November 1 and March 31st. Any proposed tree-clearing activities would adhere to local, state, and federal species regulations to reduce and avoid any impact on threatened and endangered species.

Bog Turtle

> *"Bog turtles are one of the smallest turtle species in the world, and the smallest in North America. Adults are no more than 4.5 inch long… Bog turtles occupy shallow wetland habitats. They are semi-aquatic, meaning sometimes they like to spend time in the water and sometimes they like to be on land or on top of hummocky vegetation above the water. The wetlands they occupy tend to be open-canopy herbaceous sedge bogs, fens or wet meadows, meaning there aren't a lot of trees present that shade out plants that bog turtles like, such as the tussock sedges that form hummocks used for basking and nesting, shrubby cinquefoil, poison sumac, grass-of-parnassus, and cattail, among many other plant species… Bog turtles generally retreat into more densely vegetated areas (different areas than what they typically use during spring and summer months), under the roots of trees or shrubs, rock walls, or even muskrat burrows to hibernate from mid-September through mid-April (depending on latitude)."*

Wetland 5 is comprised mostly of scrub-shrub wetlands with various mature trees interspersed throughout. The southern portion of Wetland 5 could potentially serve as a bog turtle habitat, due to a mix of scrub-shrub and herbaceous wetland cover. However, the proximity of the road and various business/residential developments along the west and south property boundaries could preclude the presence of bog turtles in Wetland 5.

The proposed bridge from Miller Road would include crossing through Wetland 5 and the associated stream. During construction activities, Best Management Practices (BMPs) and erosion and sediment controls will be utilized. The bridge design will include a culvert to maintain streamflow; that culvert is not anticipated to negatively impact wildlife species, including potential bog turtles.

Based on this functions and values assessment, Wetland 5 is considered to be a Medium-Quality wetland that provides specific environmental functions and/or values, but low community value.

Table 2: Wetland Function/Values Classification Chart

Function Value Category	Groundwater Recharge/ Discharge	Floodflow Alteration	Fish and Shellfish Habitat	Sediment/ Toxicant Retention; Nutrient Removal; Product Transport	Sediment/ Shoreline Stabilization	Wildlife Habitat	Recreation Consumption	Educational/ Scientific Value; Uniqueness/ Heritage	Endangered Species
Wetland 1	Medium	N/A	N/A	Medium	N/A	Medium	Low	Low	Medium
Wetland 2	Medium	N/A	N/A	Medium	N/A	Medium	Low	Low	Medium
Wetland 3	Medium	N/A	N/A	Medium	N/A	Medium	Low	Low	Medium
Wetland 4	Medium	N/A	N/A	Medium	N/A	Medium	Low	Low	Medium
Wetland 5	Medium	Low	Low	Low	Medium	Medium	Low	Low	Medium

4

Proposed Activities and Potential Impacts

This development Project proposes to construct the Union Energy Center, which will provide a battery energy storage system (BESS) for up to 116 megawatts (MW) of Alternating Current (AC). The BESS will consist of:

- Gravel driveways and one bridge crossing.
- Two pads for battery storage.
- Lithium-ion battery containers.
- Heating, ventilation and air conditioning (HVAC) cooling systems.
- Control instrumentation.
- A stormwater management system; and
- Electric grid interconnection switchgear for the 115-kilovolt interconnection.

The Project will also include a substation to collect the energy from the BESS and a subdivided substation for New York State Electric & Gas (NYSEG) to own and operate. The entire development will have motion-sensor safety lighting, perimeter security fencing, and sufficient maintenance of vegetation to screen from neighboring properties.

4.1 – Proposed Activity Within Wetlands

The proposed development will require ±3,000sf (±0.06 acres) of permanent impacts to the ±165,850sf (±3.81 acre) Wetland 5 for the proposed bridge crossing, which is ±2% of the total area of Wetland 5. No additional impacts to any other regulated wetlands onsite are proposed at this time. The proposed bridge crossing will be the only site access entry point, coming from Miller Road towards the east across Wetland 5. The crossing will be ±20ft in width and ±95ft in length and will include a culvert/headwall system for water conveyance, two retaining walls, and a guardrail.

Based on VHB’s functions and values assessment above, and the July 2021 Wetland and Watercourse Delineation Report prepared by VHB, Wetland 5 is a Medium Quality wetland. Permits from local, state, and federal agencies for these disturbances will be procured prior to the start of construction.

4.2 – Potential Effects of Proposed Activity on Flora

At the location of the proposed bridge crossing, Wetland 5 is dominated by scrub-shrub and herbaceous vegetation, with individual canopy trees present (See Image 2). Due to the absence of a thick canopy, light reaches ground surface year-round at this location, but emergent vegetation and exposed roots were not observed at this location. Species present include Multiflora rose (Rosa multiflora), American beech (*Fagus grandifolia*), Black cherry (*Prunus serotina*), Japanese honeysuckle (*Lonicera japonica*), Jewelweed (*Impatiens capensis*) and Common rush (*Juncus effusus*).

Although vegetation will be removed for the installation of the crossing, it is anticipated that the remaining disturbed areas will naturally revegetate. Any temporarily lost habitat is anticipated to return within the following one to two growing seasons, and no adverse long-term impacts to vegetation at the proposed crossing location are anticipated.

Nevertheless, the Project proposes mitigation for all wetland impacts to compensate for lost vegetation. Please see Section 5 below for details.

4.3 – Potential Effects of Proposed Activity on Fauna

The proposed crossing impact area is about ±2% of Wetland 5, the remainder of which will remain undisturbed, and impacts to wildlife habitat are anticipated to be minimal. The proposed culverts are not anticipated to hinder streamflow, and the crossing will not hinder wildlife access within and around Wetland 5. The portion of the stream channel not disturbed by the crossing structure will be protected using Best Management Practices (BMPs) and soil erosion and sediment control (SESC) measures such as silt fences, wattles, and haybales. Wildlife access to Wetland 5 and the stream channel is also anticipated to remain suitable for small and large mammals. Post-construction continued use of the wetland and stream for foraging and shelter habitat for avian and small mammal species is also anticipated.

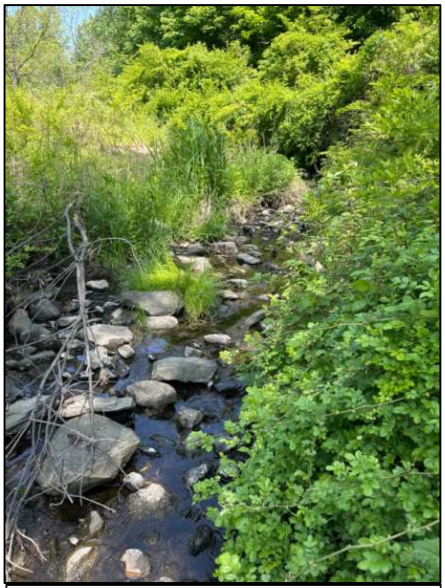


Image 3 - Existing Conditions of Proposed Bridge Crossing Area

As required by the USFWS, any tree-clearing activities will occur between November 1 and March 31 to avoid impacting potential Northern Long-eared Bat and Indiana Bat habitat. Additionally, BMPs and SESC measures will also be used to protect potential Bog turtle habitat onsite, including exclusion area fences around the Project’s Limit of Disturbance during construction, and daily construction site sweeps to identify and relocate any potential species that may be traversing the site. Any species identified would be relocated onsite, outside of the construction work area.

5

Conceptual Compensatory Mitigation Approach

Compensatory wetland mitigation is provided for impacts to the freshwater wetlands. As the proposed Project will involve a permanent impact of ±3,000sf (±0.06 acres) of Wetland 5 and ±27,200sf ±(0.62 acres) of the NYDEC Adjacent Area associated with Wetland 5, a preliminary conceptual mitigation approach has been prepared to offset impacts. Note that this approach is subject to change based on the Project's continued planning and design phase, but the approach will compensate for all regulated impacts as required by the USACE. Additionally, a USACE permit authorization will be required for the proposed impacts, and therefore, the final compensatory mitigation plan will be reviewed and approved by the USACE prior to the start of construction within Wetland 5.

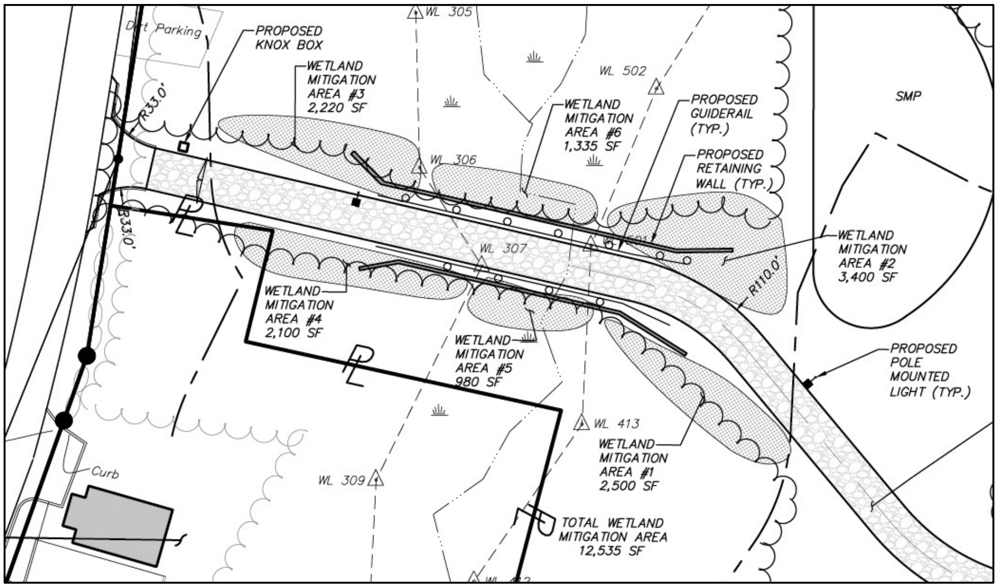


Image 4 - Preliminary Conceptual Compensatory Mitigation Approach

Currently, the Project proposes to enhance the existing Wetland 5 by an approximate 12:1 mitigation/impact ratio. Therefore, the Project proposes to support and enhance the following functions of Wetland 5:

- Groundwater Recharge/Discharge.
- Floodflow Alteration.
- Sediment/Toxicant Retention, Nutrient Removal, Product Transport; and
- Wildlife Habitat.

Upon completion of compensatory mitigation activities, a five-year post-construction monitoring period is proposed to monitor the success of the enhancements and the survival of planted species.

At the end of each growing year, an annual report will be submitted to the USACE to document the status and progress of the restored and enhanced wetlands, and any mitigative tasks that may be required during the following five growing seasons to continue a successful enhancement progression. Upon the completion of the fifth year, a final mitigation report would be submitted documenting the completion of all mitigation requirements required for this proposed Project.

6

References

1. Cowardin, L.M., V. Carter, F.C. Golet, E.T. LaRoe (1979). Classification of Wetlands and Deepwater Habitats of the United States. US Government Printing Office. Washington D.C. GPO 024-010-00524-6.103 pp.

2. USACOE (1993). The Highway Methodology Workbook Supplement. US Army Corps of Engineers New England Division. NEDEP. 32 pp.

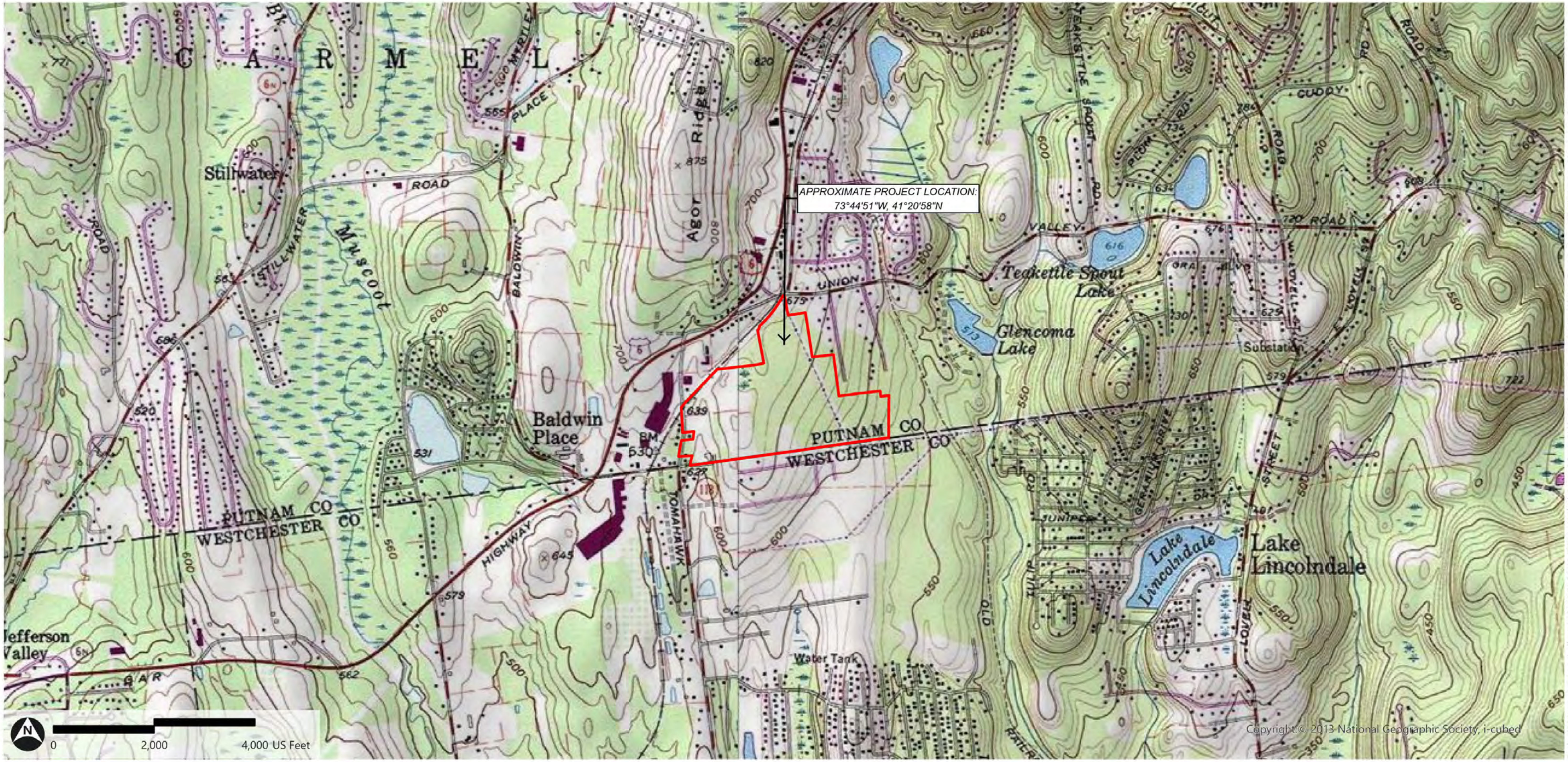
3. United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil descriptions. Website:

   http://soils.usda.gov/technical/classification/osd/index.html).

FIGURES

Figure 1: USGS Site Location Map

Union Energy Center | 24 Miller Road, Carmel, New York - Parcel No. 86.11-1-14



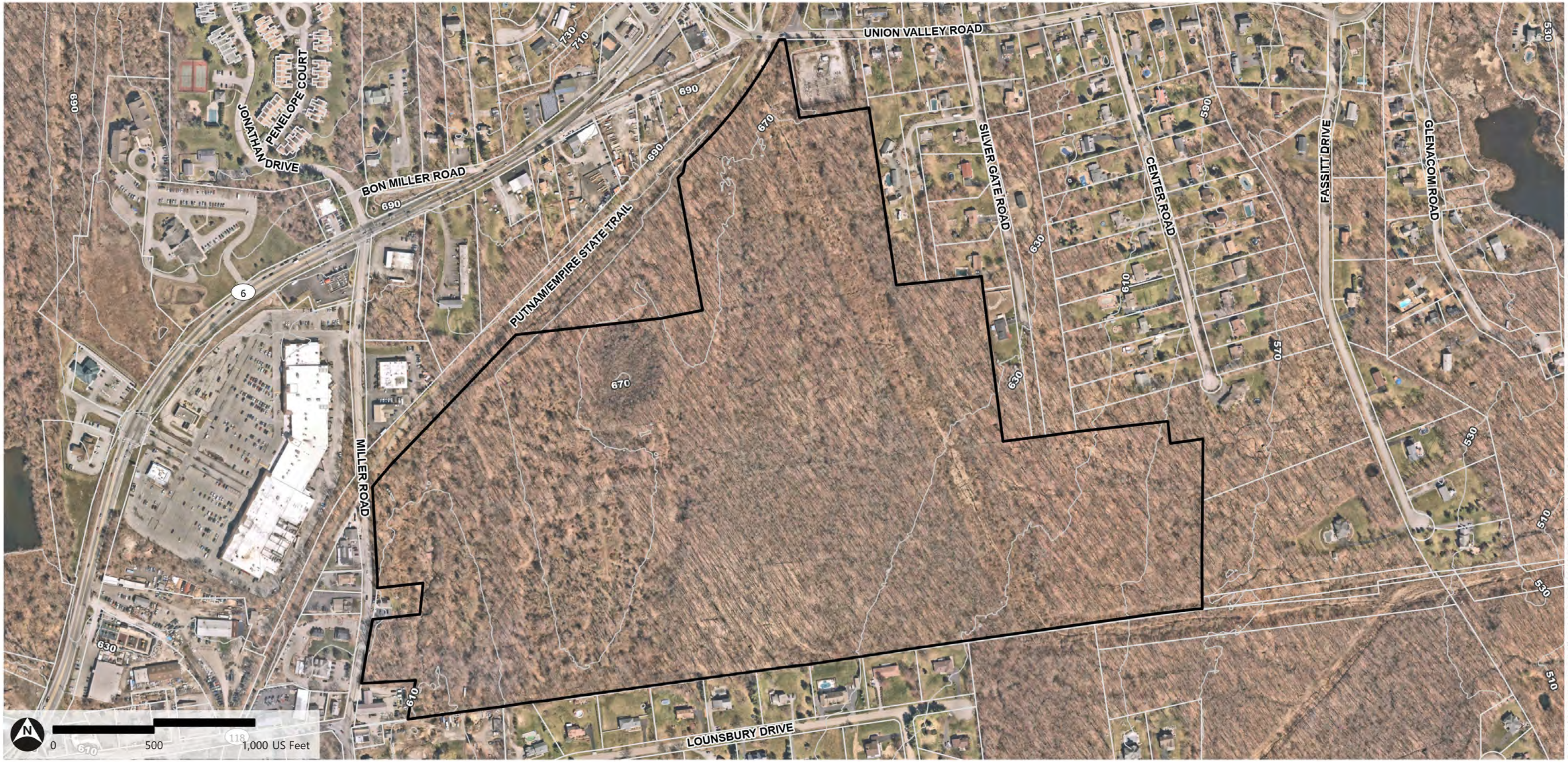
🟥 Project Area

Source: USGS, VHB

Path: \\vhb.com\gis\proj\Albany\20692.01 BPUS P1ESA Wetlnd Carmel\Project\Union Energy Center Project\Union Energy Center Project.aprx (User: srao, Date:

Figure 2: Aerial Imagery Map

Union Energy Center | 24 Miller Road, Carmel, New York - Parcel No. 86.11-1-14



Project Area

Parcel Boundary

10-foot Contours

Source: NYS GIS Clearinghouse, NearMap, VHB

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APPENDIX A

WETLAND DELINEATION REPORT

WETLAND AND WATERCOURSE DELINEATION REPORT

24 Miller Road

Mahopac, New York

PREPARED FOR

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Development, LLC
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July 12, 2021

Table of Contents

Appendices

1

Introduction

1.1 Proposed Project

BPUS Generation Development, LLC ("the Client) proposes to develop an approximate 93.60-acre parcel located on Miller Road and Union Valley Road in the Town of Carmel, Putnam County, New York (the Project Site). A Site Location Map has been prepared (Appendix A, Figure A.1).

Proposed structure configurations and/or site design details are not currently available. BPUS Generation Development, LLC is a battery energy storage system (BESS) project intended to improve the resiliency, reliability, and affordability of New York's electrical grid. The project area will consist of battery enclosures, inverters, transformers, a security fence, and vegetative screening. The batteries themselves are housed in enclosures, that will be supported by concrete pads or piers. Similarly, the inverters and transformers will also be supported by concrete pads or piers. The rest of the site's ground cover will most likely be gravel or a similar substance. The project will interconnect to the existing NYSEG transmission system near the property. There will exist space between the enclosures and the security fence to allow access to vehicles for routine maintenance.

1.2. Existing Conditions

VHB conducted a desktop review prior to visiting the Project Site. This review included the National Resource Conservation Service (NRCS) Web Soil Survey (NRCS, 2019), United States Geological Survey (USGS) National Hydrologic Database (NHD), United

States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), New York State Department of Conservation (NYSDEC) Environmental Resource Mapper (NYSDEC, 2021), New York State Historic Preservation Office (NYSHPO), as well as orthoimagery and topography of the proposed Project Site (see Appendix A, Figures A.1-A.8).

1.3 Land Cover

Based on desktop review of the USFWS NWI maps (USFWS, 2021) and NYSDEC ERM (NYSDEC, 2021), both NYSDEC-regulated wetlands and federally mapped wetlands are present within the Project Site. A map of federal and state wetland and surface water boundaries are provided in Appendix A, Figure A.2.

Through desktop review and field survey, VHB identified five (5) land cover types present within the Project Site, including: palustrine forested wetland, composed of green ash (*Fraxinus nigra*), American beech (*Fagus grandifolia*), and Red maple (*Acer rubrum*), palustrine emergent and forested wetland, composed of American elm (*Ulnus americana*) and green ash, unpaved roads and paths, upland forest, and intermittent stream (Edinger, G. J. et al, 2014). A map illustrating the land cover areas has been provided (Appendix A, Figure A.3). As shown in Figure 3, upland forest dominated the Site, with a total of approximately 69.70 acres; followed by 11.15 acres of sucessional shrubland. The areas proposed for development are primarily located within upland forested and forested/scrub shrub wetlands.

The Project Site is bounded by residential properties and sporadic areas of undeveloped mixed deciduous-coniferous forest to the south, west, east, and north. A transmission line right-of-way (ROW) transects the center of the property. According to the Town of Carmel Zoning Map (dated 08/29/19), the Project Site lies entirely within the Commercial/Business Park District.

The topography of the Project Site is generally undulating, with elevation ranging between approximately 560 feet and 680 feet above mean sea level (AMSL). The highest point, 679 feet AMSL, is located toward the north western portion of the parcel while the lowest point, 566 feet AMSL, is located along the southeastern boundary (Appendix A, Figure A.4).

The Project Site is not located within any Federal Emergency Management Agency (FEMA) designated flood zones according to the National Flood Hazard Layer (NFHL) panel numbers 36079C0226E and 36079C0207E (effective dates 03/04/2013) (Appendix A, Figure A.5).

According to the NRCS, Project Site falls within the Lower Hudson HUC 12 Watershed and both the Muscoot River and Plum River-Croton River HUC 8 Watershed (Appendix A, Figure A.6). The closest traditional navigable water (TNW) is approximately 1.57 river miles and 0.84 aerial miles from the Project Site (see Appendix A, Figure A.7).

Additionally, the Project Site is located within an archaeological sensitive area. Consultation with SHPO will be performed at a later date in compliance with the State Environmental Quality Review Act (SEQRA).

1.4 Soils

According to the NRCS, the Project Site is comprised of 13 soil types, six (6) of which are hydric soils. Hydric soils present include: Fluvaquents-Udifluvents complex, frequently flooded (Ff), Natchaug muck, 0 yo 2 percent slopes (NcA), Ridgebury complex, 0 to 3 percent slopes, very stony (RdA), Ridegebury complex, 3 to 8 percent slopes (RdB), Ridegebury complex, 0 to 8 pecent slopes, very stony (RgB), and Sun Loam (Sh). A map depicting the soil units has been provided (Appendix A, Figure A.8).

2

Wetland & Water Assessment

VHB has performed desktop analyses, field inspections, and wetland/waterbody delineations on behalf of the Client for the 93.60-acre parcel, as illustrated by the "Project Site" within the Site Location Map (Appendix A, Figure A.1). Delineations occurred at the Project Site on May 14, 17 and 18 of 2021, identifying fie (5) palustrine wetlands and six (6) stream features.

Wetland boundaries have not been reviewed with NYSDEC or the United States Army Corp of Engineers (USACE). A Site Visit will be scheduled at a later date to confirm the delineation boundaries.

2.1 Wetlands and Waters

2.1.1 Background

Waters of the United States (WOTUS) are defined as: "*waters traditionally (currently or in the past) used for interstate or foreign commerce; as well as, a tributary of, or a feature* *containing a "significant nexus" or connection to a traditional navigable waterway (TNW)"* (USACE, 2012).

Wetlands are a subset of the WOTUS that may be subject to regulation under Section 404 of the Clean Water Act (CWA) (33 U.S.C. 1344). Wetlands are defined by key indicators, that under normal circumstances, support a "*prevalence of vegetation typically adapted for life in saturated soil conditions*." Wetland impacts are regulated by the CWA of 1972 (USACE, 2012). For most land uses and activities, including development, in New York State (NYS), the USACE and NYSDEC are both responsible for protecting wetlands from pollutants or activities that may result in the discharge of dredged or fill material into WOTUS. Not all regulated wetlands are mapped, and any mapped wetlands are subject to field verification.

Generally, a stream with at least intermittent flow is considered jurisdictional under the CWA. Similar to wetlands, WOTUS are regulated under CWA Section 404; navigable waterways are also regulated under Section 10 of the Rivers and Harbors act of 1899.

2.1.2 Methods

VHB Wetland Scientists conducted delineations for the Project Site on May 14, 18 and 19, 2021. Wetland delineations were conducted in accordance with the methodologies detailed in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)* ("Regional Supplement") (USACE, 2012) and the *New York State Freshwater Wetlands Delineation Manual* (Browne, S. et al, 1995). These methodologies require the evidence of three (3) criteria: a dominance of hydrophytic vegetation, the existence of hydric soils, and the presence of wetland hydrology.

Vegetation present was identified to species level using several regional references, with nomenclature following the 2016 USACE National Wetland Plant List (Lichvar, R.W. et. al., 2016). Observations were also recorded during the delineation to describe general wetland characteristics, determine potential functions and values, and classify wetlands in accordance with the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin, L.M. et. al., 1979). Wetlands are demarcated in the field with pink "Wetland Delineation" flagging, labeled with unique flag identification (ID) codes, which include the wetland number and flag number (i.e., W1-1).

Once boundaries were located, soil profiles were documented in both wetlands and uplands using a hand-held, 2-inch Dutch soil auger to extract soil samples to a depth of approximately 20 inches unless a restrictive layer was encountered. Soils were examined for color using the Munsell Soil Color Chart, texture, and depth of any redoximorphic features to determine if any hydric soil indicators were present. Redoximorphic features were recorded by color and type (concentrations, depletions, oxidized root channels, etc.).

USACE Wetland Determination Forms were completed for each wetland and upland area delineated (Appendix C).

Waters were field-delineated in accordance with guidance provided in the "*Regulatory Guidance Letter: Subject – Ordinary High Water ("OHW") Identification*" (USACE, 2005). During field work, flow regimes are preliminarily classified as perennial, seasonal, intermittent, or ephemeral based on qualitative observations of in-stream hydrology and existing geomorphic characteristics. Additional observations made during the delineation include channel substrate, surrounding land use, and OHW measurements, to complete an overall assessment of physical and habitat characteristics (Appendix C.2).

Narrow streams (generally defined as ephemeral or small intermittent streams with channel widths of less than 4 feet) were delineated along the centerline. Larger streams (large intermittent to perennial streams) were surveyed with two lines, each at the top of bank (TOB). Streams were demarcated in the field using blue survey tape, labeled with unique flag ID codes which includes the stream number and flag number (i.e., "S1-1"). Tributaries to streams are designated by adding a letter to the parent stream (i.e., A tributary to Stream S1 would be designated "S1A").

Wetland and stream flags were located in the field using the Collector and global navigation satellite systems (GNSS) status applications on Trimble R1 units capable of sub-meter accuracy. Weather data was compiled for the days of delineation to determine if the soil and vegetation were inspected under normal circumstances for that time of the year (National Oceanic Atmospheric Administration (NOAA), 2021).

2.1.3 Results

Please find a summary of wetlands identified onsite in Appendix B. Two (2) palustrine forested wetlands, one (1) palustrine forested/scrub-shrub wetland, one (1) palustrine emergent/forested wetland, and one (1) palustrine scrub-shrub/forested wetland cover types were delineated within the Project Site, encompassing a total of approximately 43.33 acres. Five (5) water features were also delineated within the Project Site. A Natural Resource Map (Appendix A, A.4) has been prepared to illustrate flagging details of each wetland area and stream identified.

Wetlands W1 and W3 are palustrine forested wetlands. W1 is anticipated to be sourced by surface runoff waters, and W3 is sourced by tributaries to Muscoot River onsite. Wetlands W2 and W5 are both palustrine forested and scrub-shrub; however, W2 is primarily forested with scrub-shrub fringe wetlands, and W5 is primarily scrub-shrub within minor forested areas dispersed throughout. W2 is sourced by surface runoff waters, and both W2 and W5 are sourced by delineated tributaries to Muscoot River onsite.

Wetland W4 is primarily emergent, with at least 8-11in of standing water at the time of delineation. The wetland is also partially forested with multiple mature canopy trees present. This wetland is anticipated to be sourced by surface runoff waters and a high-water table. Wetland W4, W1, W2 and W3 are all anticipated to by hydrologically connected either by surface water connectivity or groundwater connection.

Please find a summary of waters delineated onsite in Appendix B. Streams S1, S3, S4, S5 and S6 are all unnamed tributaries to Muscoot River and flow to either the south or southwest. Each stream is under four feet in width, and S1 and S3 are under two feet in width. S4, S5 and S6 are all culverted from adjacent tributaries, and converge into a single stream channel which flows offsite via another culvert along the southern border.

Throughout the wetlands within the Project Site, the forest stratum was primarily composed of black ash, green ash, and American elm. When shrub stratum was present, Spicebush (*Lindera benzoin*) was most common. The herbaceous stratum was generally composed of siltgrass, sensitive fern and fringed loosestrife.

Hydric soil indicators were predominately histosols (A1), depleted below the dark surface (A11), dark surface (S7) and depleted matrix (F3) within the Project Site wetlands. The A horizon was very dark within the wetland areas, with a lighter depleted matrix horizon below as documented by the wetland data forms (Appendix C.1). Upland soils were characterized by a dark surface layer but without a depleted matrix, with distinct A and B horizons as documented in the upland data forms (Appendix C.1).

Complete USACE wetland determination data forms were provided for wetlands and uplands; and VHB stream data was collected (Appendix C.2). Photographs of the individual plots are included with the data forms; additional photos of general wetland and upland views are provided in the Photograph Log (Appendix D).

2.1.4 Conclusions

As described in Section 2.1.3, VHB identified and delineated five (5) wetlands and six (6) streams at the Project Site. Based on field observations, Wetlands W1, W2, W3 and

W4 are hydrologically connected wetlands. W5 is anticipated to be solely under the jurisdiction of the USACE, as it remains outside of the NYDEC's 100ft review area buffer and is smaller in size. However, it is anticipated that NYSEDC may include their wetland under their jurisdiction as well for site conformity. Therefore, jurisdictional under both the NYSDEC and USACE is anticipated for the entire site. Additionally, these wetlands have a 100-foot upland adjacent area regulated by NYSDEC. None of the wetlands identified onsite are isolated. A jurisdictional determination from both the NYSDEC and the USACE would be required to confirm jurisdiction of wetlands onsite.

Based on preliminary field observations, all streams onsite appear to be jurisdictional under the CWA. A preliminary jurisdictional determination from the USACE would be necessary to determine the jurisdictional status of this stream.

3

Project Summary

On behalf of the Client, VHB conducted delineations of wetland and water features during spring of 2021.

The likely jurisdictional status of each feature is summarized, along with the approximate feature size, in the table below.

Jurisdiction Determination of Wetland and Stream Features

Feature ID	Type	Acres	Potential Jurisdiction
Wetland W1	PFO	3.46	Jurisdiction determination necessary with NYSDEC/USACE
Wetland W2	PFO/SS	30.29	Jurisdiction determination necessary with NYSDEC/USACE
Wetland W3	PFO	3.48	Jurisdiction determination necessary with NYSDEC/USACE
Wetland W4	PEM/FO	2.28	Jurisdiction determination necessary with NYSDEC/USACE
Wetland W5	PSS/FO	3.81	Jurisdiction determination necessary with USACE
Feature ID	**Type**	**Linear Feet**	**Potential Jurisdiction**
Stream S1	Perennial	504	Hydrologically Connected to Muscoot River – USACE
Stream S3	Perennial	203	Hydrologically Connected to Muscoot River – USACE
Stream S4	Intermittent	1,313	Hydrologically Connected to Muscoot River – USACE

Stream S5	Perennial	206	Hydrologically Connected to Muscoot River – USACE
Stream S6	Perennial	350	Hydrologically Connected to Muscoot River – USACE

Direct impacts to jurisdictional wetland or water features within the Project Site would require federal approvals from USACE. A jurisdictional determination with USACE is necessary if any direct impacts are anticipated.

4

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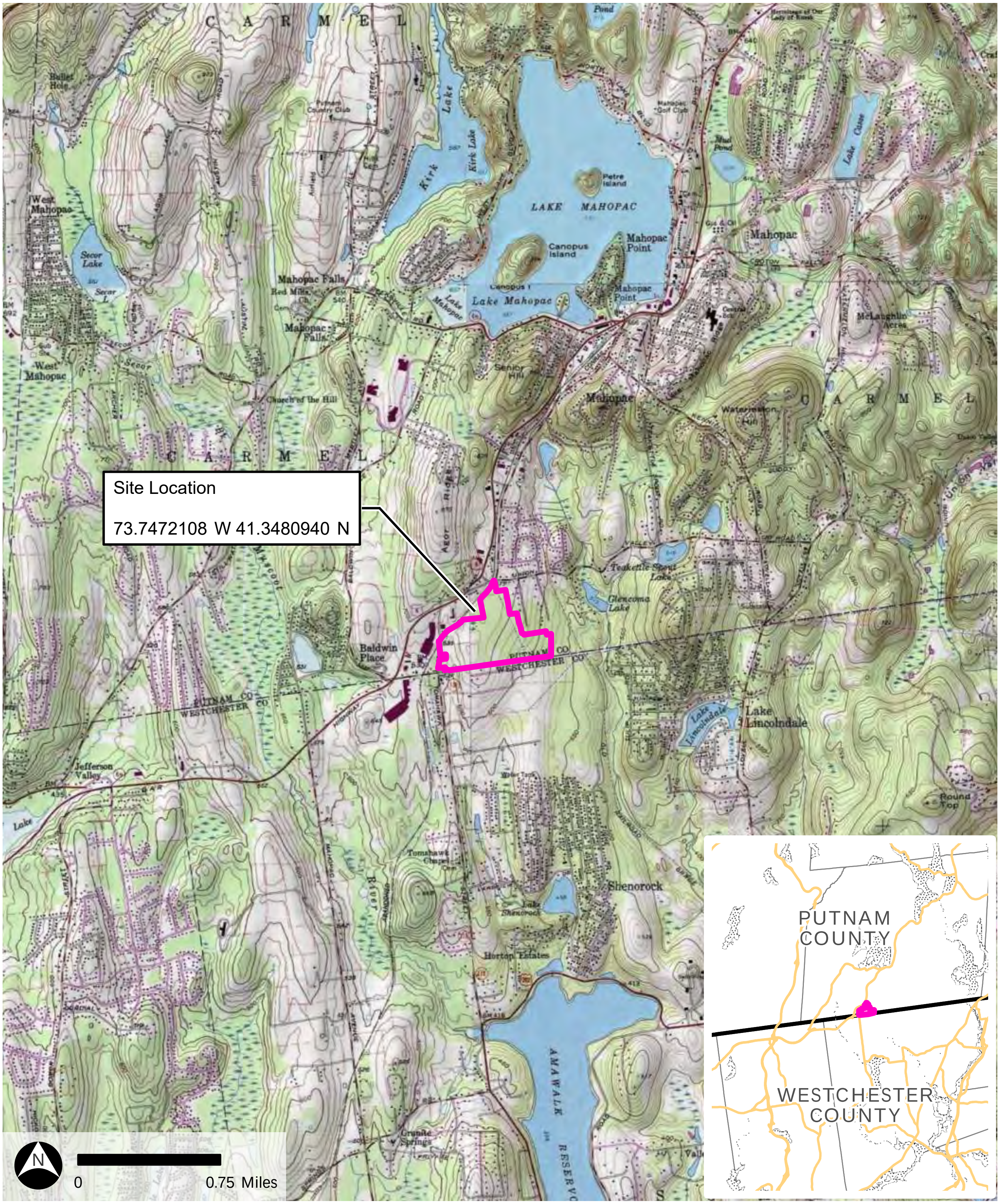
Appendix A

Figures

Figure A.1: Site Location

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

July 01, 2021



▭ Study Area

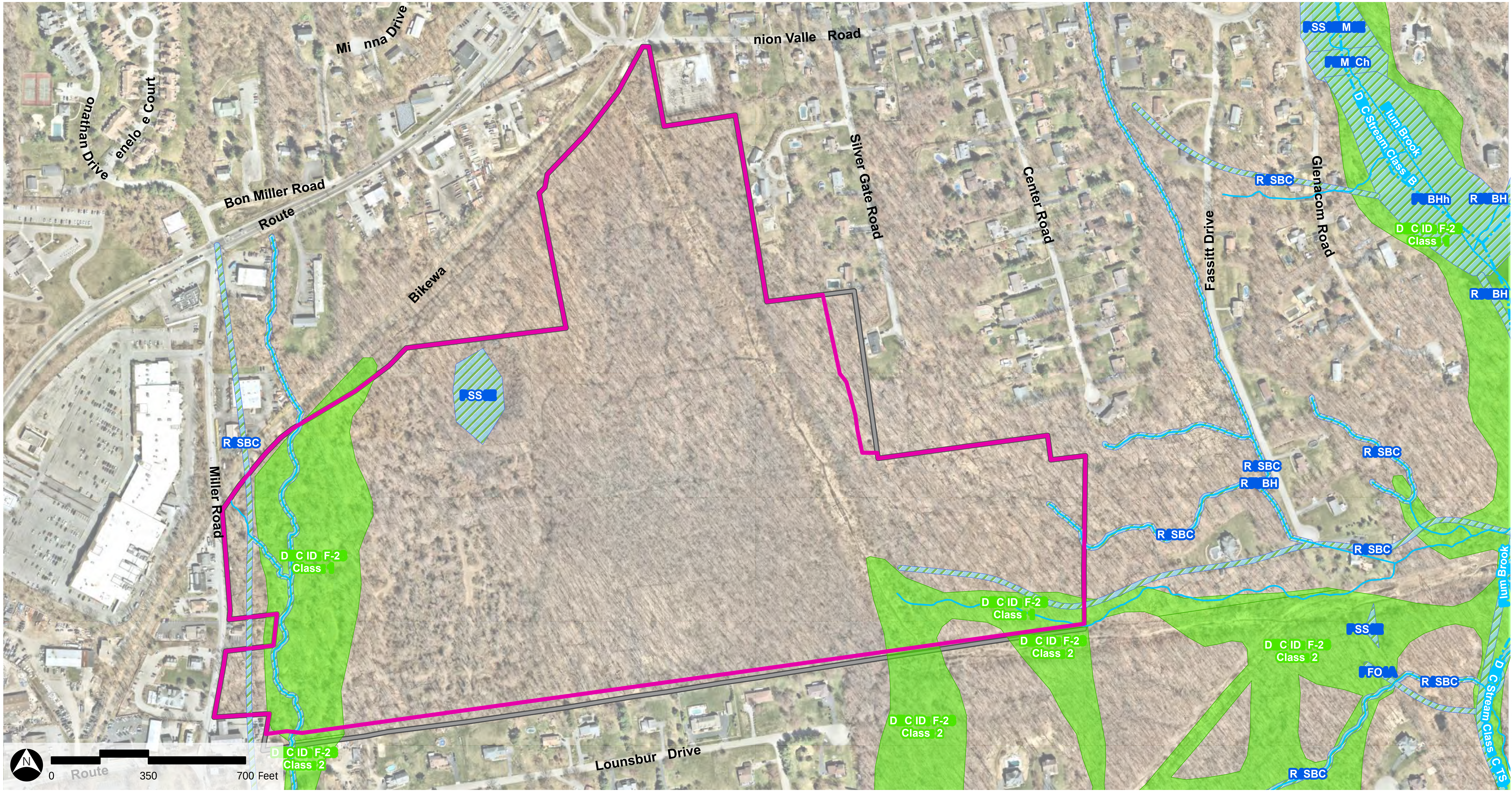
Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed.

Path: \\vhb.com\gis\proj\Albany\20692.00 EastPoint Energy Carmel\Project\Delineation Report Series\Fig1_SiteLocation.aprx (SManley, 7/1/2021)

Figure A.2: Federal and State Mapped Wetlands

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: July 01, 2021



- ▭ Study Area
- ▭ Parcel Boundary
- Streams (NYSDEC)
- Streams (NHD)
- ▨ Wetlands (NWI)
- 🟩 Wetlands (NYSDEC)

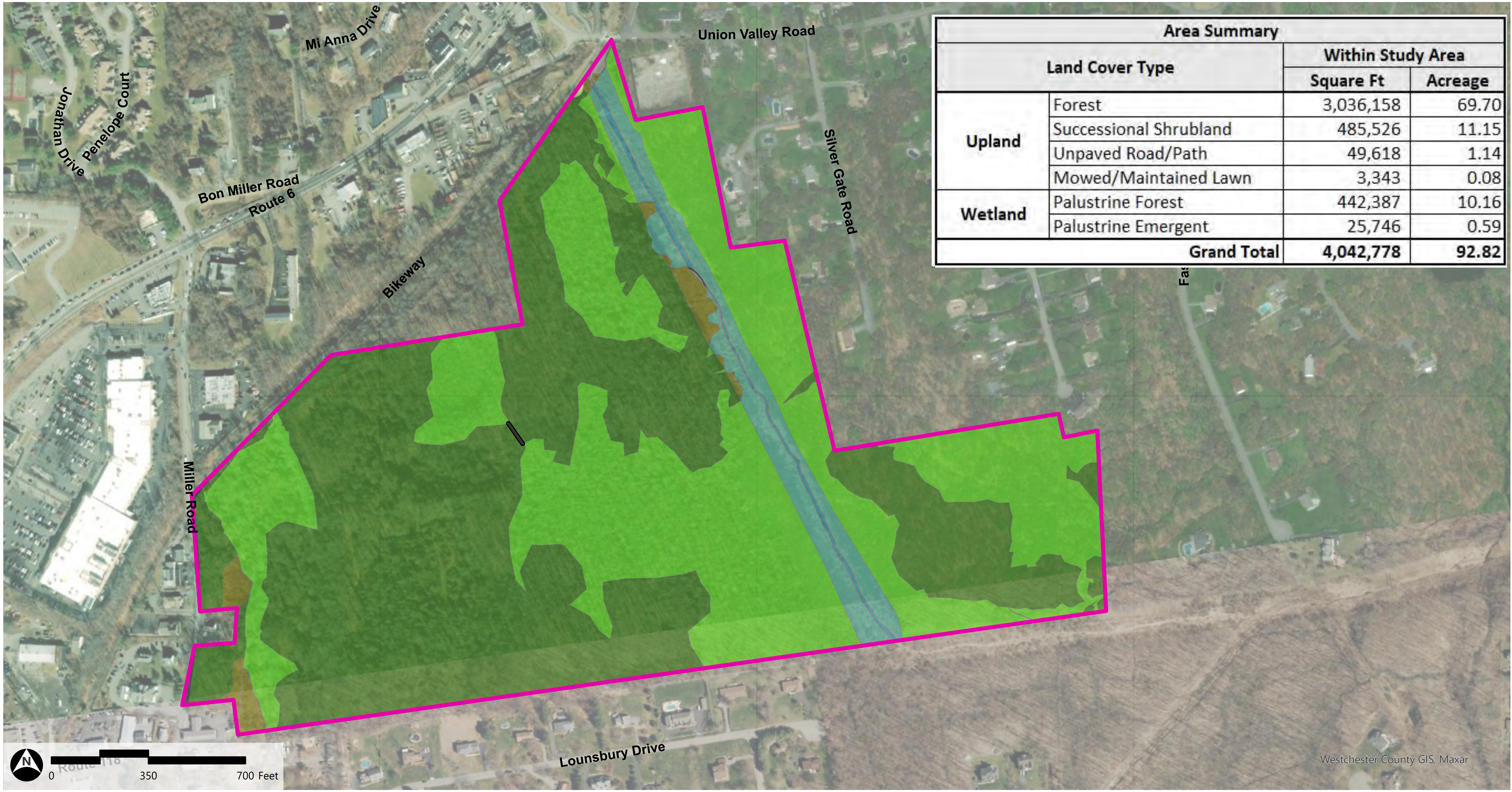
Sources: Background imagery from NearMap (2021); Wetlands (NYSDEC) from NYSDEC (2021); Wetlands (NWI) from US Wildlife Service (2021); Streams (NHD) from USGS (2019); Streams (NYSDEC) from NYSDEC (2019).

\\vhb.com\gis\proj\Albany\20692.00 EastPoint Energy Carmel\Project\Delineation Report Series\Fig2_StateFederalWetlands.aprx (User: SManley, Date: 7/1/2021)

Figure A.3: Land Cover

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 15, 2021



Area Summary			
Land Cover Type		Within Study Area	
		Square Ft	Acreage
Upland	Forest	3,036,158	69.70
	Successional Shrubland	485,526	11.15
	Unpaved Road/Path	49,618	1.14
	Mowed/Maintained Lawn	3,343	0.08
Wetland	Palustrine Forest	442,387	10.16
	Palustrine Emergent	25,746	0.59
	Grand Total	**4,042,778**	**92.82**

Study Area

Culvert

Land Cover

Upland Forest

Successional Shrubland

Mowed/Maintained Lawn

Unpaved Road/Path

Paved road/path

Palustrine Forested Wetland

Palustrine Scrub-Shrub Wetland

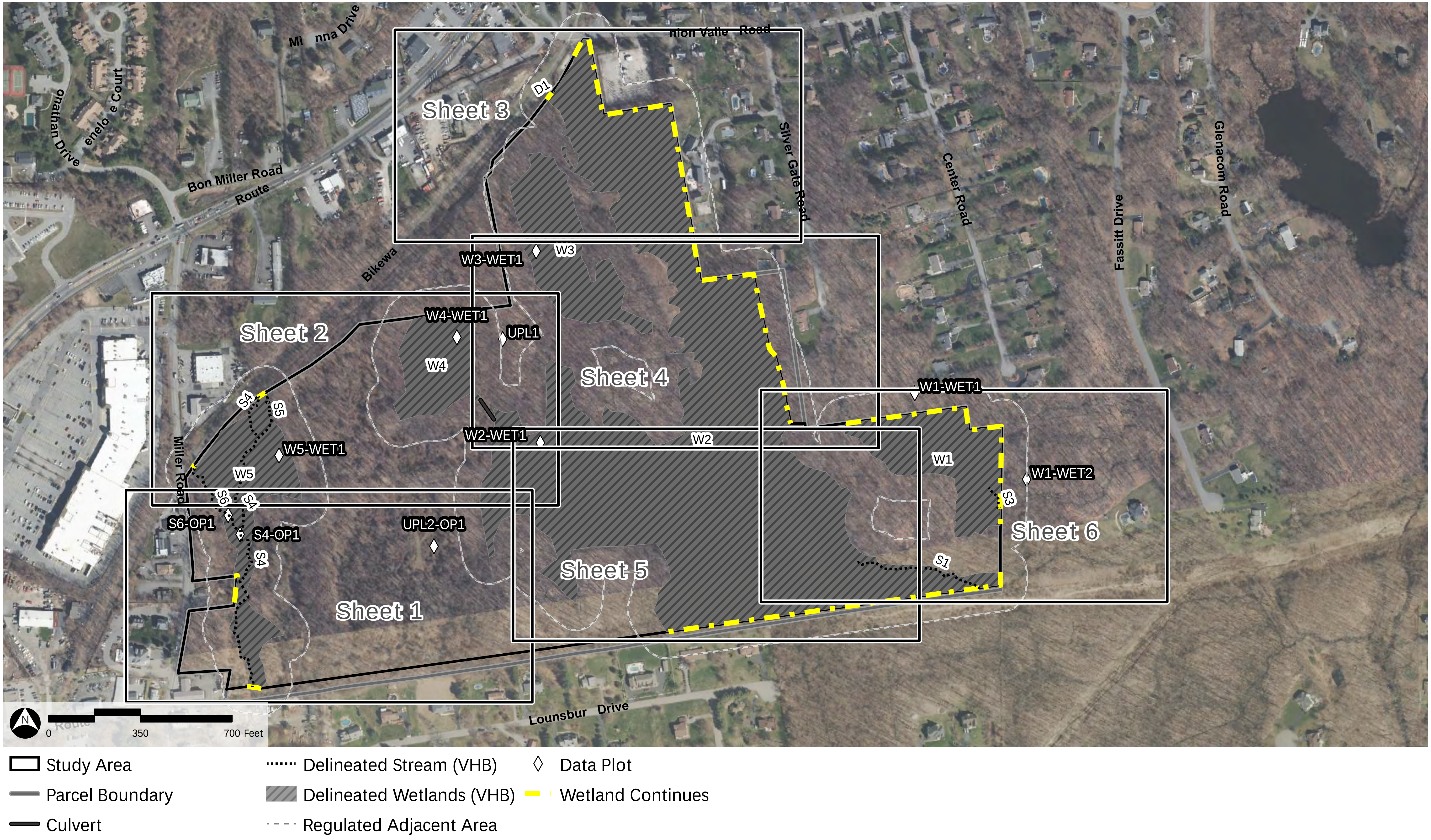
Palustrine Emergent Wetland

Sources: Background imagery from NYS GIS Program (2018/2016); Land cover by VHB (2021) determined during field assessment and Edinger's Ecological Communities of New York State.

\\vhb\gis\proj\Albany\20692.00 EastPoint Energy Carmel\Project\Delineation Report Series\Fig3_LandCover.aprx (User: SManley, Date: 6/15/2021)

Figure A.4: Natural Resources Index Map

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

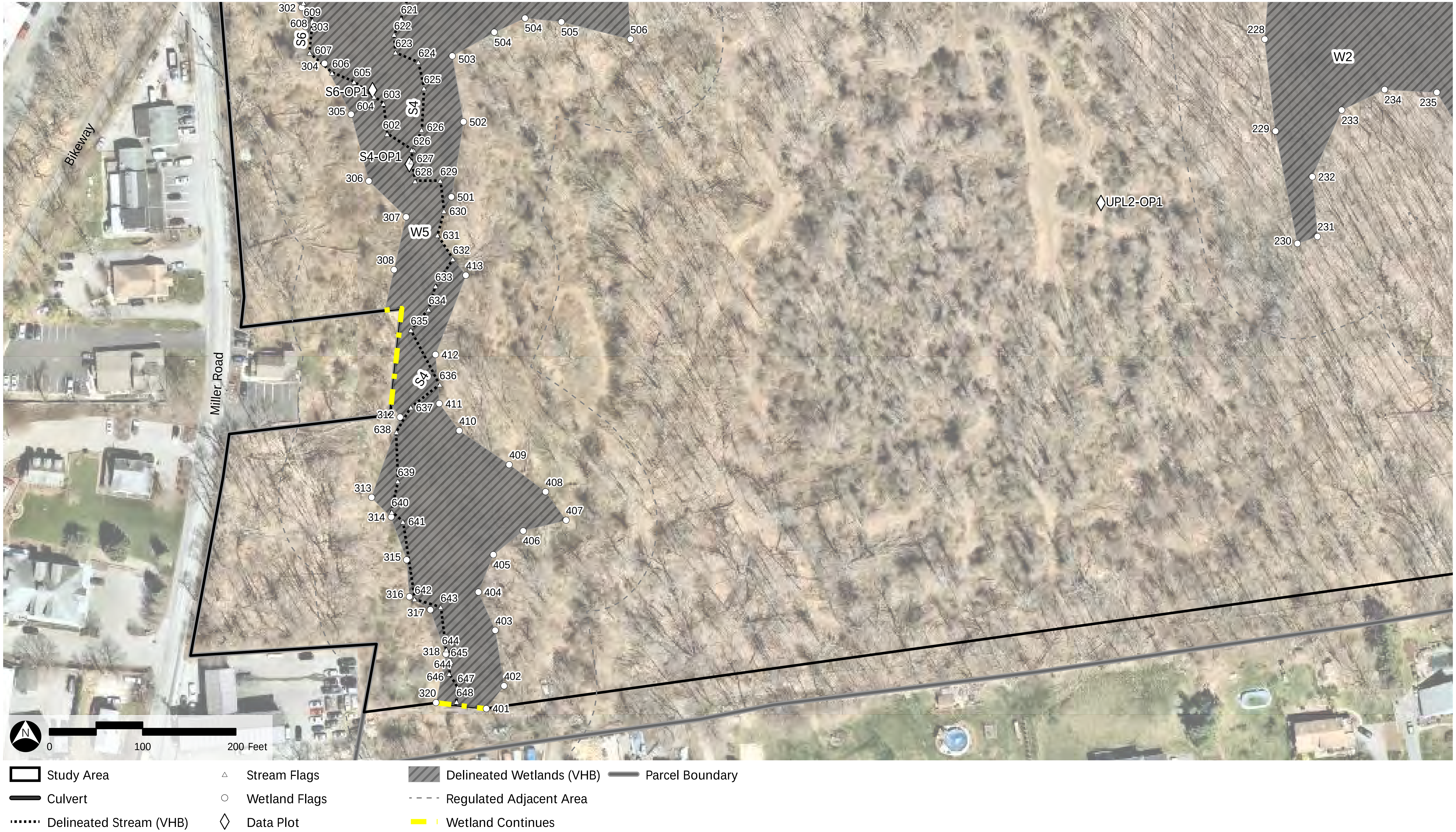


Sources: Background imagery from NYS GIS Program (2018/2016).

Figure A.4: Natural Resources Map Series [Sheet 1 of 6]

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 26, 2021

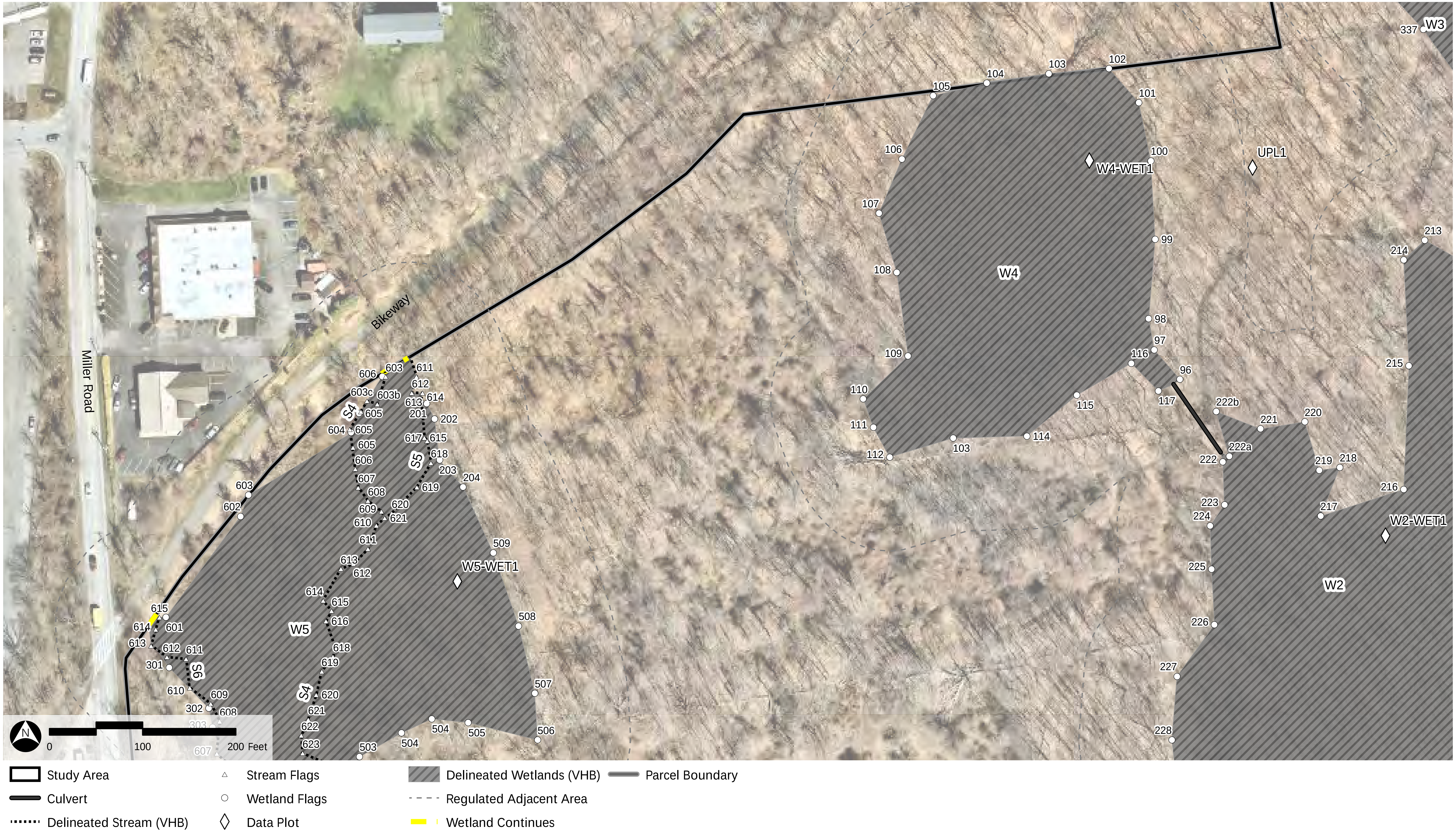


Sources: Background imagery from NearMap (April 2021).

Figure A.4: Natural Resources Map Series [Sheet 2 of 6]

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 26, 2021



Sources: Background imagery from NearMap (April 2021).

Figure A.4: Natural Resources Map Series [Sheet 3 of 6]

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

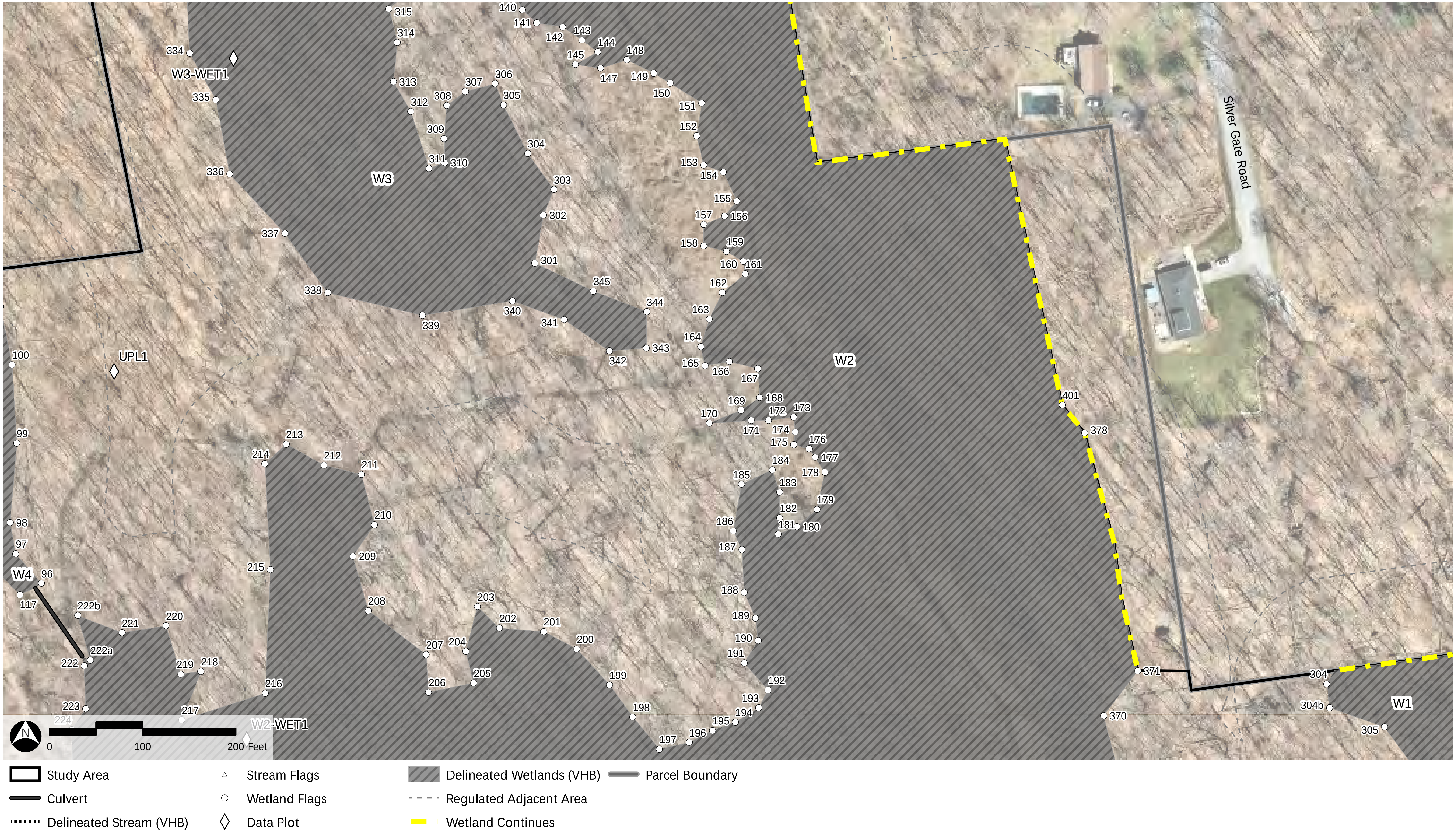
DRAFT: June 26, 2021

Sources: Background imagery from NearMap (April 2021).

Figure A.4: Natural Resources Map Series [Sheet 4 of 6]

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 26, 2021



Sources: Background imagery from NearMap (April 2021).

Figure A.4: Natural Resources Map Series [Sheet 5 of 6]

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 26, 2021

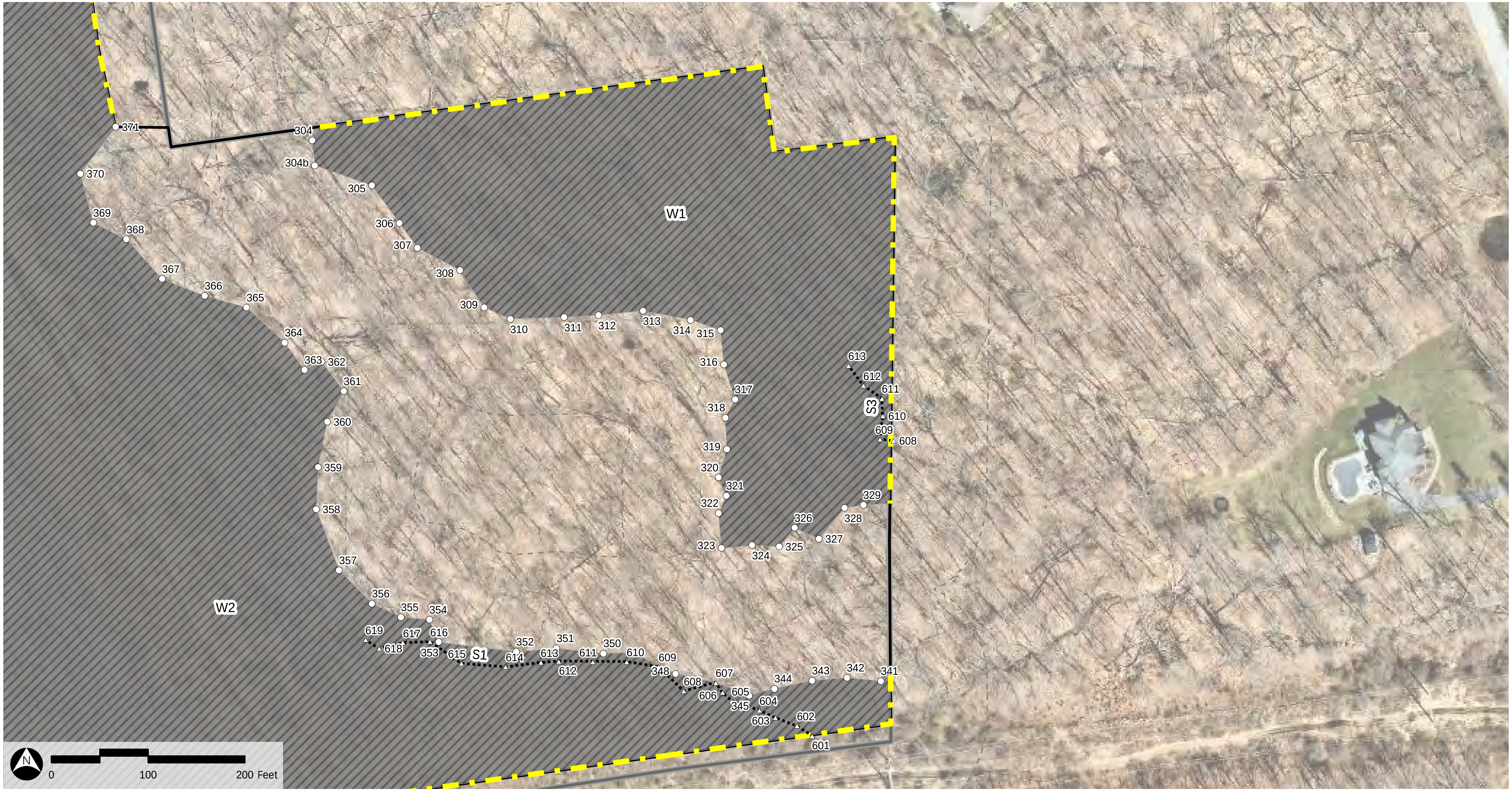
▭ Study Area
▬ Culvert
⋯ Delineated Stream (VHB)
△ Stream Flags
○ Wetland Flags
◊ Data Plot
▨ Delineated Wetlands (VHB)
- - - Regulated Adjacent Area
▬ Wetland Continues
▬ Parcel Boundary

Sources: Background imagery from NearMap (April 2021).

Figure A.4: Natural Resources Map Series [Sheet 6 of 6]

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 26, 2021



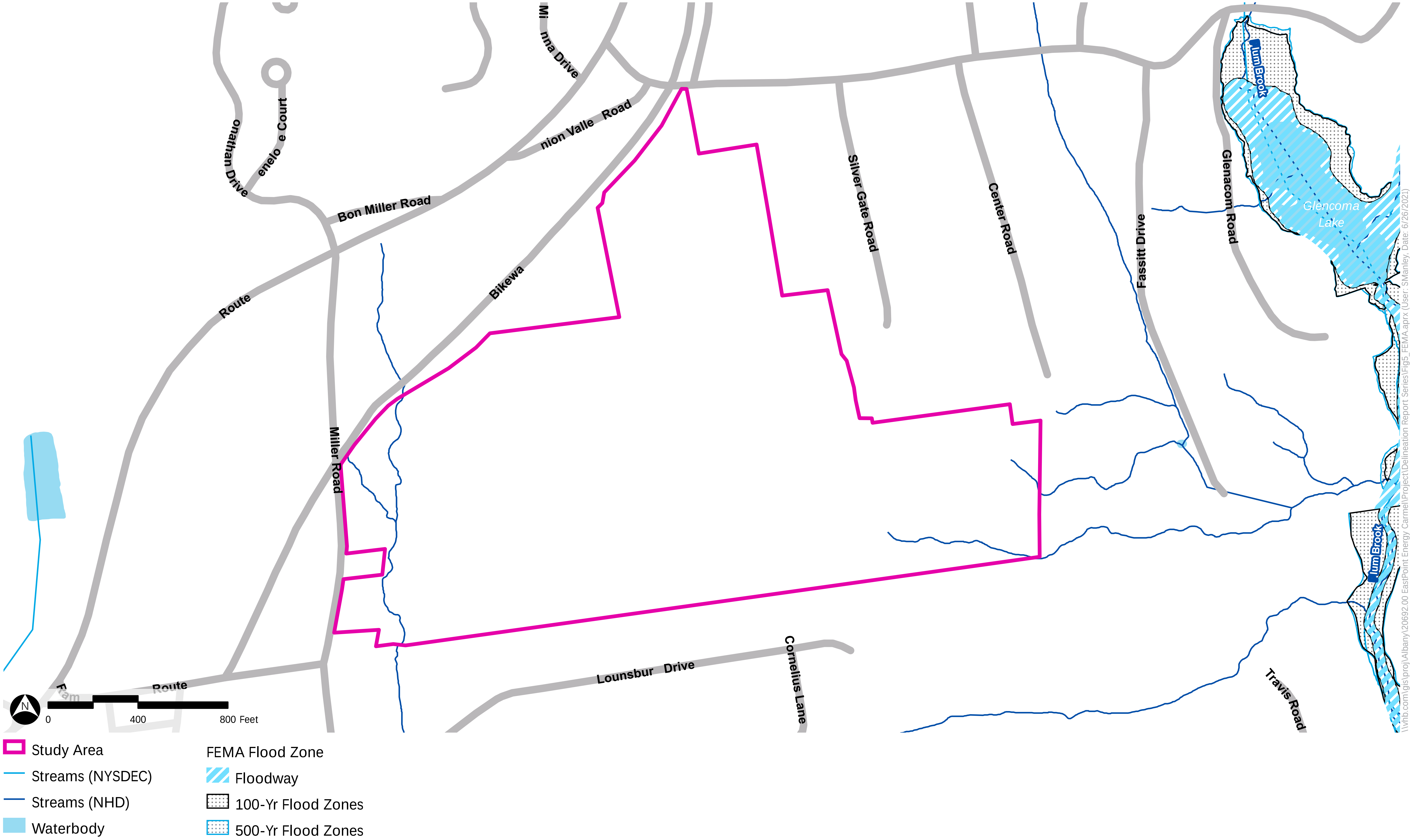
▭ Study Area
▬ Culvert
⋯ Delineated Stream (VHB)
△ Stream Flags
○ Wetland Flags
◊ Data Plot
▨ Delineated Wetlands (VHB)
▬ Parcel Boundary
- - - Regulated Adjacent Area
▬ Wetland Continues

Sources: Background imagery from NearMap (April 2021).

Figure A.5: FEMA Flood Map

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 26, 2021

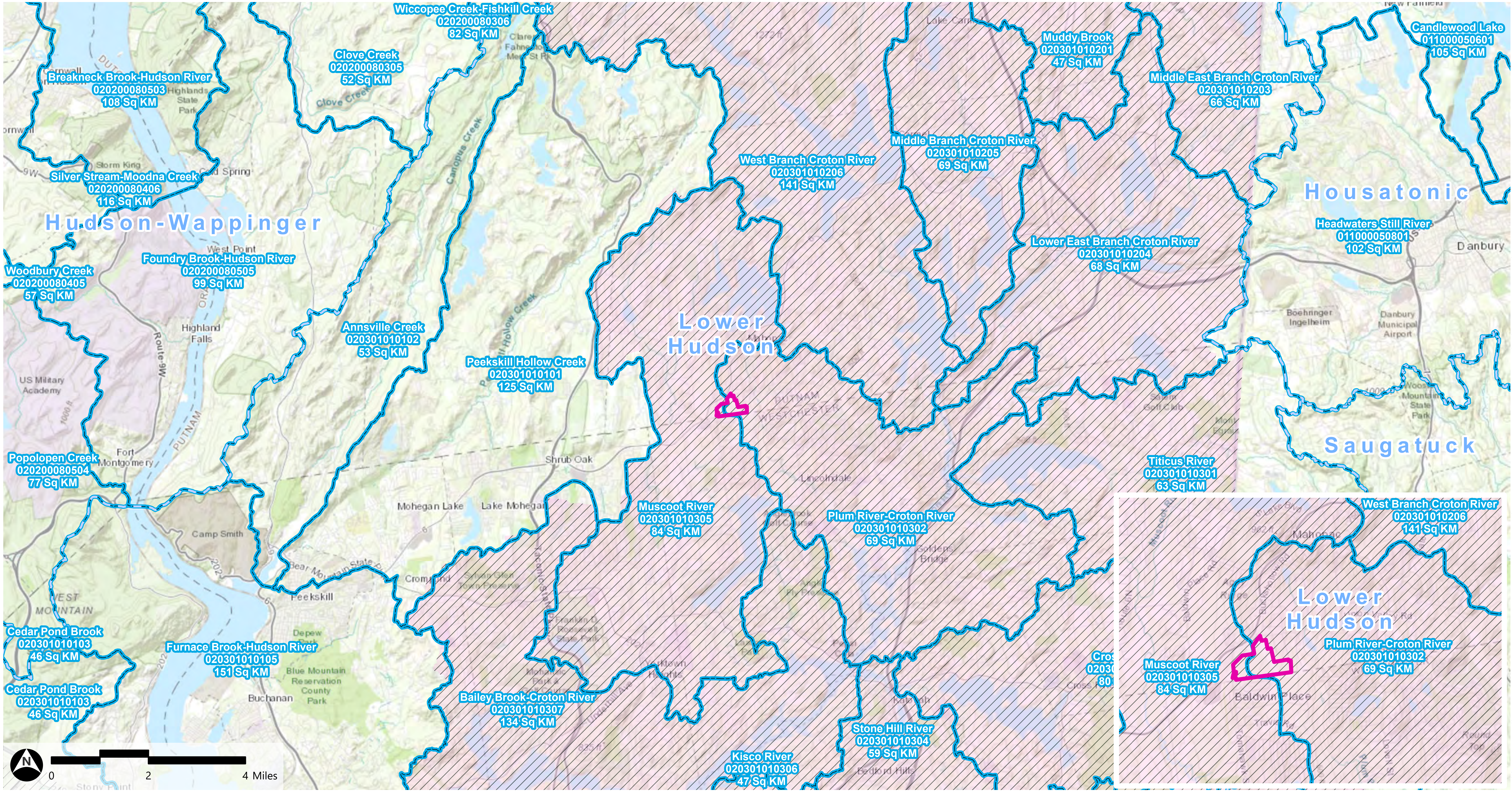


Sources: Stream (NHD) from USGS (2019); Streams (NYSDEC) from NYSDEC (2019); Flood Zones from FEMA Flood Map Service Center online portal (DFIRM 36079C0207E and 36079C0226E).

Figure A.6: USGS 8 & 12 Digit HUC Map

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 04, 2021



▭ Study Area

▭ HUC 8 Watershed Boundary

▭ HUC 12 Watershed Boundary

▨ AA and AAs Watersheds

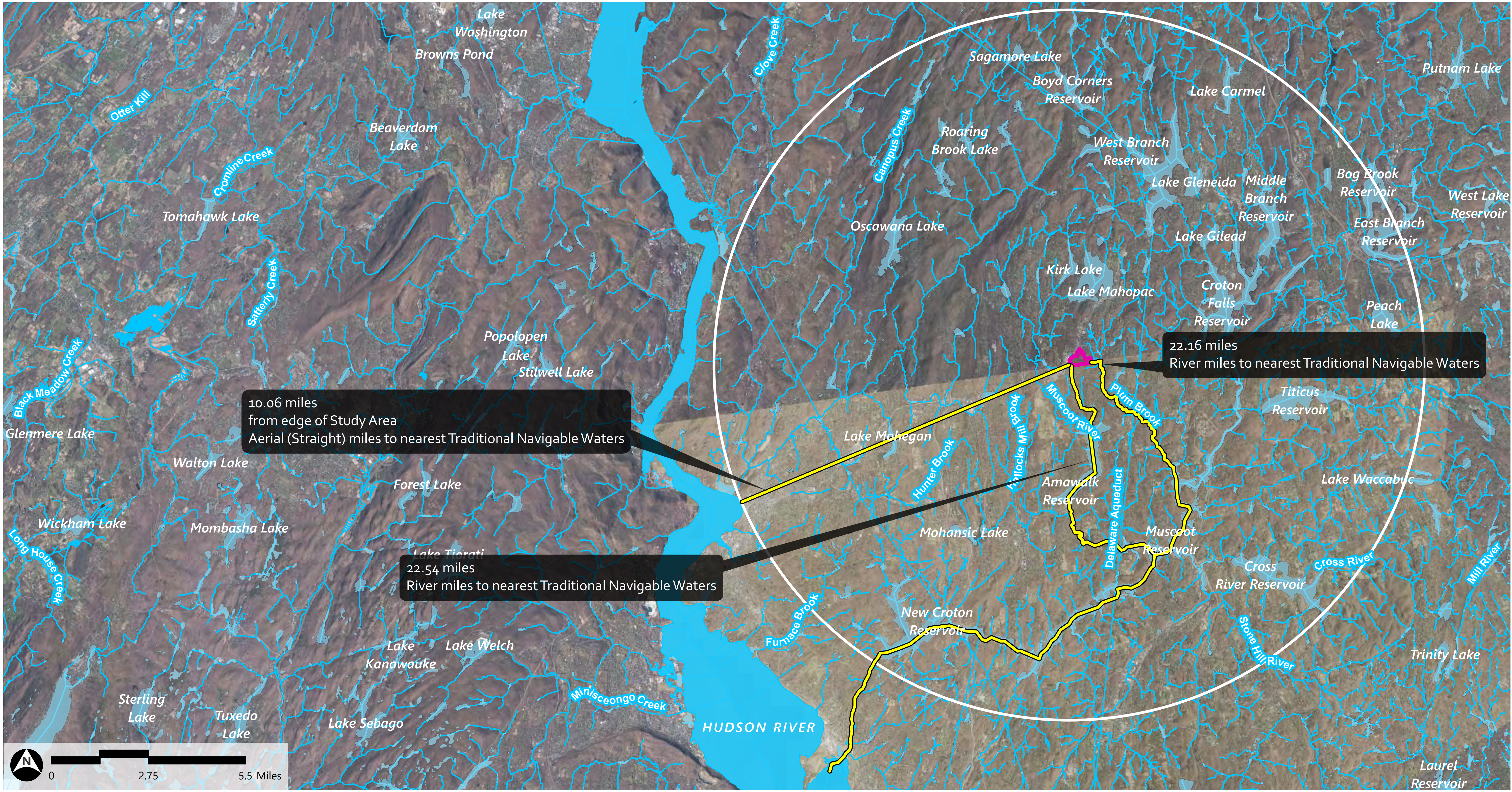
Sources: Watershed boundaries from USDA NRCS; AA and AAs Watersheds from NYSDEC (2008).

\\vhb\gis\proj\Albany\20692.00 EastPoint Energy Carmel\Project\Delineation Report Series\Fig6_HUC_Watersheds.aprx (User: SManley, Date: 6/4/2021)

Figure A.7: Stream Flow Connectivity Map

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 14, 2021



22.16 miles
River miles to nearest Traditional Navigable Waters

10.06 miles
from edge of Study Area
Aerial (Straight) miles to nearest Traditional Navigable Waters

22.54 miles
River miles to nearest Traditional Navigable Waters

\\vhb\gis\proj\Albany\20692.00 EastPoint Energy Carmel\Project\Delineation Report Series\Fig7_Connectivity.aprx (User: SManley, Date: 6/14/2021)

▭ Study Area

〰 Estimate Connectivity Lines

— Streams (NHD)

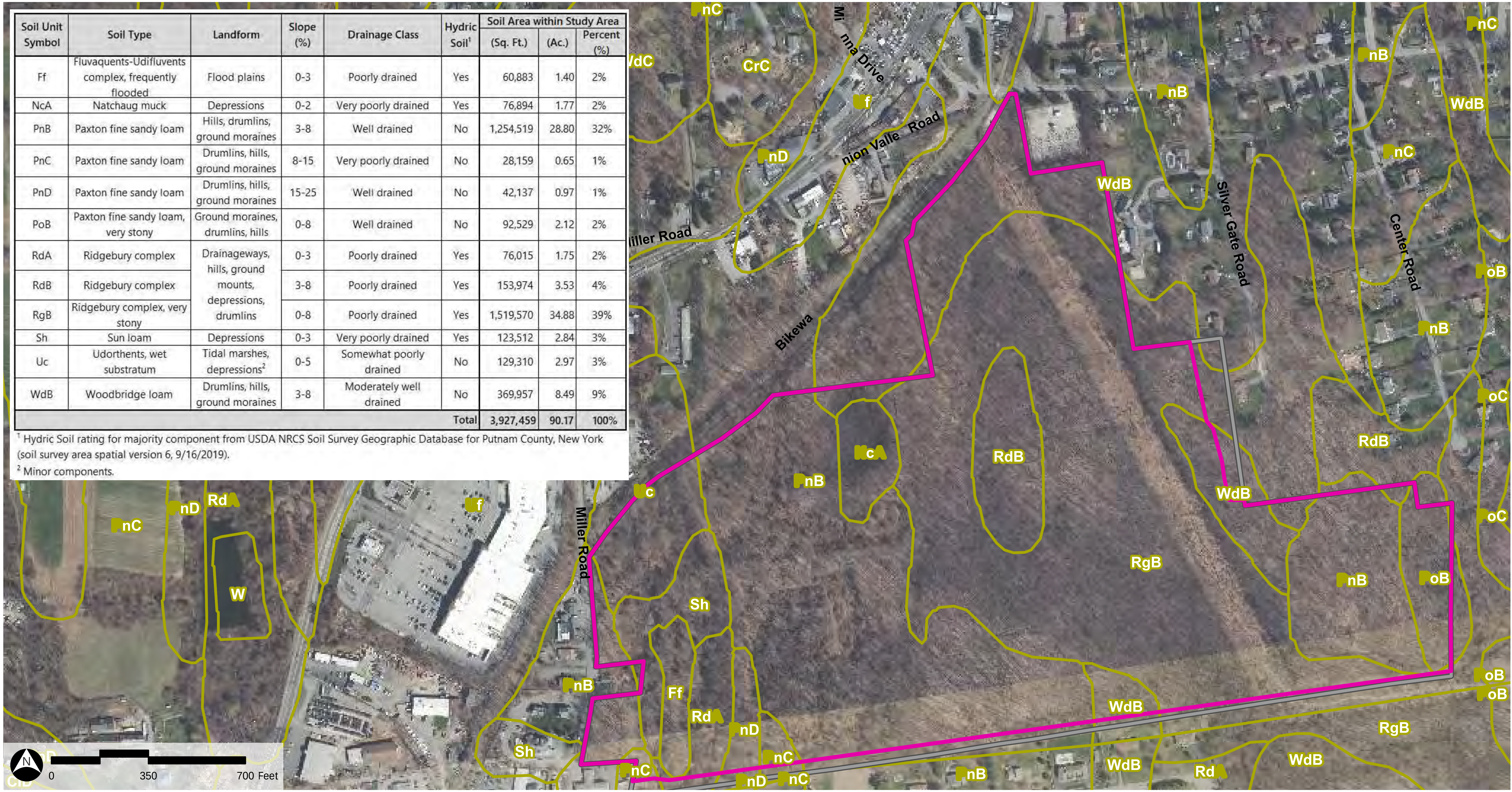
▨ Waterbody (NHD)

Sources: Background imagery from NYS GIS Program (2018/2016); Streams and Waterbodies (NHD) from USGS (2019).

Figure A.8: NRCS Soils

BPUS Generation Development, LLC | Town of Carmel, Putnam County, New York

DRAFT: June 26, 2021



Soil Unit Symbol	Soil Type	Landform	Slope (%)	Drainage Class	Hydric Soil[1]	Soil Area within Study Area		
						(Sq. Ft.)	(Ac.)	Percent (%)
Ff	Fluvaquents-Udifluvents complex, frequently flooded	Flood plains	0-3	Poorly drained	Yes	60,883	1.40	2%
NcA	Natchaug muck	Depressions	0-2	Very poorly drained	Yes	76,894	1.77	2%
PnB	Paxton fine sandy loam	Hills, drumlins, ground moraines	3-8	Well drained	No	1,254,519	28.80	32%
PnC	Paxton fine sandy loam	Drumlins, hills, ground moraines	8-15	Very poorly drained	No	28,159	0.65	1%
PnD	Paxton fine sandy loam	Drumlins, hills, ground moraines	15-25	Well drained	No	42,137	0.97	1%
PoB	Paxton fine sandy loam, very stony	Ground moraines, drumlins, hills	0-8	Well drained	No	92,529	2.12	2%
RdA	Ridgebury complex	Drainageways, hills, ground mounts, depressions, drumlins	0-3	Poorly drained	Yes	76,015	1.75	2%
RdB	Ridgebury complex		3-8	Poorly drained	Yes	153,974	3.53	4%
RgB	Ridgebury complex, very stony		0-8	Poorly drained	Yes	1,519,570	34.88	39%
Sh	Sun loam	Depressions	0-3	Very poorly drained	Yes	123,512	2.84	3%
Uc	Udorthents, wet substratum	Tidal marshes, depressions[2]	0-5	Somewhat poorly drained	No	129,310	2.97	3%
WdB	Woodbridge loam	Drumlins, hills, ground moraines	3-8	Moderately well drained	No	369,957	8.49	9%
					Total	3,927,459	90.17	100%

[1] Hydric Soil rating for majority component from USDA NRCS Soil Survey Geographic Database for Putnam County, New York (soil survey area spatial version 6, 9/16/2019).

[2] Minor components.

🟪 Study Area

▬ Parcel Boundary

🟨 NRCS Soil Boundary (MYSYM)

Sources: Background imagery from NYS GIS Program (2018/2016); Soils from NRCS (2019).

\\vhb.com\gis\proj\Albany\20692.00 EastPoint Energy Carmel\Project\Delineation Report Series\Fig8_Soils.aprx (User: SManley, Date: 6/26/2021)

Appendix B

Supplemental Tables

BPUS Generation Development, LLC
Town of Carmel, Putnam County, New York
Table 1: Summary of Delineated Wetlands
Prepared by VHB
July 9, 2021

VHB Wetland ID	Delineated Area[1]		Field Designated Cowardin Classification[2]	NWI Classification	NYSDEC Classification	Potential Jurisdictional Status	Buffer/Setback Requirements	General Description
	(Sq. Ft.)	(Ac.)						
W1	**150,659**	**3.46**	PFO6	-	1	NYSDEC and USACE	100 ft.	Connected to Muscoot River via tributaries flowing to the southeast
W2	**1,319,479**	**30.29**	PFO6/PSS6	-	1	NYSDEC and USACE	100 ft.	Primarily forested, portion of wetland within utility right-of-way is maintained and has become scrub-shrub.
W3	151,415	3.48	PFO6	-	-	NYSDEC and USACE	100 ft.	Forested wetland within the northern portion of the Site.
W4	99,265	2.28	PEM1/PFO6	PSS1E	-	NYSDEC and USACE	100 ft.	Connected to W2 via HDPE culvert
W5	**165,817**	**3.81**	PSS6/PFO6	R4SBC	1	USACE	100 ft.	Sourced by a culverted tributary to Muscoot River, wetland is forested with scrub-shrub fringe.
Total Area of Wetlands within Jurisdictional Determination Area	**1,886,635**	**43.33**						

NOTES:

[1] VHB Study Area is located entirely within property boundary. Wetland and parcel bounaries surveyed by Insite June 2021. Individual wetland areas displayed in **bold** continue outside of the Study Area.

[2] Classification follows Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitat of the United States. U.S. Fish and Wildlife Service. FWS/OBD-79/31. 103pp.

BPUS Generation Development, LLC
Town of Carmel, Putnam County, New York
Table 2: Summary of Delineated Waters
Prepared by VHB
July 9, 2021

VHB Stream ID[1]	USGS Stream/ Water Name	Average Ordinary High Water (OHW-width)[2]	Length of Delineated Stream Channel Within Jurisdictional Determination Area	Approximate Area of Delineated Stream Within Jurisdictional Determination Area [3]		Flow Regime (Perennial, Intermittent, Ephemeral and Ditch)[4]	Potential Jurisdictional Status[5]	NYSDEC Surface Water Classification[6]	Buffer/Setback Requirements	General Description
		(Feet)	(Linear Feet)	(Square Feet)	(Acres)					
S1	Unnamed Tributary to Plum Brook	2	504	1,008	0.02	Perennial	NYSDEC/USACE Jurisdiction	B	100ft	Minor stream sourcing Wetland Area 1 onsite
S3	Unnamed Tributary to Plum Brook	2	103	206	0.00	Perennial	NYSDEC/USACE Jurisdiction	B	100ft	Minor stream sourcing Wetland Areas 1 and 2 onsite
S4	Unnamed Tributary to Muscoot River	4	1,313	5,252	0.12	Intermittent	NYSDEC/USACE Jurisdiction	B	100ft	Part of a culverted stream that flows through the site, sourcing Wetland Area 5
S5	Unnamed Tributary to Muscoot River	5	206	1,030	0.02	Perennial	NYSDEC/USACE Jurisdiction	B	100ft	Part of a culverted stream that flows through the site, sourcing Wetland Area 5
S6	Unnamed Tributary to Muscoot River	5	350	1,750	0.04	Perennial	NYSDEC/USACE Jurisdiction	B	100ft	Part of a culverted stream that flows through the site, sourcing Wetland Area 5
D1	Unnamed	1	12	12	0.00	Ephemeral	Non-Jurisdictional	-	-	Minor ditch that very breifly intersects the Site boundary
Total Length and Area of Stream Channel or Other Waters within Jurisdictional Determination Area			**2,488**	**9,258**	**0.213**					

NOTES:

[1] VHB's Stream ID refers to unique ID designated in the field.

[2] U.S. Army Corps of Engineers (USACE). 2005. "Regulatory Guidance Letter. Subject: Ordinary High Water Mark Identification." No. 05-05.

[3] Approximate area of delineated streams within the study area is calculated from the average OHW times the length of delineated stream channel within the study area.

[4] Stream flow regime determined based on qualitative observations of in stream hydrology indicators and geomorphic characteristic and are subject to professional judgment and confirmation by USACE and/or NYSDEC.

[5] Jurisdictional status as determined by VHB; subject to confirmation or field verification by NYSDEC and USACE.

[6] Surface waters classifications were made pursuant to 6NYCRR, Chapter X, Article 2, Parts 701 (classification and standards definitions).

Appendix C

Resource Data Forms

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

UPL1-OP1

Project Site: East Point City/County: Carmel / Putnam Samp. Date: 5/18/2021
Applicant/Owner: BPUS Generation Development, LLC State: NY Sampling Point: UPL1-OP1
Investigator(s): Jimmy Monfils and Anna Loss Section, Township, Range:
Landform (hillslope, terrace, etc.): Undulating Local relief (concave, convex, none): Convex Slope (%): 1-2%
Subregion (LRR or MLRA): Lat: 41.34978 Long: -73.74760 Datum:
Soil Map Unit: NWI Class:
Are climatic/hydrologic conditions on the site typical for this time of year? Yes Remarks:
Are Normal Circumstances present? Yes If needed, explain any answers in Remarks:
Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Remarks:
Are Vegetation No , Soil No , or Hydrology No naturally problematic? Remarks:

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes
Hydric Soil Present? No
Wetland Hydrology Present? No

Is This Sample Area Within a Wetland? No

Remarks: One or more parameters lacking. Area is not a jurisdictional wetland.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Drainage Patterns (B10)
- Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

Field Observations:
Surface Water Present? Depth (inches): N/A
Water Table Present? Depth (inches): N/A
Saturation Present? Depth (inches): N/A

Wetland Hydrology Present? No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No primary or secondary indicators of wetland hydrology present; parameter is not met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	7.5YR_3/3	100		N/A	N/A	N/A	FINE_SANDY_LOAM	
10-21	10YR_4/6	100		N/A	N/A	N/A	SANDY_CLAY_LOAM	
4-10	10YR_4/4	100		N/A	N/A	N/A	FINE_SANDY_LOAM	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7) (LRR R, MLRA 149B)
- Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- Thin Dark Surface (S9) (LRR R, MLRA 149B)
- Loamy Mucky Mineral (F1) (LRR K, L)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- Coast Prairie Redox (A16) (LRR K, L, R)
- 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- Dark Surface (S7) (LRR K, L, M)
- Polyvalue Below Surface (S8) (LRR K, L)
- Thin Dark Surface (S9) (LRR K, L)
- Iron-Manganese Masses (F12) (LRR K, L, R)
- Piedmont Floodplain Soils (F19) (MLRA 149B)
- Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- Red Parent Material (F21)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? No

Remarks:

No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.

VEGETATION - Use scientific names of plants.

Sampling Point: UPL1-OP1

Tree Stratum (Plot size: 30 ft)

	Tree Stratum	Absolute % Cover	Dom. Sp?	Indicator Status
1.	*Fagus grandifolia*	20.5	X	FACU
2.	*Quercus alba*	10.5	X	FACU
3.	*Quercus rubra*	3		FACU
4.	*Liriodendron tulipifera*	3		FACU
5.				
6.				
7.				
8.				
		37.0	= Total Cover	

Sapling Stratum (Plot size: 30 ft)

1.	Carpinus caroliniana	10.5	X	FAC
2.				
3.				
4.				
5.				
6.				
7.				
8.				
		10.0	= Total Cover	

Shrub Stratum (Plot size: 15 ft)

1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
		0.0	= Total Cover	

Herb Stratum (Plot size: 5 ft)

1.	*Carya ovata*	3	X	FACU
2.	*Maianthemum canadense*	10.5	X	FAC
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
		14.0	= Total Cover	

Woody Vines (Plot size: 30 ft)

1.				
2.				
3.				
4.				
5.				
		0.0	= Total Cover	

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: 2 (A)

Dominants across all strata: 5 (B)

% Dominants OBL, FACW, FAC: 40.00% (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL	0.0	x 1 =	0.0
FACW	0.0	x 2 =	0.0
FAC	21.0	x 3 =	63.0
FACU	40.0	x 4 =	160.0
UPL	0.0	x 5 =	0.0
Sum:	61.0 (A)		223.0 (B)

Prevalence Index = B/A = 3.66

Hydrophytic Vegetation Indicators:

___ Dominance Test is > 50%

X Prevalence Index is <= 3.0

___ Problematic Hydrophytic Vegetation[1] (explain)

___ Rapid Test for Hydrophytic Vegetation

___ Morphological Adaptations

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes

Remarks: (If observed, list morphological adaptations below).

No hydrophytic vegetation indicators present; parameter is not met.

UPL2-OP1

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project Site: East Point City/County: Carmel / Putnam Samp. Date: 5/18/2021
Applicant/Owner: BPUS Generation Development, LLC State: NY Sampling Point: UPL2-OP1
Investigator(s): Jimmy Monfils and Anna Loss Section, Township, Range:
Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Flat Slope (%): <1%
Subregion (LRR or MLRA): Lat: 41.34675 Long: -73.75113 Datum:
Soil Map Unit: NWI Class: PFO
Are climatic/hydrologic conditions on the site typical for this time of year? Yes Remarks:
Are Normal Circumstances present? Yes If needed, explain any answers in Remarks:
Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Remarks:
Are Vegetation No , Soil No , or Hydrology No naturally problematic? Remarks:

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes
Hydric Soil Present? No
Wetland Hydrology Present? -
Is This Sample Area Within a Wetland? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Drainage Patterns (B10)
- Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

Field Observations:
Surface Water Present? Depth (inches): N/A
Water Table Present? Depth (inches): N/A
Saturation Present? Depth (inches): N/A
Wetland Hydrology Present? -

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No primary or secondary indicators of wetland hydrology present; parameter is not met.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR_3/4	100		N/A	N/A	N/A	SANDY_LOAM	
14-19	10YR_4/6	100		N/A	N/A	N/A	COARSE_SANDY_LOAM	
7-14	10YR_4/3	100		N/A	N/A	N/A	SANDY_LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7) (LRR R, MLRA 149B)
- Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- Thin Dark Surface (S9) (LRR R, MLRA 149B)
- Loamy Mucky Mineral (F1) (LRR K, L)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- Coast Prairie Redox (A16) (LRR K, L, R)
- 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- Dark Surface (S7) (LRR K, L, M)
- Polyvalue Below Surface (S8) (LRR K, L)
- Thin Dark Surface (S9) (LRR K, L)
- Iron-Manganese Masses (F12) (LRR K, L, R)
- Piedmont Floodplain Soils (F19) (MLRA 149B)
- Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- Red Parent Material (F21)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):
Hydric Soil Present? No

Remarks:

No hydric soil indicators present and soil does not meet NTCHS definition of hydric soil; parameter is not met.

VEGETATION - Use scientific names of plants.

Sampling Point: UPL2-OP1

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dom. Sp?	Indicator Status
1. *Acer saccharum*	10.5	X	FACU
2. *Carya ovata*	3		FACU
3. *Prunus serotina*	3		FACU
4.			
5.			
6.			
7.			
8.			
	16.0	= Total Cover	

Sapling Stratum (Plot size: 30 ft)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0.0	= Total Cover	

Shrub Stratum (Plot size: 15 ft)			
1. *Lonicera japonica*	20.5	X	FACU
2. *Berberis thunbergii*	38	X	UPL
3. *Rosa multiflora*	10.5		FACU
4.			
5.			
6.			
7.			
8.			
	69.0	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Artemisia vulgaris*	38	X	UPL
2. *Ranunculus repens*	3		FAC
3. *Alliaria petiolata*	3		FACU
4. *Asclepias syriaca*	3		UPL
5. *Phalaris arundinacea*	3		OBL
6. *Solidago rugosa*	3		FAC
7.			
8.			
9.			
10.			
11.			
12.			
	53.0	= Total Cover	

Woody Vines (Plot size: 30 ft)			
1. *Vitis aestivalis*	20.5		FACU
2. *Celastrus orbiculatus*	10.5		FACU
3.			
4.			
5.			
	31.0	= Total Cover	

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: 0 (A)

Dominants across all strata: 7 (B)

% Dominants OBL, FACW, FAC: 0.00% (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply By:	
OBL	3.0	x 1 =	3.0
FACW	0.0	x 2 =	0.0
FAC	6.0	x 3 =	18.0
FACU	81.5	x 4 =	326.0
UPL	79.0	x 5 =	395.0
Sum:	169.5 (A)		742.0 (B)

Prevalence Index = B/A = 4.38

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is > 50%
- X Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes

Remarks: (If observed, list morphological adaptations below).
No hydrophytic vegetation indicators present; parameter is not met.

vhb

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

W1-WET1

Project Site: East Point City/County: Carmel / Putnam Samp. Date: 5/14/2021
Applicant/Owner: BPUS Generation Development, LLC State: NY Sampling Point: W1-WET1
Investigator(s): Jimmy Monfils and Anna Loss Section, Township, Range:
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 1-2%
Subregion (LRR or MLRA): Lat: 41.34866 Long: -73.74253 Datum:
Soil Map Unit: NWI Class: PFO
Are climatic/hydrologic conditions on the site typical for this time of year? - Remarks:
Are Normal Circumstances present? - If needed, explain any answers in Remarks:
Are Vegetation - , Soil - , or Hydrology - significantly disturbed? Remarks:
Are Vegetation - , Soil - , or Hydrology - naturally problematic? Remarks:

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes
Hydric Soil Present? -
Wetland Hydrology Present? -
Is This Sample Area Within a Wetland? No

Remarks: All parameters are met. Area is classified as a palustrine forested (PFO) wetland.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- X Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

Field Observations:
Surface Water Present? X Depth (inches): 1
Water Table Present? X Depth (inches): Surface
Saturation Present? X Depth (inches): Surface
Wetland Hydrology Present? -

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR_2/2	100		N/A	N/A	N/A	SILTY_CLAY_LOAM	
5-14	10YR_2/2	80	7.5YR_3/4	12	C	M	SILTY_CLAY_LOAM	
			7.5YR_5/8	8	C	M		
2-5	10YR_2/2	95	7.5YR_3/4	5	C	M	SILTY_CLAY_LOAM	
14-18	10YR_3/3	75	7.5YR_4/6	25	C	M	GRAVELLY_CLAY_LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- X Dark Surface (S7) (LRR R, MLRA 149B)
- Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- Thin Dark Surface (S9) (LRR R, MLRA 149B)
- Loamy Mucky Mineral (F1) (LRR K, L)
- Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- Coast Prairie Redox (A16) (LRR K, L, R)
- 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- Dark Surface (S7) (LRR K, L, M)
- Polyvalue Below Surface (S8) (LRR K, L)
- Thin Dark Surface (S9) (LRR K, L)
- Iron-Manganese Masses (F12) (LRR K, L, R)
- Piedmont Floodplain Soils (F19) (MLRA 149B)
- Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- Red Parent Material (F21)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):
Hydric Soil Present? -

Remarks:

VEGETATION - Use scientific names of plants.

Sampling Point: W1-WET1

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dom. Sp?	Indicator Status
1. *Fraxinus pennsylvanica*	10.5	X	FACW
2. *Fagus grandifolia*	10.5	X	FACU
3. *Acer rubrum*	10.5	X	FAC
4. *Ulmus americana*	3		FAC
5. *Tilia americana*	3		FACU
6.			
7.			
8.			
	38.0	= Total Cover	

Sapling Stratum (Plot size: 30 ft)			
1. Tilia americana	3	X	FACU
2. Fraxinus pennsylvanica	38	X	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	41.0	= Total Cover	

Shrub Stratum (Plot size: 15 ft)			
1. *Nyssa sylvatica*	10.5	X	FAC
2. *Rosa multiflora*	3	X	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	14.0	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Onoclea sensibilis*	10.5	X	FACW
2. *Fraxinus pennsylvanica*	3	X	FACW
3. *Solidago rugosa*	3	X	FAC
4. *Microstegium vimineum*	63	X	FAC
5. *Osmunda claytoniana*	10.5		FAC
6. *Phalaris arundinacea*	3		OBL
7.			
8.			
9.			
10.			
11.			
12.			
	93.0	= Total Cover	

Woody Vines (Plot size: 30 ft)			
1. *Toxicodendron radicans*	10.5		FAC
2.			
3.			
4.			
5.			
	10.0	= Total Cover	

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: 9 (A)

Dominants across all strata: 12 (B)

% Dominants OBL, FACW, FAC: 75.00% (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL	3.0	x 1 =	3.0	
FACW	62.0	x 2 =	124.0	
FAC	111.0	x 3 =	333.0	
FACU	19.5	x 4 =	78.0	
UPL	0.0	x 5 =	0.0	
Sum:	195.5	(A)	538.0	(B)

Prevalence Index = B/A = 2.75

Hydrophytic Vegetation Indicators:

___ Dominance Test is > 50%

X Prevalence Index is <= 3.0

___ Problematic Hydrophytic Vegetation[1] (explain)

___ Rapid Test for Hydrophytic Vegetation

___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes

Remarks: (If observed, list morphological adaptations below).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

W1-WET2

Project Site: East Point City/County: Carmel / Putnam Samp. Date: 5/14/2021
Applicant/Owner: BPUS Generation Development, LLC State: NY Sampling Point: W1-WET2
Investigator(s): Jimmy Monfils and Anna Loss Section, Township, Range:
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 3-5%
Subregion (LRR or MLRA): Lat: 41.34774 Long: -73.74098 Datum:
Soil Map Unit: NWI Class: PFO
Are climatic/hydrologic conditions on the site typical for this time of year? - Remarks:
Are Normal Circumstances present? - If needed, explain any answers in Remarks:
Are Vegetation - , Soil - , or Hydrology - significantly disturbed? Remarks:
Are Vegetation - , Soil - , or Hydrology - naturally problematic? Remarks:

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes
Hydric Soil Present? -
Wetland Hydrology Present? -

Is This Sample Area Within a Wetland? No

Remarks: All parameters are met. Area is classified as a palustrine forested (PFO) wetland.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
X Water Marks (B1)
Sediment Deposits (B2)
Drift Deposits (B3)
Algal Mat or Crust (B4)
Iron Deposits (B5)
Inundation Visible on Aerial (B7)
Sparsely Vegetated Concave Surface (B8)

X Water-Stained Leaves (B9)
Aquatic Fauna (B13)
Marl Deposits (B15)
Hydrogen Sulfide Odor (C1)
Oxidized Rhizospheres on Living Roots (C3)
Presence of Reduced Iron (C4)
Recent Iron Reduction in Tilled Soils (C6)
Thin Muck Surface (C7)
Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

Surface Soil Cracks (B6)
X Drainage Patterns (B10)
Moss Trim Lines (B16)
Dry-Season Water Table (C2)
Crayfish Burrows (C8)
Saturation Visible on Aerial (C9)
Stunted or Stressed Plants (D1)
Geomorphic Position (D2)
Shallow Aquitard (D3)
X Microtopographic Relief (D4)
FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? X Depth (inches): 1
Water Table Present? X Depth (inches): Surface
Saturation Present? X Depth (inches): Surface

Wetland Hydrology Present? -

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR_3/1	100		N/A	N/A	N/A	SANDY_CLAY	Saturated
6-12	7.5YR_3/1	100		N/A	N/A	N/A	SANDY_CLAY	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

Histosol (A1)
Histic Epipedon (A2)
Black Histic (A3)
Hydrogen Sulfide (A4)
Stratified Layers (A5)
Depleted Below Dark Surface (A11)
Thick Dark Surface (A12)
Sandy Mucky Mineral (S1)
Sandy Gleyed Matrix (S4)
Sandy Redox (S5)
Stripped Matrix (S6)
X Dark Surface (S7) (LRR R, MLRA 149B)

Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
Thin Dark Surface (S9) (LRR R, MLRA 149B)
Loamy Mucky Mineral (F1) (LRR K, L)
Loamy Gleyed Matrix (F2)
Depleted Matrix (F3)
Redox Dark Surface (F6)
Depleted Dark Surface (F7)
Redox Depressions (F8)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils[3]:

2 cm Muck (A10) (LRR K, L, MLRA 149B)
Coast Prairie Redox (A16) (LRR K, L, R)
5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
Dark Surface (S7) (LRR K, L, M)
Polyvalue Below Surface (S8) (LRR K, L)
Thin Dark Surface (S9) (LRR K, L)
Iron-Manganese Masses (F12) (LRR K, L, R)
Piedmont Floodplain Soils (F19) (MLRA 149B)
Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
Red Parent Material (F21)
Very Shallow Dark Surface (TF12)
Other (Explain in Remarks)

Restrictive Layer (if observed):
Type: Rock refusal
Depth (inches): 12

Hydric Soil Present? -

Remarks:

VEGETATION - Use scientific names of plants.

Sampling Point: W1-WET2

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dom. Sp?	Indicator Status
1. *Acer rubrum*	38	X	FAC
2. *Carya ovata*	10.5		FACU
3. *Fagus grandifolia*	3		FACU
4. *Acer saccharinum*	3		FAC
5.			
6.			
7.			
8.			
	54.0	= Total Cover	

Sapling Stratum (Plot size: 30 ft)			
1. Acer rubrum	10.5	X	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	10.0	= Total Cover	

Shrub Stratum (Plot size: 15 ft)			
1. *Berberis thunbergii*	10.5	X	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	10.0	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Onoclea sensibilis*	3	X	FACW
2. *Symplocarpus_SP*	10.5	X	
3. *Impatiens capensis*	10.5	X	FACW
4. *Arisaema triphyllum*	3		FACW
5. *Fraxinus pennsylvanica*	3		FACW
6. *Carex aquatilis*	10.5	X	OBL
7. *Alliaria petiolata*	3		FACU
8.			
9.			
10.			
11.			
12.			
	44.0	= Total Cover	

Woody Vines (Plot size: 30 ft)			
1.			
2.			
3.			
4.			
5.			
	0.0	= Total Cover	

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: 5 (A)

Dominants across all strata: 6 (B)

% Dominants OBL, FACW, FAC: 83.33% (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL	10.5	x 1 =	10.5
FACW	19.5	x 2 =	39.0
FAC	51.5	x 3 =	154.5
FACU	16.5	x 4 =	66.0
UPL	10.5	x 5 =	52.5
Sum:	108.5	(A)	322.5 (B)

Prevalence Index = B/A = 2.97

Hydrophytic Vegetation Indicators:

___ Dominance Test is > 50%

X Prevalence Index is <= 3.0

___ Problematic Hydrophytic Vegetation[1] (explain)

___ Rapid Test for Hydrophytic Vegetation

___ Morphological Adaptations

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes

Remarks: (If observed, list morphological adaptations below).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

W2-WET1

Project Site: East Point
City/County: Carmel / Putnam
Samp. Date: 5/17/2021
Applicant/Owner: BPUS Generation Development, LLC
State: NY
Sampling Point: W2-WET1
Investigator(s): Jimmy Monfils and Anna Loss
Section, Township, Range:
Landform (hillslope, terrace, etc.): Depression
Local relief (concave, convex, none): Concave
Slope (%): 1-2%
Subregion (LRR or MLRA):
Lat: 41.34754
Long: -73.74888
Datum:
Soil Map Unit:
NWI Class: PFO
Are climatic/hydrologic conditions on the site typical for this time of year? -
Remarks:
Are Normal Circumstances present? - If needed, explain any answers in Remarks:
Are Vegetation - , Soil - , or Hydrology - significantly disturbed? Remarks:
Are Vegetation - , Soil - , or Hydrology - naturally problematic? Remarks:

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes
Hydric Soil Present? -
Wetland Hydrology Present? -

Is This Sample Area Within a Wetland? No

Remarks: All parameters are met. Area is classified as a palustrine forested (PFO) wetland.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial (B7)
- Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- X Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	X	Depth (inches):	1
Water Table Present?	X	Depth (inches):	Surface
Saturation Present?	X	Depth (inches):	Surface

Wetland Hydrology Present? -

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR_3/2	100		N/A	N/A	N/A	SILTY_CLAY_LOAM	
11-17	10YR_3/1	90	7.5YR_5/3	10	D	M	GRAVELLY_SILTY_CLAY_LOAM	
6-11	10YR_2/2	80	7.5YR_4/4	20	C	M	SILTY_CLAY_LOAM	
17-22	10YR_6/2	95	10YR_3/2	5	D	M	GRAVELLY_SANDY_CLAY_LOAM	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Dark Surface (S7) (LRR R, MLRA 149B)
- Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- Thin Dark Surface (S9) (LRR R, MLRA 149B)
- Loamy Mucky Mineral (F1) (LRR K, L)
- Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- Coast Prairie Redox (A16) (LRR K, L, R)
- 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- Dark Surface (S7) (LRR K, L, M)
- Polyvalue Below Surface (S8) (LRR K, L)
- Thin Dark Surface (S9) (LRR K, L)
- Iron-Manganese Masses (F12) (LRR K, L, R)
- Piedmont Floodplain Soils (F19) (MLRA 149B)
- Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- Red Parent Material (F21)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? -

Remarks:

VEGETATION - Use scientific names of plants.

Sampling Point: W2-WET1

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dom. Sp?	Indicator Status
1. *Fraxinus pennsylvanica*	38	X	FACW
2. *Acer saccharinum*	20.5	X	FAC
3. *Acer rubrum*	10.5		FAC
4.			
5.			
6.			
7.			
8.			
	69.0	= Total Cover	

Sapling Stratum (Plot size: 30 ft)			
1. Fraxinus pennsylvanica	10.5	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	10.0	= Total Cover	

Shrub Stratum (Plot size: 15 ft)			
1. *Euonymus alatus*	10.5	X	
2. *Rosa multiflora*	10.5	X	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	21.0	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Onoclea sensibilis*	10.5	X	FACW
2. *Impatiens capensis*	10.5	X	FACW
3. *Carex aquatilis*	20.5	X	OBL
4. *Viburnum dentatum*	3		FAC
5. *Symplocarpus_SP*	3		
6. *Microstegium vimineum*	10.5		FAC
7. *Phalaris arundinacea*	10.5		OBL
8.			
9.			
10.			
11.			
12.			
	68.0	= Total Cover	

Woody Vines (Plot size: 30 ft)			
1. *Celastrus orbiculatus*	3		FACU
2.			
3.			
4.			
5.			
	3.0	= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	6	(A)
# Dominants across all strata:	8	(B)
% Dominants OBL, FACW, FAC:	75.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL	31.0	x 1 =	31.0	
FACW	69.5	x 2 =	139.0	
FAC	44.5	x 3 =	133.5	
FACU	13.5	x 4 =	54.0	
UPL	0.0	x 5 =	0.0	
Sum:	158.5 (A)		357.5	(B)

Prevalence Index = B/A = 2.26

Hydrophytic Vegetation Indicators:

X Dominance Test is > 50%

X Prevalence Index is <= 3.0

___ Problematic Hydrophytic Vegetation[1] (explain)

___ Rapid Test for Hydrophytic Vegetation

___ Morphological Adaptations

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes

Remarks: (If observed, list morphological adaptations below).

vhb

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

W3-WET1

Project Site: East Point City/County: Carmel / Putnam Samp. Date: 5/18/2021
Applicant/Owner: BPUS Generation Development, LLC State: NY Sampling Point: W3-WET1
Investigator(s): Jimmy Monfils and Anna Loss Section, Township, Range:
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 1-2%
Subregion (LRR or MLRA): Lat: 41.35103 Long: -73.74742 Datum:
Soil Map Unit: NWI Class: PFO
Are climatic/hydrologic conditions on the site typical for this time of year? Yes Remarks:
Are Normal Circumstances present? Yes If needed, explain any answers in Remarks:
Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Remarks:
Are Vegetation No , Soil No , or Hydrology No naturally problematic? Remarks:

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes
Hydric Soil Present? Yes
Wetland Hydrology Present? Yes

Is This Sample Area Within a Wetland? Yes

Remarks: All parameters are met. Area is classified as a palustrine forested (PFO) wetland.

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one is required; check all that apply)

Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
X Water Marks (B1)
Sediment Deposits (B2)
Drift Deposits (B3)
Algal Mat or Crust (B4)
Iron Deposits (B5)
Inundation Visible on Aerial (B7)
Sparsely Vegetated Concave Surface (B8)

X Water-Stained Leaves (B9)
Aquatic Fauna (B13)
Marl Deposits (B15)
Hydrogen Sulfide Odor (C1)
Oxidized Rhizospheres on Living Roots (C3)
Presence of Reduced Iron (C4)
Recent Iron Reduction in Tilled Soils (C6)
Thin Muck Surface (C7)
Other (Explain in Remarks)

Secondary Indicators (minimum of two required)
Surface Soil Cracks (B6)
X Drainage Patterns (B10)
Moss Trim Lines (B16)
Dry-Season Water Table (C2)
Crayfish Burrows (C8)
Saturation Visible on Aerial (C9)
Stunted or Stressed Plants (D1)
Geomorphic Position (D2)
Shallow Aquitard (D3)
X Microtopographic Relief (D4)
FAC-Neutral Test (D5)

Field Observations:
Surface Water Present? Depth (inches): N/A
Water Table Present? X Depth (inches): 4
Saturation Present? X Depth (inches): Surface

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
9-14	10YR_3/1	100		N/A	N/A	N/A	SILTY_CLAY	
17-23	10YR_4/3	90	7.5YR_3/3	10	C	M	SANDY_CLAY_LOAM	
0-9	10YR_2/1	100		N/A	N/A	N/A	SILTY_CLAY	Mostly organic matter
14-17	10YR_3/1	85	10YR_4/3	15	C	M	SILTY_CLAY	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.
[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

X Histosol (A1)
Histic Epipedon (A2)
Black Histic (A3)
Hydrogen Sulfide (A4)
Stratified Layers (A5)
X Depleted Below Dark Surface (A11)
Thick Dark Surface (A12)
Sandy Mucky Mineral (S1)
Sandy Gleyed Matrix (S4)
Sandy Redox (S5)
Stripped Matrix (S6)
X Dark Surface (S7) (LRR R, MLRA 149B)

Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
Thin Dark Surface (S9) (LRR R, MLRA 149B)
Loamy Mucky Mineral (F1) (LRR K, L)
Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
Redox Dark Surface (F6)
Depleted Dark Surface (F7)
Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:
2 cm Muck (A10) (LRR K, L, MLRA 149B)
Coast Prairie Redox (A16) (LRR K, L, R)
5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
Dark Surface (S7) (LRR K, L, M)
Polyvalue Below Surface (S8) (LRR K, L)
Thin Dark Surface (S9) (LRR K, L)
Iron-Manganese Masses (F12) (LRR K, L, R)
Piedmont Floodplain Soils (F19) (MLRA 149B)
Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
Red Parent Material (F21)
Very Shallow Dark Surface (TF12)
Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? Yes

Remarks:

VEGETATION - Use scientific names of plants.

Sampling Point: W3-WET1

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dom. Sp?	Indicator Status
1. Ulmus americana	20.5	X	FAC
2. Acer saccharinum	10.5	X	FAC
3. Acer rubrum	10.5	X	FAC
4. Fraxinus pennsylvanica	3		FACW
5.			
6.			
7.			
8.			
	44.0	= Total Cover	

Sapling Stratum (Plot size: 30 ft)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0.0	= Total Cover	

Shrub Stratum (Plot size: 15 ft)			
1. Lindera benzoin	38		FACW
2. Rosa multiflora	10.5		FACU
3. Viburnum dentatum	3		FAC
4.			
5.			
6.			
7.			
8.			
	52.0	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. Symplocarpus_SP	10.5	X	
2. Onoclea sensibilis	3	X	FACW
3. Fraxinus pennsylvanica	3	X	FACW
4. Lysimachia ciliata	3	X	FACW
5. Geranium maculatum	3	X	FACU
6. Arisaema triphyllum	3	X	FACW
7.			
8.			
9.			
10.			
11.			
12.			
	26.0	= Total Cover	

Woody Vines (Plot size: 30 ft)			
1. Celastrus orbiculatus	3		FACU
2.			
3.			
4.			
5.			
	3.0	= Total Cover	

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: 9 (A)

Dominants across all strata: 12 (B)

% Dominants OBL, FACW, FAC: 75.00% (A/B)

Prevalence Index Worksheet:

	Total % Cover of:		Multiply By:	
OBL	0.0	x 1 =	0.0	
FACW	53.0	x 2 =	106.0	
FAC	44.5	x 3 =	133.5	
FACU	16.5	x 4 =	66.0	
UPL	0.0	x 5 =	0.0	
Sum:	114.0	(A)	305.5	(B)

Prevalence Index = B/A = 2.68

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is > 50%
- ☒ Prevalence Index is <= 3.0
- ☐ Problematic Hydrophytic Vegetation[1] (explain)
- ☐ Rapid Test for Hydrophytic Vegetation
- ☐ Morphological Adaptations

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes

Remarks: (If observed, list morphological adaptations below).

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

W4-WET1

Project Site: East Point
City/County: Carmel / Putnam
Samp. Date: 5/18/2021
Applicant/Owner: BPUS Generation Development, LLC
State: NY
Sampling Point: W4-WET1
Investigator(s): Jimmy Monfils and Anna Loss
Section, Township, Range:
Landform (hillslope, terrace, etc.): Depression
Local relief (concave, convex, none): Concave
Slope (%): 3-5%
Subregion (LRR or MLRA):
Lat: 41.34836
Long: -73.74987
Datum:
Soil Map Unit:
NWI Class: PFO
Are climatic/hydrologic conditions on the site typical for this time of year? -
Remarks:
Are Normal Circumstances present? -
If needed, explain any answers in Remarks:
Are Vegetation -, Soil -, or Hydrology - significantly disturbed? Remarks:
Are Vegetation -, Soil -, or Hydrology - naturally problematic? Remarks:

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes
Hydric Soil Present? -
Wetland Hydrology Present? -

Is This Sample Area Within a Wetland? No

Remarks: All parameters are met. Area is classified as a palustrine forested (PFO) wetland.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial (B7)
- Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- X Moss Trim Lines (B16)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- X Saturation Visible on Aerial (C9)
- Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- Shallow Aquitard (D3)
- X Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? X Depth (inches): 2
Water Table Present? X Depth (inches): Surface
Saturation Present? X Depth (inches): Surface

Wetland Hydrology Present? -

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
2-10	7.5YR_2.5/2	100		N/A	N/A	N/A	SILTY_CLAY_LOAM	
16-20	10YR_5/2	75	10YR_5/8	25	C	M	CLAY_LOAM	
0-2	7.5YR_2.5/1	100		N/A	N/A	N/A	SILTY_CLAY_LOAM	Mostly organic material
10-16	10YR_4/1	85	10YR_5/8	15	C	M	SILTY_CLAY	
20-24	10YR_5/1	90	10YR_5/8	10	C	M	CLAY_LOAM	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- X Dark Surface (S7) (LRR R, MLRA 149B)
- Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- Thin Dark Surface (S9) (LRR R, MLRA 149B)
- Loamy Mucky Mineral (F1) (LRR K, L)
- Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- Coast Prairie Redox (A16) (LRR K, L, R)
- 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- Dark Surface (S7) (LRR K, L, M)
- Polyvalue Below Surface (S8) (LRR K, L)
- Thin Dark Surface (S9) (LRR K, L)
- Iron-Manganese Masses (F12) (LRR K, L, R)
- Piedmont Floodplain Soils (F19) (MLRA 149B)
- Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- Red Parent Material (F21)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? -

Remarks:

VEGETATION - Use scientific names of plants.

Sampling Point: W4-WET1

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dom. Sp?	Indicator Status
1. *Ulmus americana*	20.5	X	FAC
2. *Acer rubrum*	10.5	X	FAC
3. *Acer saccharinum*	10.5	X	FAC
4. *Fraxinus pennsylvanica*	3		FACW
5. *Betula alleghaniensis*	3		FACU
6.			
7.			
8.			
	48.0	= Total Cover	

Sapling Stratum (Plot size: 30 ft)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0.0	= Total Cover	

Shrub Stratum (Plot size: 15 ft)			
1. *Clethra_SP*	10.5	X	
2. *Lindera benzoin*	10.5	X	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	21.0	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Symplocarpus foetidus*	20.5	X	OBL
2. *Carex aquatilis*	10.5	X	OBL
3. *Osmundastrum cinnamomeum*	10.5	X	FACW
4. *Juncus effusus*	3		OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	44.0	= Total Cover	

Woody Vines (Plot size: 30 ft)			
1.			
2.			
3.			
4.			
5.			
	0.0	= Total Cover	

Dominance Test Worksheet:

# Dominants OBL, FACW, FAC:	7	(A)
# Dominants across all strata:	7	(B)
% Dominants OBL, FACW, FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:	
OBL	34.0	x 1 =	34.0	
FACW	24.0	x 2 =	48.0	
FAC	41.5	x 3 =	124.5	
FACU	3.0	x 4 =	12.0	
UPL	0.0	x 5 =	0.0	
Sum:	102.5	(A)	218.5	(B)

Prevalence Index = B/A = 2.13

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is > 50%
- X Prevalence Index is <= 3.0
- ___ Problematic Hydrophytic Vegetation[1] (explain)
- ___ Rapid Test for Hydrophytic Vegetation
- ___ Morphological Adaptations

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes

Remarks: (If observed, list morphological adaptations below).

W5-WET1

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project Site: East Point
City/County: Carmel / Putnam
Samp. Date: 5/18/2021
Applicant/Owner: BPUS Generation Development, LLC
State: NY
Sampling Point: W5-WET1
Investigator(s): Jimmy Monfils and Anna Loss
Section, Township, Range:
Landform (hillslope, terrace, etc.): Depression
Local relief (concave, convex, none): Concave
Slope (%): <1%
Subregion (LRR or MLRA):
Lat: 41.34715
Long: -73.75123
Datum:
Soil Map Unit:
NWI Class: PFO
Are climatic/hydrologic conditions on the site typical for this time of year? Yes
Remarks:
Are Normal Circumstances present? Yes
If needed, explain any answers in Remarks:
Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Remarks:
Are Vegetation No , Soil No , or Hydrology No naturally problematic? Remarks:

SUMMARY OF FINDINGS - Attach site map showing sample point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes
Hydric Soil Present? Yes
Wetland Hydrology Present? Yes

Is This Sample Area Within a Wetland? Yes

Remarks: All parameters are met. Area is classified as a palustrine forested (PFO) wetland.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

X Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial (B7)
___ Sparsely Vegetated Concave Surface (B8)

X Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
X Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
X Microtopographic Relief (D4)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? X Depth (inches): 1
Water Table Present? X Depth (inches): Surface
Saturation Present? X Depth (inches): Surface

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(in)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
3-7	7.5YR_2.5/1	90	7.5YR_3/4	10	C	M	SILTY_CLAY_LOAM	
13-17	10YR_4/3	90	7.5YR_4/1	10	D	M	SANDY_CLAY	
0-3	7.5YR_2.5/1	97	7.5YR_3/4	3	C	M	SILTY_CLAY_LOAM	Primarily organic matter
7-13	10YR_4/1	50	10YR_4/6	30	C	N/A	SANDY_CLAY_LOAM	
			5YR_3/4	15	C	M		
			7.5YR_5/8	5	C	M		

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

X Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
X Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
X Dark Surface (S7) (LRR R, MLRA 149B)

___ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
___ Thin Dark Surface (S9) (LRR R, MLRA 149B)
___ Loamy Mucky Mineral (F1) (LRR K, L)
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
___ Coast Prairie Redox (A16) (LRR K, L, R)
___ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
___ Dark Surface (S7) (LRR K, L, M)
___ Polyvalue Below Surface (S8) (LRR K, L)
___ Thin Dark Surface (S9) (LRR K, L)
___ Iron-Manganese Masses (F12) (LRR K, L, R)
___ Piedmont Floodplain Soils (F19) (MLRA 149B)
___ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches):

Hydric Soil Present? Yes

Remarks:

VEGETATION - Use scientific names of plants.

Sampling Point: W5-WET1

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dom. Sp?	Indicator Status
1. *Acer saccharinum*	10.5	X	FAC
2. *Ulmus americana*	3		FAC
3. *Acer rubrum*	3		FAC
4.			
5.			
6.			
7.			
8.			
	16.0	= Total Cover	
Sapling Stratum (Plot size: 30 ft)			
1. Fraxinus pennsylvanica	10.5	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	10.0	= Total Cover	
Shrub Stratum (Plot size: 15 ft)			
1. *Rosa multiflora*	10.5	X	FACU
2. *Viburnum dentatum*	10.5	X	FAC
3. *Ligustrum japonicum*	3	X	FAC
4. *Lonicera japonica*	3	X	FACU
5.			
6.			
7.			
8.			
	27.0	= Total Cover	
Herb Stratum (Plot size: 5 ft)			
1. *Symplocarpus foetidus*	63	X	OBL
2. *Alysicarpus_SP*	10.5		
3. *Equisetum sylvaticum*	3		FACW
4. *Onoclea sensibilis*	20.5		FACW
5. *Lythrum salicaria*	10.5		OBL
6. *Toxicodendron radicans*	3		FAC
7.			
8.			
9.			
10.			
11.			
12.			
	110.0	= Total Cover	
Woody Vines (Plot size: 30 ft)			
1. *Toxicodendron radicans*	3		FAC
2.			
3.			
4.			
5.			
	3.0	= Total Cover	

Dominance Test Worksheet:

Dominants OBL, FACW, FAC: 6 (A)

Dominants across all strata: 8 (B)

% Dominants OBL, FACW, FAC: 75.00% (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply By:
OBL	73.5	x 1 =	73.5
FACW	34.0	x 2 =	68.0
FAC	36.0	x 3 =	108.0
FACU	13.5	x 4 =	54.0
UPL	0.0	x 5 =	0.0
Sum:	157.0 (A)		303.5 (B)

Prevalence Index = B/A = 1.93

Hydrophytic Vegetation Indicators:

___ Dominance Test is > 50%
X Prevalence Index is <= 3.0
___ Problematic Hydrophytic Vegetation[1] (explain)
___ Rapid Test for Hydrophytic Vegetation
___ Morphological Adaptations

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes

Remarks: (If observed, list morphological adaptations below).

Appendix D

Photograph Log

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development

Site Location: Carmel. New York

Project No: 20692.00

Photo No. 1

Date: 5/18/2021

Description: Near Data Point Upland No. 1, view of the upland forested area. Forest floor is clear of herbaceous and shrub vegetation cover, and trees ranging from sapling to mature canopy trees dominate.

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development

Site Location: Carmel. New York

Project No: 20692.00

Photo No. 2

Date: 5/18/2021

Description: Near Data Point Upland No. 1, another view of the upland forested area that represents the eastern portion of the upland areas onsite.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development	Site Location: Carmel. New York	Project No: 20692.00

Photo No. 3

Date: 5/18/2021

Description: Near Data Point Upland No. 2, view of upland forest area and ATV trails representative of the western portion of the uplands onsite. While mature canopy trees are still dominant, herbaceous and shrub vegetative cover are also prevalent.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development	Site Location: Carmel. New York	Project No: 20692.00

Photo No. 4

Date: 5/18/2021

Description: Near Data Point Upland No. 2, view of upland forest area and ATV trails representative of the western portion of the uplands onsite.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development

Site Location: Carmel. New York

Project No: 20692.00

Photo No. 5

Date: 5/18/2021

Description: Near Data Point Upland No. 2, view of upland forest area adjacent to ATV trails onsite. Forest floor vegetation is transitioning from clear to herbaceous and shrub dominated.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development

Site Location: Carmel. New York

Project No: 20692.00

Photo No. 6

Date: 5/18/2021

Description: Near Stream 3 in Wetland Area 1, view of wetland area identified onsite. Ferns, Skunk Cabbage, and tree saplings were dominant and water saturation and surface ponding were observed.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development	Site Location: Carmel. New York	Project No: 20692.00

Photo No. 7 | Date: 5/18/2021

Description: Near Wetland Flag No. 303 in Wetland Area 2, view of wetlands in the foreground, and uplands in the background.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development	Site Location: Carmel. New York	Project No: 20692.00

Photo No. 8 | Date: 5/18/2021

Description: Near Wetland Flag No. 369 in Wetland Area 2, view of saturated wetlands observed onsite.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development | Site Location: Carmel. New York | Project No: 20692.00

Photo No. 9 | Date: 5/18/2021

Description: Near Wetland Flag No. 367 in Wetland Area 2, view of the utility right-of-way bisecting the site. Primarily maintained, wetlands do extend across the right-of-way.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development | Site Location: Carmel. New York | Project No: 20692.00

Photo No. 10 | Date: 5/18/2021

Description: Near Wetland Flag No. 154 in Wetland Area 2, view of stained leaves observed. Surface water was minimally present, and herbaceous cover was dominant.

Client Name: BPUS Generation Development | Site Location: Carmel. New York | Project No: 20692.00

Photo No. 11 | Date: 5/18/2021

Description: Near Wetland Flag No. 334 in Wetland Area 3, view of forested wetlands and stained leaves. Snags were common in the wetland area, and although minimal shrubs were present, herbaceous cover, saplings and nature canopy trees were dominant.

Client Name: BPUS Generation Development | Site Location: Carmel. New York | Project No: 20692.00

Photo No. 12 | Date: 5/18/2021

Description: Near Wetland Flag No. 334 in Wetland Area 3, an alternate view of the forest wetlands in the area.

PHOTOGRAPHIC LOG

Client Name:	BPUS Generation Development	Site Location:	Carmel. New York	Project No: 20692.00
Photo No. 13	Date: 5/18/2021			

Description: Near Wetland Flag No. 217in Wetland Area 2, view of saturated wetlands observed. Herbaceous cover is dominant.

PHOTOGRAPHIC LOG

Client Name:	BPUS Generation Development	Site Location:	Carmel. New York	Project No: 20692.00
Photo No. 14	Date: 5/18/2021			

Description: Near Wetland Flag No. 115 in Wetland Area 4, view of wetland area with varying depths of surface water present. Herbaceous and shrub vegetation are dominant, with minor saplings and small mature trees present.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development

Site Location: Carmel. New York

Project No: 20692.00

Photo No. 15

Date: 5/18/2021

Description: Near Wetland Flag No. 108 in Wetland Area 4, view of saturated forested wetlands, dominated by herbaceous cover, shrubs, and mature canopy trees.

Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development

Site Location: Carmel. New York

Project No: 20692.00

Photo No. 16

Date: 5/18/2021

Description: Near Wetland Flag No. 201 in Wetland Area 5, wetlands encompass a minor stream onsite that flows from the north to south.

vhb Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

Client Name: BPUS Generation Development
Site Location: Carmel. New York
Project No: 20692.00

Photo No. 17
Date: 5/18/2021

Description: Near Wetland Flag No. 501 in Wetland Area 5, view of minor stream channel with adjacent fringe wetlands onsite.

vhb Engineers | Scientists | Planners | Designers

PHOTOGRAPHIC LOG

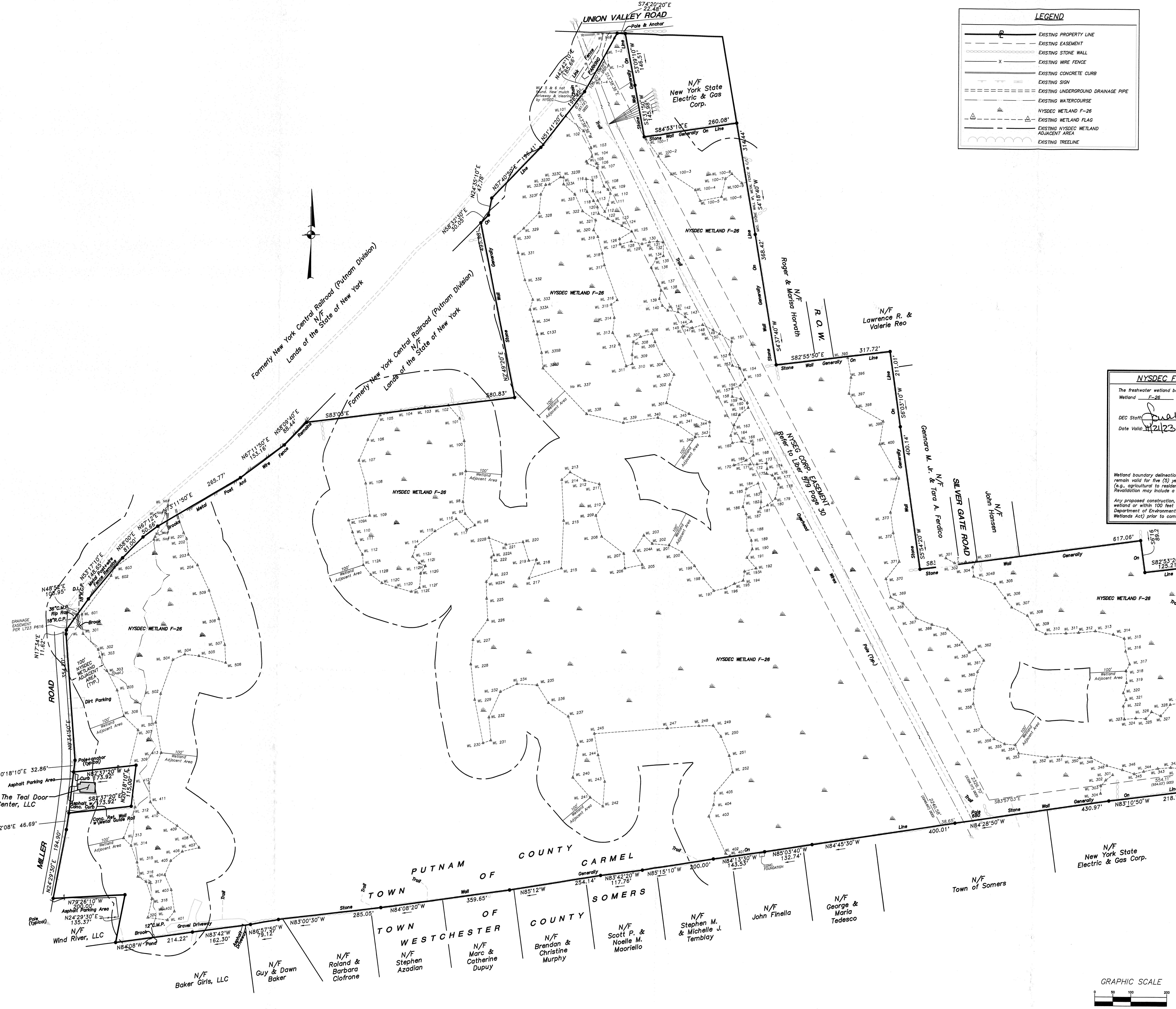
Client Name: BPUS Generation Development
Site Location: Carmel. New York
Project No: 20692.00

Photo No. 18
Date: 5/18/2021

Description: Near Wetland Flag No. 306 in Wetland Area 5, view of minor stream channel and adjacent fringe wetlands.

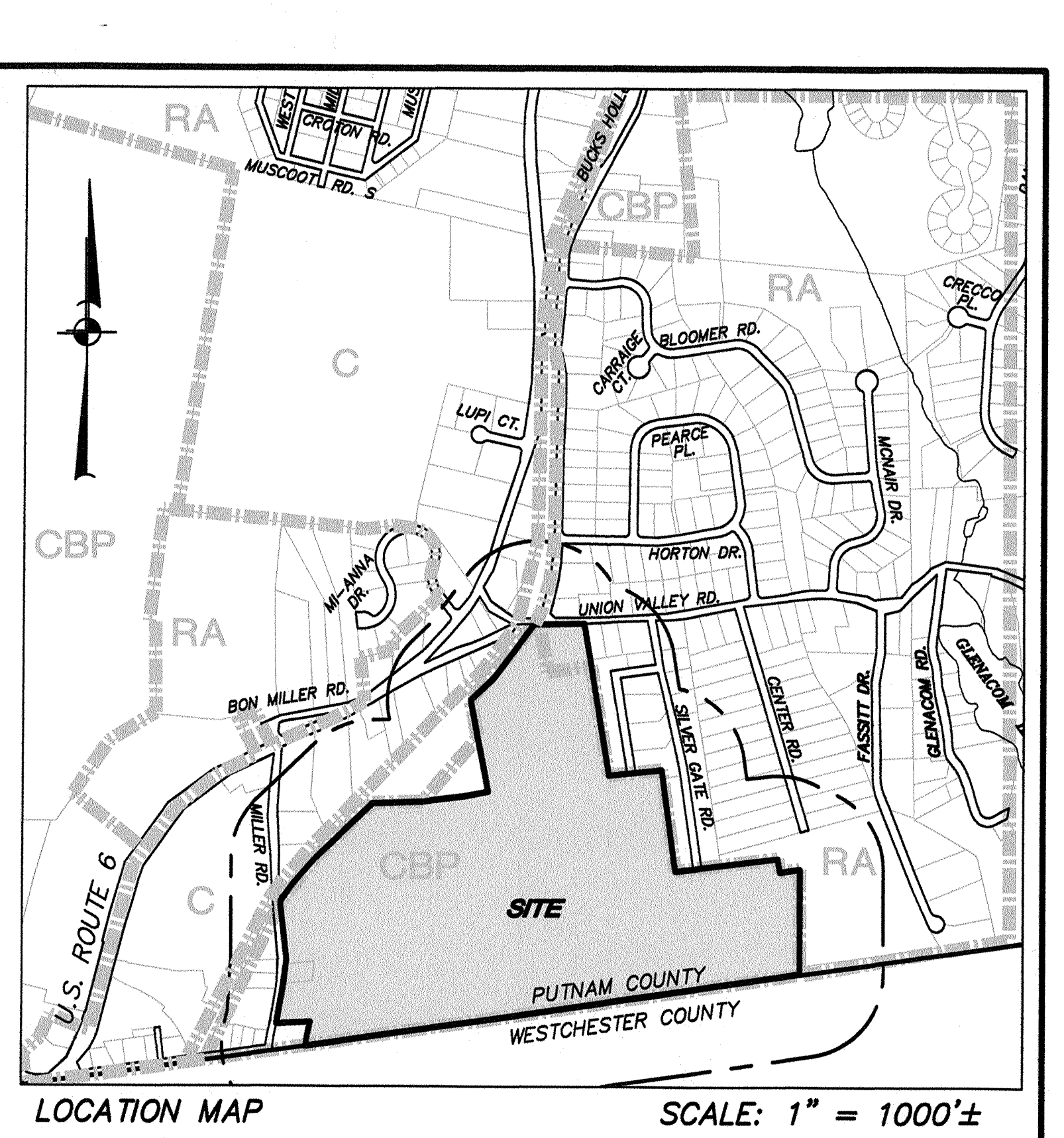
APPENDIX B

NYSDEC WETLAND VALIDATION APPROVAL



LEGEND

PL	EXISTING PROPERTY LINE
	EXISTING EASEMENT
	EXISTING STONE WALL
X	EXISTING WIRE FENCE
	EXISTING CONCRETE CURB
	EXISTING SIGN
	EXISTING UNDERGROUND DRAINAGE PIPE
	EXISTING WATERCOURSE
	NYSDEC WETLAND F-26
	EXISTING WETLAND FLAG
	EXISTING NYSDEC WETLAND ADJACENT AREA
	EXISTING TREELINE



LOCATION MAP SCALE: 1" = 1000'±

OWNER:

MILLER RD LLC
888 ROUTE 6
MAHOPAC NY 10541

NYS ELEC & GAS CORP.
39 UNION VALLEY ROAD
MAHOPAC NY 10541

THE TEAL DOOR CENTER, LLC
18 MILLER ROAD
MAHOPAC NY 10541

SITE DATA:

Zone: C/BP
Total Acreage 95.5 AC.±
Tax Map Nos.:
1. 86.11-1-14 (93.5 AC.±)
2. 86.8-2-85 (1.6 AC.±)
3. 86.14-1-8 (0.4 AC.±)

APPLICANT:

EAST POINT ENERGY, LLC
310 4th STREET NE, 3rd FLOOR
CHARLOTTESVILLE, VA 22902

GENERAL NOTES:

1. The boundaries, topography, and wetland flags shown hereon are taken from a survey by Insite Engineering, Surveying & Landscape Architecture, P.C., entitled "Survey of Property Prepared for East Point Energy", last revised on March 29, 2023.
2. Site conditions on Now or Formerly The Teal Door Center, LLC area approximated from aerial orthoimagery.

NYSDEC FRESHWATER WETLAND BOUNDARY VALIDATION

The freshwater wetland boundary as represented on these plans accurately depicts the limits of Freshwater Wetland F-26 as delineated by Anna Loss, Sara Berryman & Sarah Pawliczak on May 14, 17, 18, 2021 & July 20, 2023

DEC Staff: Sarah Pawliczak Surveyor/Engineer:
Date Valid: 11/21/23 Expiration Date: 11/21/28 SEAL

Jeffrey B. DeRosa, L.S.
N.Y.S. License No. 50749

JEFFREY DEROSA
50749

Wetland boundary delineations as validated by the New York State Department of Environmental Conservation remain valid for five (5) years unless existing exempt activities, area hydrology, or land use-practices change (e.g., agricultural to residential). After five (5) years the boundary must be revalidated by DEC staff. Revalidation may include a new delineation and survey of the wetland boundary.

Any proposed construction, grading, filling, excavating, clearing or other regulated activity in the freshwater wetland or within 100 feet of the wetland boundary as depicted on this plan requires a permit from the NYS Department of Environmental Conservation under Article 24 of the Environmental Conservation Law (Freshwater Wetlands Act) prior to commencement of work.

RECEIVED
NOV 21 2023
Natural Resources
NYSDEC Region 3 - New Paltz

GRAPHIC SCALE
0 50 100 200
(IN FEET)
1 inch = 100 ft.

NO.	DATE	REVISION	BY

INSITE
ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

3 Garrett Place
Carmel, NY 10512
(845) 225-9690
(845) 225-9717 fax
www.insite-eng.com

PROJECT:
UNION ENERGY CENTER
MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:
WETLAND VALIDATION MAP

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	11-15-23	DRAWN BY	K.J.K.
SCALE	1"=100'	CHECKED BY	A.D.T.

DRAWING NO. WV-1
SHEET 1 / 1

APPENDIX C

NYSDEC NATURAL HERITAGE AND USFWS IPAC DOCUMENTATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New York Ecological Services Field Office
3817 Luker Road
Cortland, NY 13045-9385
Phone: (607) 753-9334 Fax: (607) 753-9699
Email Address: fw5es_nyfo@fws.gov

In Reply Refer To:
Project Code: 2023-0107129
Project Name: East Point Energy - Union NY Solar Farm

July 20, 2023

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. **Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.**

Note: IPaC has provided all available attachments because this project is in multiple field office jurisdictions.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New York Ecological Services Field Office
3817 Luker Road
Cortland, NY 13045-9385
(607) 753-9334

This project's location is within the jurisdiction of multiple offices. However, only one species list document will be provided for all offices. The species and critical habitats in this document reflect the aggregation of those that fall in each of the affiliated office's jurisdiction. Other offices affiliated with the project:

Long Island Ecological Services Field Office
340 Smith Road
Shirley, NY 11967-2258
(631) 286-0485

PROJECT SUMMARY

Project Code: 2023-0107129

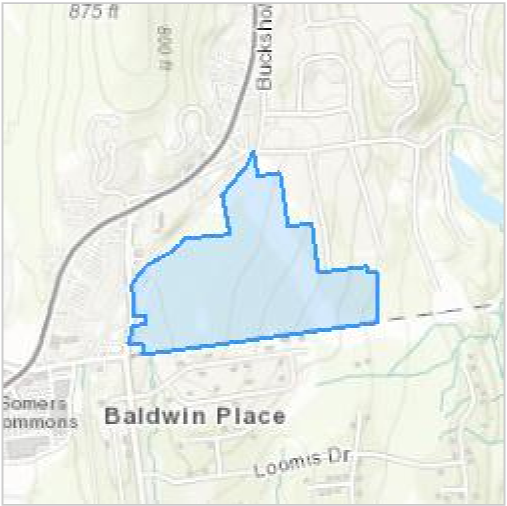
Project Name: East Point Energy - Union NY Solar Farm

Project Type: Power Gen - Solar

Project Description: Proposed battery energy storage facility - The Project Area will consist of battery enclosures, inverters, transformers, a security fence, and vegetative screening. The batteries themselves are housed in enclosures, that will be supported by concrete pads or piers. Similarly, the inverters and transformers will also be supported by concrete pads or piers. The rest of the site's ground cover will most likely be gravel or a similar substance. The Project will interconnect to the existing NYSEG transmission system near the property. Space between the enclosures and the security fence will be included in the design to allow access for vehicles performing routine maintenance.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.348824,-73.74773514695679,14z



Counties: Putnam and Westchester counties, New York

ENDANGERED SPECIES ACT SPECIES

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered

REPTILES

NAME	STATUS
Bog Turtle *Glyptemys muhlenbergii* Population: Wherever found, except GA, NC, SC, TN, VA No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6962	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Sep 1 to Aug 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10

NAME	BREEDING SEASON
Black-capped Chickadee *Poecile atricapillus practicus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 10 to Jul 31
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Canada Warbler *Cardellina canadensis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Golden-winged Warbler *Vermivora chrysoptera* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8745	Breeds May 1 to Jul 20
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (🟩)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

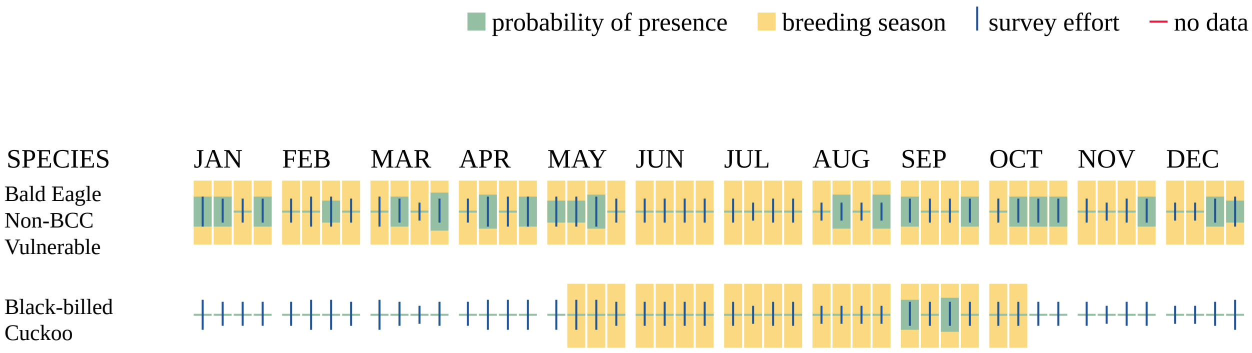
1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (🟨)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

MIGRATORY BIRDS FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?
The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);

2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities,

should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER FORESTED/SHRUB WETLAND

- PSS1E

RIVERINE

- R4SBC

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Sara Berryman
Address: 100 Great Meadow Road
Address Line 2: Suite 200
City: Wethersfield
State: CT
Zip: 06109
Email sberryman@vhb.com
Phone: 8608074336

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Assistant Regional Director-Ecological Services
300 Westgate Center Drive
Hadley, MA 01035-9589
Phone: (413) 253-8304 Fax: (413) 253-8293

In Reply Refer To: July 20, 2023
Project code: 2023-0107129
Project Name: East Point Energy - Union NY Solar Farm

Federal Nexus: yes
Federal Action Agency (if applicable): Army Corps of Engineers

Subject: Technical assistance for 'East Point Energy - Union NY Solar Farm'

Dear Sara Berryman:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on July 20, 2023, for "East Point Energy - Union NY Solar Farm" (here forward, Project). This project has been assigned Project Code 2023-0107129 and all future correspondence should clearly reference this number.

The Service developed the IPaC system and associated species' determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into the IPaC must accurately represent the full scope and details of the Project. Failure to accurately represent or implement the Project as detailed in IPaC or the Northeast Determination Key (Dkey), invalidates this letter. ***Answers to certain questions in the DKey commit the project proponent to implementation of conservation measures that must be followed for the ESA determination to remain valid.***

To make a no effect determination, the full scope of the proposed project implementation (action) should not have any effects (either positive or negative effect(s)), to a federally listed species or designated critical habitat. Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17). Under Section 7 of the ESA, if a federal action agency makes a no effect determination, no further consultation with, or concurrence from, the Service is required (ESA §7). If a proposed Federal action may affect a listed species or designated critical habitat, formal consultation is required (except when the Service concurs, in writing, that a proposed action "is not likely to adversely affect (NLAA)" listed species or designated critical habitat [50 CFR §402.02, 50 CFR§402.13]).

The IPaC results indicated the following species is (are) potentially present in your project area and, based on your responses to the Service's Northeast DKey, you determined the proposed Project will have the following effect determinations:

Species	**Listing Status**	**Determination**
Bog Turtle (*Glyptemys muhlenbergii*)	Threatened	May affect
Indiana Bat (*Myotis sodalis*)	Endangered	NLAA

Consultation with the Service is not complete. Further consultation or coordination with the Service is necessary for those species or designated critical habitats with a determination of "May Affect". Please contact our Assistant Regional Director-Ecological Services to discuss methods to avoid or minimize potential adverse effects to those species or designated critical habitats.

In addition to the species listed above, the following species and/or critical habitats may also occur in your project area and are not covered by this conclusion:

- Monarch Butterfly *Danaus plexippus* Candidate
- Northern Long-eared Bat *Myotis septentrionalis* Endangered

Please Note: If the Action may impact bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d) by the prospective permittee may be required. Please contact the Migratory Birds Permit Office, (413) 253-8643, or PermitsR5MB@fws.gov, with any questions regarding potential impacts to Eagles.

If you have any questions regarding this letter or need further assistance, please contact the Assistant Regional Director-Ecological Services and reference the Project Code associated with this Project.

Action Description

You provided to IPaC the following name and description for the subject Action.

1. Name

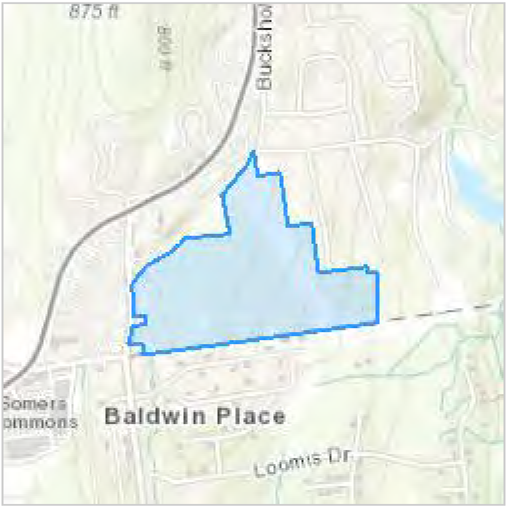
East Point Energy - Union NY Solar Farm

2. Description

The following description was provided for the project 'East Point Energy - Union NY Solar Farm':

> Proposed battery energy storage facility - The Project Area will consist of battery enclosures, inverters, transformers, a security fence, and vegetative screening. The batteries themselves are housed in enclosures, that will be supported by concrete pads or piers. Similarly, the inverters and transformers will also be supported by concrete pads or piers. The rest of the site's ground cover will most likely be gravel or a similar substance. The Project will interconnect to the existing NYSEG transmission system near the property. Space between the enclosures and the security fence will be included in the design to allow access for vehicles performing routine maintenance.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.348824,-73.74773514695679,14z



QUALIFICATION INTERVIEW

1. As a representative of this project, do you agree that all items submitted represent the complete scope of the project details and you will answer questions truthfully?

   Yes

2. Does the proposed project include, or is it reasonably certain to cause, intentional take of listed species?

   Note: This question could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered, or proposed species.

   No

3. Is the action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   Yes

4. Is the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), or Federal Transit Administration (FTA) the lead agency for this project?

   No

5. Are you including in this analysis all impacts to federally listed species that may result from the entirety of the project (not just the activities under federal jurisdiction)?

   Note: If there are project activities that will impact listed species that are considered to be outside of the jurisdiction of the federal action agency submitting this key, contact your local Ecological Services Field Office to determine whether it is appropriate to use this key. If your Ecological Services Field Office agrees that impacts to listed species that are outside the federal action agency's jurisdiction will be addressed through a separate process, you can answer yes to this question and continue through the key.

   Yes

6. Are you the lead federal action agency or designated non-federal representative requesting concurrence on behalf of the lead Federal Action Agency?

   No

7. Is the lead federal action agency the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC)?

   No

8. Is the lead federal action agency the Federal Energy Regulatory Commission (FERC)?

   No

9. Will the proposed project involve the use of herbicide where listed species are present?

   No

10. Are there any caves or anthropogenic features suitable for hibernating or roosting bats within the area expected to be impacted by the project?

    No

11. Does any component of the project associated with this action include structures that may pose a collision risk to **birds** (e.g., land-based or offshore wind turbines, communication towers, high voltage transmission lines, any type of towers with or without guy wires)?

    Note: For federal actions, answer 'yes' if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

    No
12. Does any component of the project associated with this action include structures that may pose a collision risk to **bats** (e.g., land-based wind turbines)?

    Note: For federal actions, answer 'yes' if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

    No
13. Will the proposed project result in permanent changes to water quantity in a stream or temporary changes that would be sufficient to result in impacts to listed species?

    For example, will the proposed project include any activities that would alter stream flow, such as water withdrawal, hydropower energy production, impoundments, intake structures, diversion structures, and/or turbines? Projects that include temporary and limited water reductions that will not displace listed species or appreciably change water availability for listed species (e.g. listed species will experience no changes to feeding, breeding or sheltering) can answer "No". Note: This question refers only to the amount of water present in a stream, other water quality factors, including sedimentation and turbidity, will be addressed in following questions.

    No
14. Will the proposed project affect wetlands where listed species are present?

    This includes, for example, project activities within wetlands, project activities within 300 feet of wetlands that may have impacts on wetlands, water withdrawals and/or discharge of contaminants (even with a NPDES).

    Yes
15. Will the proposed project activities (including upland project activities) occur within 0.125 miles of the water's edge of a stream or tributary of a stream where listed species may be present?

    Yes
16. Will the proposed project directly affect a streambed (below ordinary high water mark (OHWM)) of the stream or tributary where listed species may be present?

    Yes
17. Will the proposed project bore underneath (directional bore or horizontal directional drill) a stream where listed species may be present?

    No

18. Will the proposed project involve a new point source discharge into a stream or change an existing point source discharge (e.g., outfalls; leachate ponds) where listed species may be present?

    No

19. Will the proposed project involve the removal of excess sediment or debris, dredging or in-stream gravel mining where listed species may be present?

    No

20. Will the proposed project involve the creation of a new water-borne contaminant source where listed species may be present?

    Note New water-borne contaminant sources occur through improper storage, usage, or creation of chemicals. For example: leachate ponds and pits containing chemicals that are not NSF/ANSI 60 compliant have contaminated waterways. Sedimentation will be addressed in a separate question.

    No

21. Will the proposed project involve perennial stream loss, in a stream of tributary of a stream where listed species may be present, that would require an individual permit under 404 of the Clean Water Act?

    No

22. Will the proposed project involve blasting where listed species may be present?

    No

23. Will the proposed project include activities that could negatively affect fish movement temporarily or permanently (including fish stocking, harvesting, or creation of barriers to fish passage).

    No

24. Will the proposed project involve earth moving that could cause erosion and sedimentation, and/or contamination along a stream or tributary of a stream where listed species may be present?

    Note: Answer "Yes" to this question if erosion and sediment control measures will be used to protect the stream.

    Yes

25. Will earth moving activities result in sediment being introduced to streams or tributaries of streams where listed species may be present through activities such as, but not limited to, valley fills, large-scale vegetation removal, and/or change in site topography?

    Yes

26. Will the proposed project involve vegetation removal within 200 feet of a perennial stream bank where aquatic listed species may be present?

    No

27. Will erosion and sedimentation control Best Management Practices (BMPs) associated with applicable state and/or Federal permits, be applied to the project? If BMPs have been provided by and/or coordinated with and approved by the appropriate Ecological Services Field Office, answer "Yes" to this question.

    Yes

28. Is the project being funded, lead, or managed in whole or in part by U.S Fish and Wildlife Restoration and Recovery Program (e.g., Partners, Coastal, Fisheries, Wildlife and Sport Fish Restoration, Refuges)?

    No

29. [Semantic] Does the project intersect the Virginia big-eared bat critical habitat?

    Automatically answered
    No

30. [Semantic] Does the project intersect the Indiana bat AOI?

    Automatically answered
    Yes

31. Is the action area within 0.5 mile radius of any known hibernacula (caves or mines) openings or underground features?
    Note: If you are unsure, contact the appropriate Ecological Services Field Office before continuing through the key.

    No

32. Are trees present within the action area?

    Note: If there are trees within the action area that are of a sufficient size to be potential roosts for bats (i.e., live trees and/or snags ≥5 inches dbh (12.7 centimeter), answer "Yes". If you are unsure, answer "Yes." Or refer to Appendix A of the Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines for definitions and an assessment form that will assist you in determining if suitable habitat is present within your project's action area. Suitable summer habitat for Indiana bat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥5 inches dbh (12.7 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat

    Yes

33. Is the action area within known occupied Indiana bat habitat? Known occupied Indiana bat habitat includes established conservation buffers (10-mile buffer around Phase 1 or Phase 2 hibernacula, 5-mile buffer around Phase 3 or Phase 4 hibernacula; 5-mile buffer around Indiana bat captures or detections; 2.5-mile buffer around known roosts).

    No

34. Has a presence/probable absence bat survey following the Service’s Range-wide Indiana Bat and Northern long-eared Bat Survey Guidelines been conducted within the action area?

    No

35. Does the project involve removal or modification of a human-made structure (barn, house, or other building) known or suspected to contain roosting bats?

    Note: Most maintenance and general human disturbance in and around structures will not affect Indiana bats as bats roosting in human structures are adjusted to a certain level of routine noise and are generally expected to roost away from areas with excessive disturbance. Answer ‘no’ if the proposed action will not include disturbance to human structures known or suspected to contain roosting bats or if the structure does not offer suitable roosting habitat for northern long-eared bats. If unsure, answer ‘yes.’

    No

36. Does the project include removal/modification of an existing bridge or culvert?

    No

37. Will the project include tree cutting, other means of knocking down or bringing down trees, or tree trimming?

    Yes

38. Does the project include emergency cutting or trimming of hazard trees in order to remove an imminent threat to human safety or property?

    No

39. Will the proposed project result in the removal of any known or potential Indiana bat roost trees?

    Note: Suitable Indiana bat roost trees are live trees and/or snags ≥5 inches dbh that have exfoliating bark, cracks, crevices, and/or cavities.

    No

40. Will the project result in the use of prescribed fire?

    No

41. Will the proposed project involve blasting within Indiana bat suitable habitat?

    No

42. Does the project include temporary or permanent lighting of roadway(s), facility(ies), and/or parking lot(s)?

    No

43. [Semantic] Does the project intersect the Indiana bat critical habitat?

    Automatically answered
    No

44. [Semantic] Does the project intersect the candy darter critical habitat?

    Automatically answered
    No

45. [Semantic] Does the project intersect the diamond darter critical habitat?

    Automatically answered
    No

46. [Semantic] Does the project intersect the Big Sandy crayfish critical habitat?

    Automatically answered
    No

47. [Hidden Semantic] Does the project intersect the Guyandotte River crayfish critical habitat?

    Automatically answered
    No

48. [Hidden Semantic] Does the project intersect the Bog Turtle AOI?

    Automatically answered
    Yes

49. Are bog turtles known to occur within the action area?

    If unsure, data can be requested from the appropriate state Natural Heritage program.

    Yes

50. Do you have any other documents that you want to include with this submission?

    No

PROJECT QUESTIONNAIRE

1. Approximately how many acres of trees would the proposed project remove?

   45

2. Approximately how many total acres of disturbance are within the disturbance/construction limits of the proposed project?

   45

3. Briefly describe the habitat within the construction/disturbance limits of the project site.

   Mostly forested with wetlands, utility ROW with some emergent wetlands.

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Sara Berryman
Address: 100 Great Meadow Road
Address Line 2: Suite 200
City: Wethersfield
State: CT
Zip: 06109
Email sberryman@vhb.com
Phone: 8608074336

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Assistant Regional Director-Ecological Services
5600 American Blvd. West
Bloomington, MN 55437-1458
Phone: (612) 713-5350 Fax: (612) 713-5292

In Reply Refer To: July 20, 2023
Project code: 2023-0107129
Project Name: East Point Energy - Union NY Solar Farm

Federal Nexus: yes
Federal Action Agency (if applicable): Army Corps of Engineers

Subject: Technical assistance for 'East Point Energy - Union NY Solar Farm'

Dear Sara Berryman:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on July 20, 2023, for 'East Point Energy - Union NY Solar Farm' (here forward, Project). This project has been assigned Project Code 2023-0107129 and all future correspondence should clearly reference this number. **Please carefully review this letter. Your Endangered Species Act (Act) requirements are not complete.**

Ensuring Accurate Determinations When Using IPaC

The Service developed the IPaC system and associated species' determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into IPaC must accurately represent the full scope and details of the Project. **Failure to accurately represent or implement the Project as detailed in IPaC or the Northern Long-eared Bat Rangewide Determination Key (Dkey), invalidates this letter.**

Determination for the Northern Long-Eared Bat

Based on your IPaC submission and the standing analysis for the Dkey, your project has reached the determination of "May Affect" the northern long-eared bat.

Next Steps

Your action may qualify for the Interim Consultation Framework for the northern long-eared bat. To determine if it qualifies, review the Interim Consultation Framework posted here https://www.fws.gov/library/collections/interim-consultation-framework-northern-long-eared-bat. If you determine it meets the requirements of the Interim Consultation Framework, follow the procedures outlined there to complete section 7 consultation.

If your project does **not** meet the requirements of the Interim Consultation Framework, please contact the Assistant Regional Director-Ecological Services for further coordination on this project. Further consultation or coordination with the Service is necessary for those species or designated critical habitats with a determination of “May Affect”.

Other Species and Critical Habitat that May be Present in the Action Area

The IPaC-assisted determination for the northern long-eared bat does not apply to the following ESA-protected species and/or critical habitat that also may occur in your Action area:

- Bog Turtle *Glyptemys muhlenbergii* Threatened
- Indiana Bat *Myotis sodalis* Endangered
- Monarch Butterfly *Danaus plexippus* Candidate

You may coordinate with our Office to determine whether the Action may cause prohibited take of the species listed above.

Action Description

You provided to IPaC the following name and description for the subject Action.

1. Name

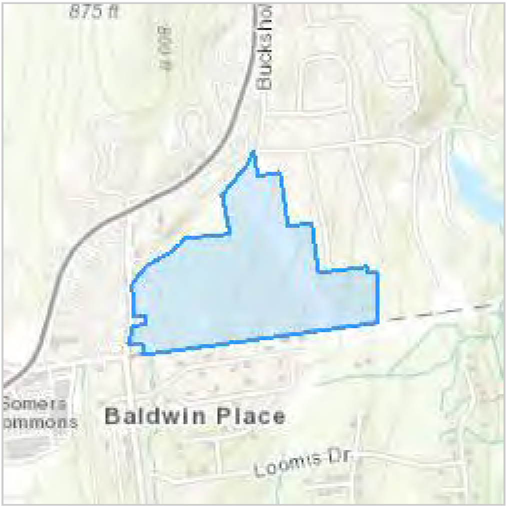
East Point Energy - Union NY Solar Farm

2. Description

The following description was provided for the project 'East Point Energy - Union NY Solar Farm':

> Proposed battery energy storage facility - The Project Area will consist of battery enclosures, inverters, transformers, a security fence, and vegetative screening. The batteries themselves are housed in enclosures, that will be supported by concrete pads or piers. Similarly, the inverters and transformers will also be supported by concrete pads or piers. The rest of the site's ground cover will most likely be gravel or a similar substance. The Project will interconnect to the existing NYSEG transmission system near the property. Space between the enclosures and the security fence will be included in the design to allow access for vehicles performing routine maintenance.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.348824,-73.74773514695679,14z



DETERMINATION KEY RESULT

Based on the answers provided, the proposed Action is consistent with a determination of "may affect" for the Endangered northern long-eared bat (*Myotis septentrionalis*).

QUALIFICATION INTERVIEW

1. Does the proposed project include, or is it reasonably certain to cause, intentional take of the northern long-eared bat or any other listed species?

   Note: Intentional take is defined as take that is the intended result of a project. Intentional take could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered or proposed species?

   No
2. Do you have post-white nose syndrome occurrence data that indicates that northern long-eared bats (NLEB) are likely to be present in the action area?

   Bat occurrence data may include identification of NLEBs in hibernacula, capture of NLEBs, tracking of NLEBs to roost trees, or confirmed acoustic detections. With this question, we are looking for data that, for some reason, may have not yet been made available to U.S. Fish and Wildlife Service.

   No
3. Does any component of the action involve construction or operation of wind turbines?

   Note: For federal actions, answer 'yes' if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

   No
4. Is the proposed action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   Yes
5. Is the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), or Federal Transit Administration (FTA) funding or authorizing the proposed action, in whole or in part?

   No

6. Are you an employee of the federal action agency or have you been officially designated in writing by the agency as its designated non-federal representative for the purposes of Endangered Species Act Section 7 informal consultation per 50 CFR § 402.08?

   Note: This key may be used for federal actions and for non-federal actions to facilitate section 7 consultation and to help determine whether an incidental take permit may be needed, respectively. This question is for information purposes only.

   No

7. Is the lead federal action agency the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC)? Is the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC) funding or authorizing the proposed action, in whole or in part?

   No

8. Is the lead federal action agency the Federal Energy Regulatory Commission (FERC)?

   No

9. Have you determined that your proposed action will have no effect on the northern long-eared bat? Remember to consider the effects of any activities that would not occur but for the proposed action.

   If you think that the northern long-eared bat may be affected by your project or if you would like assistance in deciding, answer “No” below and continue through the key. If you have determined that the northern long-eared bat does not occur in your project’s action area and/or that your project will have no effects whatsoever on the species despite the potential for it to occur in the action area, you may make a “no effect” determination for the northern long-eared bat.

   Note: Federal agencies (or their designated non-federal representatives) must consult with USFWS on federal agency actions that may affect listed species [50 CFR 402.14(a)]. Consultation is not required for actions that will not affect listed species or critical habitat. Therefore, this determination key will not provide a consistency or verification letter for actions that will not affect listed species. If you believe that the northern long-eared bat may be affected by your project or if you would like assistance in deciding, please answer “No” and continue through the key. Remember that this key addresses only effects to the northern long-eared bat. Consultation with USFWS would be required if your action may affect another listed species or critical habitat. The definition of Effects of the Action can be found here: https://www.fws.gov/media/northern-long-eared-bat-assisted-determination-key-selected-definitions

   No

10. Have you contacted the appropriate agency to determine if your action is near any known northern long-eared bat hibernacula?

    Note: A document with links to Natural Heritage Inventory databases and other state-specific sources of information on the locations of northern long-eared bat hibernacula is available here. Location information for northern long-eared bat hibernacula is generally kept in state natural heritage inventory databases – the availability of this data varies by state. Many states provide online access to their data, either directly by providing maps or by providing the opportunity to make a data request. In some cases, to protect those resources, access to the information may be limited.

    Yes
11. Is any portion of the action area within 0.5-mile radius of any known northern long-eared bat hibernacula? If unsure, contact your local Ecological Services Field Office.

    No
12. Does the action area contain any caves (or associated sinkholes, fissures, or other karst features), mines, rocky outcroppings, or tunnels that could provide habitat for hibernating northern long-eared bats?

    No
13. Is suitable summer habitat for the northern long-eared bat present within 1000 feet of project activities?
    (If unsure, answer "Yes.")

    Note: If there are trees within the action area that are of a sufficient size to be potential roosts for bats (i.e., live trees and/or snags ≥3 inches (12.7 centimeter) dbh), answer "Yes". If unsure, additional information defining suitable summer habitat for the northern long-eared bat can be found at: https://www.fws.gov/media/northern-long-eared-bat-assisted-determination-key-selected-definitions

    Yes
14. Will the action cause effects to a bridge?

    No
15. Will the action result in effects to a culvert or tunnel?

    No

16. Does the action include the intentional exclusion of northern long-eared bats from a building or structure?

    Note: Exclusion is conducted to deny bats' entry or reentry into a building. To be effective and to avoid harming bats, it should be done according to established standards. If your action includes bat exclusion and you are unsure whether northern long-eared bats are present, answer "Yes." Answer "No" if there are no signs of bat use in the building/structure. If unsure, contact your local U.S. Fish and Wildlife Services Ecological Services Field Office to help assess whether northern long-eared bats may be present. Contact a Nuisance Wildlife Control Operator (NWCO) for help in how to exclude bats from a structure safely without causing harm to the bats (to find a NWCO certified in bat standards, search the Internet using the search term "National Wildlife Control Operators Association bats"). Also see the White-Nose Syndrome Response Team's guide for bat control in structures

    No

17. Does the action involve removal, modification, or maintenance of a human-made structure (barn, house, or other building) **known or suspected to contain roosting bats?**

    No

18. Will the action cause construction of one or more new roads open to the public?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

19. Will the action include or cause any construction or other activity that is reasonably certain to increase average daily traffic on one or more existing roads?

    Note: For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.). .

    No

20. Will the action include or cause any construction or other activity that is reasonably certain to increase the number of travel lanes on an existing thoroughfare?

    For federal actions, answer 'yes' when the construction or operation of these facilities is either (1) part of the federal action or (2) would not occur but for an action taken by a federal agency (federal permit, funding, etc.).

    No

21. Will the proposed action involve the creation of a new water-borne contaminant source (e.g., leachate pond pits containing chemicals that are not NSF/ANSI 60 compliant)?

    No

22. Will the proposed action involve the creation of a new point source discharge from a facility other than a water treatment plant or storm water system?

    No

23. Will the proposed action involve blasting?

    No

24. Will the action involve military training (e.g., smoke operations, obscurant operations, exploding munitions, artillery fire, range use, helicopter or fixed wing aircraft use)?

    No

25. Will the proposed action involve the use of herbicides or pesticides other than herbicides (e.g., fungicides, insecticides, or rodenticides)?

    No

26. Will the action include or cause activities that are reasonably certain to cause chronic nighttime noise in suitable summer habitat for the northern long-eared bat? Chronic noise is noise that is continuous or occurs repeatedly again and again for a long time.

    Note: Additional information defining suitable summer habitat for the northern long-eared bat can be found at: https://www.fws.gov/media/northern-long-eared-bat-assisted-determination-key-selected-definitions

    No

27. Does the action include, or is it reasonably certain to cause, the use of artificial lighting within 1000 feet of suitable northern long-eared bat roosting habitat?

    Note: Additional information defining suitable roosting habitat for the northern long-eared bat can be found at: https://www.fws.gov/media/northern-long-eared-bat-assisted-determination-key-selected-definitions

    No

28. Will the action include tree cutting or other means of knocking down or bringing down trees, tree topping, or tree trimming?

    Yes

29. Will the proposed action result in the cutting or other means of knocking down, bringing down, or trimming of any trees suitable for northern long-eared bat roosting?

    Note: Suitable northern long-eared bat roost trees are live trees and/or snags ≥3 inches dbh that have exfoliating bark, cracks, crevices, and/or cavities.

    Yes

PROJECT QUESTIONNAIRE

Enter the extent of the action area (in acres) from which trees will be removed - round up to the nearest tenth of an acre. For this question, include the entire area where tree removal will take place, even if some live or dead trees will be left standing.

45

In what extent of the area (in acres) will trees be cut, knocked down, or trimmed during the inactive (hibernation) season for northern long-eared bat? **Note:** Inactive Season dates for spring staging/fall swarming areas can be found here: https://www.fws.gov/media/inactive-season-dates-swarming-and-staging-areas

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In what extent of the area (in acres) will trees be cut, knocked down, or trimmed during the active (non-hibernation) season for northern long-eared bat? **Note:** Inactive Season dates for spring staging/fall swarming areas can be found here: https://www.fws.gov/media/inactive-season-dates-swarming-and-staging-areas

45

Will all potential northern long-eared bat (NLEB) roost trees (trees ≥3 inches diameter at breast height, dbh) be cut, knocked, or brought down from any portion of the action area greater than or equal to 0.1 acre? If all NLEB roost trees will be removed from multiple areas, select ‘Yes’ if the cumulative extent of those areas meets or exceeds 0.1 acre.

Yes

Enter the extent of the action area (in acres) from which all potential NLEB roost trees will be removed. If all NLEB roost trees will be removed from multiple areas, entire the total extent of those areas. Round up to the nearest tenth of an acre.

45

For the area from which all potential northern long-eared bat (NLEB) roost trees will be removed, on how many acres (round to the nearest tenth of an acre) will trees be allowed to regrow? Enter ‘0’ if the entire area from which all potential NLEB roost trees are removed will be developed or otherwise converted to non-forest for the foreseeable future.

0

Will any snags (standing dead trees) ≥3 inches dbh be left standing in the area(s) in which all northern long-eared bat roost trees will be cut, knocked down, or otherwise brought down?

No

Will all project activities by completed by April 1, 2024?

No

IPAC USER CONTACT INFORMATION

Agency:	Private Entity
Name:	Sara Berryman
Address:	100 Great Meadow Road
Address Line 2:	Suite 200
City:	Wethersfield
State:	CT
Zip:	06109
Email	sberryman@vhb.com
Phone:	8608074336

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Fish and Wildlife, New York Natural Heritage Program
625 Broadway, Fifth Floor, Albany, NY 12233-4757
P: (518) 402-8935 | F: (518) 402-8925
www.dec.ny.gov

July 19, 2021

Kristin Carman
VHB
100 Great Oaks Blvd, Suite 118
Albany, NY 12203

Re: BPUS Generation Development, LLC
County: Putnam Town/City: Carmel

Dear Kristin Carman:

In response to your recent request, we have reviewed the New York Natural Heritage Program database with respect to the above project.

We have no records of rare or state-listed animals or plants, or significant natural communities at the project site.

Within five miles of the project site is a documented winter hibernaculum of **Northern long-eared bat** (*Myotis septentrionalis*, state and federally listed as Threatened). Within eight miles of the project site is a documented winter hibernaculum of **Indiana bat** (*Myotis sodalis*, state and federally listed as Engangered).For information about any permit considerations for your project, please contact the Permits staff at the NYSDEC Region 3 Office, Division of Environmental Permits, at dep.r3@dec.ny.gov.

For most sites, comprehensive field surveys have not been conducted. We cannot provide a definitive statement on the presence or absence of all rare or state-listed species or significant natural communities. Depending on the nature of the project and the conditions at the project site, further information from on-site surveys or other resources may be required to fully assess impacts on biological resources.

For information regarding other permits that may be required under state law for regulated areas or activities (e.g., regulated wetlands), please contact the Permits staff at the NYSDEC Region 3 Office as described above.

Sincerely,

Heidi J Krahling

Heidi Krahling
Environmental Review Specialist
New York Natural Heritage Program

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Energy Storage

Draft Emergency Response Plan

Updated June 10, 2022

This Draft Emergency Response Plan for energy storage facilities, presented by the American Clean Power Association (ACP), is the result of a collaborative member effort initially undertaken by the Energy Storage Association (ESA) in 2019 and continued following ESA's merger with ACP at the beginning of 2022. This document is intended to be adapted by users as needed to be appropriate to the conditions, environment, staffing, structure, technologies, and setup of a given site.

Legal disclaimer

This Draft Emergency Response Plan (ERP) is provided for information and guidance purposes only and establishes a suggested format to be considered in the preparation of an Emergency Response Plan. Sections of this draft ERP may not be applicable to every site, and the guidance offered should be modified to reflect specific conditions at your site. The American Clean Power Association assumes no responsibility or liability for the use of this draft. Site owners and operators are advised to consult with safety consultants and legal and insurance advisors concerning liability and other issues associated with the adoption and implementation of an Emergency Response Plan.

It is important to note that an ERP is a document that requires regular updates. Additionally, it should be flexible and easily understood, while supplying sufficient detail to enable personnel to implement necessary emergency procedures without question or delay in order to ensure continuity of operations.

[SITE NAME] EMERGENCY RESPONSE PLAN

Record of Revisions

Change #	Date of Change	Substance of Change	Entered By

Contents

1. Introduction

1.1 Purpose

The following emergency response procedures are provided so that all [Site Name] personnel understand the practices that are to be followed to be prepared for and to provide immediate and effective response to emergencies that might arise at the facility. Because the safety of employees is of primary concern, the [Site Name] Emergency Response Coordinator and each member of the [Site Name] staff are committed to providing a safe, healthy work environment and are responsible for ensuring implementation of these procedures.

Life safety of personnel shall be the highest priority during any event.

1.2 Limitations

This plan does not imply, nor should readers infer, that its implementation will guarantee that a perfect response will be practical or possible. No plan can shield individuals from all events.

Responders will attempt to coordinate the plan and response according to all applicable laws and standards.

Response to emergencies, events or disasters shall only be undertaken to the level of the responders' training, Personal Protective Equipment (PPE), and resources available.

There may be little to no warning during specific events to implement operational procedures.

The success or failure of all emergency plans depends upon effective training, continual (*e.g.*, annual) review of this response plan, and execution of the response.

Sites and operators shall comply with applicable codes, standards, and other requirements as apply in their locality, even if those codes, standards, and requirements contradict this plan.

Successful implementation of this plan depends on timely identification of capabilities, available resources at the time of the incident and a thorough information exchange between responding organizations and the facility or transporter.

1.3 Facility Description

[Site Name] is located in [City/County] at [Address]. The site is comprised of [type of storage system] in [number] of enclosures across [energy system site size] within a [overall site size]. The primary entrance is located at [location] with a secondary entrance at [location].

Appendix 1 provides a map of the facility. Notification information for plant and external support organizations (police, fire department, medical facilities, etc.) that may be called to respond to emergency situations at [Site Name] is included in Appendix 4. Support personnel are available on the site from [start time] to [end time]. The Site Manager or their delegated substitute is available via cellular phone in case of an emergency.

1.4 Plan Review and Revision

A review of this emergency response plan shall be conducted and documented at minimum on an annual basis. The plan shall also be reviewed and amended whenever there is a change in facility design, construction, operation, or maintenance that affects emergency response planning. When outside resources are changed or modified the plan shall be reviewed and updated to reflect the changes that may affect this plan.

2. Emergency Response Management

2.1 Overall Organization

Overall responsibility for the Emergency Response Plan (ERP) lies with the [Site Name] Emergency Response Coordinator. The Emergency Response Coordinator or their designee is responsible for program implementation, including designating evacuation routes and employee assembly points, coordinating severe weather activities, communicating emergency response procedures to site personnel, contracting with emergency response organizations, and contractor coordination.

2.2 Roles and Responsibilities

Specific management personnel will assume leadership roles for emergency responses. The Emergency Response Coordinator, Site Manager, and/or Lead Technicians will assist in the implementation of this plan by knowing and communicating evacuation routes to workers during emergency evacuation and reporting the status of the evacuation to the Fire Department. The Emergency Response Coordinator is responsible for seeing that this plan is implemented and will appoint an adequate number of personnel to enforce the plan, assure everyone is familiar with this plan and act as a liaison with the local Fire Department(s).

All facility personnel have a responsibility to immediately report emergency situations to the Lead Technician on duty or local emergency responder personnel when appropriate. There shall be no delay to report emergency events that require the local emergency responders. The Lead Technician will then notify the Emergency Response Coordinator and other key personnel of the situation using the [Site Name] Emergency Notification Telephone List (refer to Appendix 4). Where a Lead Technician is not assigned, facility personnel will refer to the Emergency Notification Telephone list to inform key personnel. Titles and roles are summarized in Appendix 3.

The Emergency Response Coordinator (or designee) shall be responsible for initiating a ‘phone tree’ for informing relevant operations and administrative contacts in [Site Owner / Operator], including the Regional Manager to initiate corporate awareness and public communications activities in accordance with company structure and policies.

A subject matter expert (SME) shall be contactable at all times by telephone. This person and a designated secondary SME contact should be readily available to first responders in the case of emergency situations. The SME shall be versed in the battery’s failure modes and hazards. A working knowledge of incident command systems will allow the SME to integrate into the emergency response operations when needed. If this is not practical, a toll-free phone number should be available such that first responders may call at any time, and be given operational data on the system, including its current state of health, system alarm notifications, and advice on how to proceed during an emergency event.

2.3 Preparation and Planning for Emergencies

2.3.1 Pre-planning for emergencies is a crucial element of this plan. The following steps have been taken in planning for emergency situations at the site:

- Fire department and other first responders have received a copy of this plan and have participated in an on-site familiarization meeting.
- All emergency responder access points to the facility shall be identified.
- An emergency response information notice board shall be maintained at [location readily visible and accessible to all personnel, identified in Appendix 1] and contain key contacts for emergencies, a list of personnel certified in First Aid/CPR, and other notices as outlined in this document or as deemed appropriate by the Emergency Response Coordinator. Provision shall be made for non-English speaking workers on site.
- All road exits are established and posted on the emergency information notice board.
- Evacuation route diagrams have been documented and posted on the emergency information notice board.
- Logs of on-site personnel for tracking headcounts during emergencies shall be maintained.
- All buildings and property surrounded by fencing will be marked by signage that identifies specific hazards (such as the NFPA diamond, and all applicable Danger, Caution, Warning signal words).
- Site personnel receive instruction to keep exits from the site or O&M Building clear and to maintain ready access to fire extinguishers by not blocking them with furniture, or any other means.
- Safe approach distances are established for equipment’s different failure modes, personnel are trained in these distances, and such information is communicated in writing to first responders during drills and other emergency response informational meetings.

- Safety Data Sheets (SDS) provided by manufacturers shall, where relevant, be provided to first responders. In some cases, manufacturers or suppliers will provide Material Safety Data Sheets (MSDS) instead of SDS where relevant.

2.3.2 Emergency Routes

A [Site Name] evacuation sheet shall be posted and orally communicated to site personnel. These procedures shall be discussed at periodic safety meetings in addition to being covered during new employee orientation. Personnel are to know at least two exits whenever possible and be familiar with the evacuation routes posted in the location indicated on the site map (Appendix 1).

Depending upon the degree of emergency, weather and/or site conditions, roadways as designated on the site map (Appendix 1) will be used for routes of evacuation. In the event of an evacuation, all personnel will meet at the designated muster point for further information. If the primary muster point is inaccessible or hazardous, personnel shall gather at the secondary muster point and inform the emergency coordinator (if not present) by radio or telephone. The emergency response coordinator shall inform personnel of a diversion to the secondary muster point by such mean as are available, to include radio or loud hailer. If personnel are unable to make it to the designated muster points, they should seek shelter wherever possible and contact their supervisor for further instructions. Accountability of personnel shall be of the upmost importance and be conducted in a timely manner. Responder access points shall be kept unobstructed at all times so first responders will not be hindered in their operations when responding to emergencies within the site.

2.4 Communications

Timely and efficient communications are essential to deal with an emergency response situation. The Emergency Response Coordinator is the central point of contact for all involved in an emergency response, including for first responders and Subject Matter Experts (SMEs). The following processes shall be observed during emergency communications:

- Employees using radios/phones shall yield to individuals who are the most directly involved in an emergency response activity, i.e. emergency response takes priority over all other communication on company network.
- Emergency transmissions should be clearly announced using signal words such as ‘urgent’ or ‘mayday.’ These signal words give priority to the radio transmitter to proceed with their message.
- If emergency radio/phone communications are interrupted or unclear, employees shall proceed to the muster point located at [location] and identified in Appendix 1.
- All hand-held radios/phones should be recharged daily with back-up batteries ready for use.

- Radios shall be inspected daily for functionality and a radio check shall be transmitted to confirm that both the transmission and receiving functions work. If a radio is not working properly then the employee shall notify the lead technician and make arrangements for some other form of communication while working. Radios that are not working properly shall be placed out of service and labeled appropriately so they will not be used by another employee.
- Provision shall be made for non-English speaking workers on site.

2.5 Operator Safety & Equipment

2.5.1 General recommendations for operator safety

- Inspect equipment daily for unsafe conditions.
- Keep hands away from exposed electrical connections.
- Keep hands away from hot surfaces.
- Observe all high voltage warnings.
- Any outstanding observations shall be reported to their supervisor immediately and documented.

2.5.2 Personal Protective Equipment

The operation or maintenance of specific equipment may have different safety requirements. There are different levels of PPE that must be checked and maintained. All personnel who wear levels of protection above and beyond their normal everyday attire must be trained in that PPE. All training of PPE shall be conducted by a competent person and documented. Some PPE have a SCAM (selection, care and maintenance) document that will instruct the end user on the limitations of the PPE and the proper maintenance of the PPE. Always be aware of individual equipment operational requirements and hazards as well as out of service dates. For example,

- Safety glasses with side shields (no dark glasses are permitted except those approved for welding or cutting)
- Face shields for cutting & grinding
- Approved safety toe shoes
- Approved hearing protection
- Approved hardhat
- Approved gloves
- Long sleeve shirt
- Long pants

All PPE is required to be worn at all times for the working being conducted. Any PPE that is compromised or no longer considered viable for protection shall be discarded and replaced. Any PPE that comes in contact with hazardous material shall be properly decontaminated and inspected for functionality before being returned to service.

2.6 Safety Training

2.6.1 General training requirements

Initial training for all site personnel with respect to the contents of this ERP shall be undertaken upon the start of employment or substantial changes in duties. Refresher training of the ERP to site personnel shall be conducted at least annually. Documentation of ERP training is to be maintained in site files.

A variety of emergency response drills (such as fire, tornado, bomb threat, etc. as relevant to the site) are to be held by [site owner/operator] at minimum on a quarterly basis and shall be documented. At least on an annual basis, the [locality] Fire Department and other emergency response personnel shall be requested to participate and assist with critique of evacuation drills. Table-top exercises are encouraged to familiarize relevant response personnel with procedures for different types of emergencies that could be encountered at the site.

The site Emergency Response Coordinator and Lead Technicians are trained in their specific duties upon being assigned these roles or beginning their employment. All building occupants have been instructed in actions to take in case of an emergency through their copies of procedures and training, as needed.

Operator personnel should receive supplier / manufacturer approved training on the specific characteristics of the energy storage system. Applicable common standards (*e.g.* on electrical safety) should be taken into account.

All personnel who wear levels of protection above and beyond their normal everyday attire must be trained in that PPE. All training of PPE shall be conducted by a competent person and documented.

All hazardous materials incident emergency responders and workers at hazardous materials facilities, transport companies, waste treatment facilities, storage facilities and disposal facilities will be provided training which meets federal and state standards. Such training will be commensurate with their employer's or organization's plan and policies.

Initial and refresher training regarding warning systems and alarms shall be conducted at least annually. Documentation of training is to be maintained in site files.

2.7 Warning Systems and Alarms

Audible and visual (e.g., flashing lights) alarm systems should be established that reflect specific on-site hazard analyses. Personnel should be trained on the significance of different alarms and the corresponding actions as outlined elsewhere in this Plan. Descriptions of each alarm and corresponding actions should be clearly posted on an emergency information notice board (location marked on map in Appendix 1).

Warning systems and alarms should be tested at least every six months or more frequently per manufacturer specifications or code requirements. Tests shall be documented. All site personnel, as well as those offsite who are likely to hear or see an alarm, should be made aware of tests so as not to cause undue concern.

3. Emergency Response

3.1 Analyze, Plan, Implement, Evaluate

The phases of emergency response may be categorized under the ‘APIE’ scheme for handling an emergency: Analyze, Plan, Implement, Evaluate.

- **Analyze:** Analyzing the response is the phase in which the notification takes place to emergency responders.
- **Plan:** Planning the response is the phase in which the proper resources and equipment are called to the emergency scene and a plan is developed to mitigate the emergency.
- **Implement:** Once a plan is developed and the proper resources and equipment are there, then the Emergency Response Coordinator will make the determination to implement the plan.
- **Evaluate:** Once the plan is implemented, it shall be evaluated for safety and effectiveness. If the plan is not safe or effective, then the process should start over again with **Analyze, Plan, Implement, and Evaluate.**

Only personnel who are properly trained in accordance with 29 CFR Part 1910.120(q)(6) may respond to hazardous chemical releases.

No employee is required or permitted to place himself or herself in harm’s way in order to facilitate extinguishment, evacuation, or rescue. All rescue operations will be performed by trained professionals upon their arrival. Rescue operations will only be conducted after a risk-reward analysis is done and proper PPE is used to protect against any adverse hazards that may be encountered.

Incidents where local fire department personnel are involved will be managed under a system established by the fire department, called ‘Incident Command System.’ This establishes a primary incident commander and a liaison to or for the Emergency Response Coordinator.

3.1.1 Analyze

Without entering an immediate hazard area, the employee who first discovers an emergency should identify the following:

- Is there a fire, spill, explosion, or other incident happening?
- Does medical assistance appear to be needed?
- Who/what is at risk: people, the environment, or property?
- What are the weather and terrain conditions and risks?

The employee will also isolate the area to keep people away from the scene until trained responders arrive, as long as it is safe to do so. An employee who has not received training in emergency response should take no actions beyond notification, isolation of the area, and personal safety precautions. Any efforts made to rescue persons, protect property, or protect the environment must be weighed against the possibility of becoming part of the problem. Attempts to rescue others shall only be attempted with proper PPE, proper training, and in a manner that does not create significant risk to rescuer or others. Persons at the scene must not contact spilled material or inhale fumes, smoke, or vapors.

3.1.2 Plan

After all life hazards are no longer a threat, a plan of operation shall be devised for remediation of the event. The plan shall be communicated to all responders and safety of all responders shall be paramount. A staging area, if needed, shall be identified for extra personnel and equipment that may be needed to accomplish the plan's objectives. All responders that will enter the hot zone (affected area) must be made aware of any decontaminated area upon their exit of the hot zone. Trained responders will be called to the scene by the O&M Manager and/or Lead Technicians to begin the process of hazard assessment and to establish objectives and priorities. The hot zone shall be identified, and all non-essential personnel shall not be permitted to enter this area without proper training and permission of the Emergency Response Coordinator.

3.1.3 Implement

The initial response phase starts with notification, which activates the emergency response system. Anyone who observes or receives information regarding an emergency at [Site Name] should immediately notify available personnel using the [Site Name] radio network or their issued cell phones. The Emergency Response Coordinator and/or Lead Technician will then ensure 911 is notified. At [Site Name], employees are notified of emergencies by cell phone/radio and word of mouth from the Emergency Response Coordinator and/or Lead Technicians. Appendix 4 provides a list of emergency notification information for [Site Name] personnel.

If an event has the potential to impact the local community, [Site Name] will contact local fire/police to make community notifications. The contact list in Appendix 2 also provides notification information for the Company Public Affairs team who will provide guidance for instances involving media. The Emergency Response Coordinator and/or Lead Technicians will coordinate any media efforts through the [Site Name] Asset Manager and Company Legal Department.

The incident command post will be set up in a location free of contaminants and located upwind uphill and upstream. The Emergency Response Coordinator or designee shall remain at the incident command post to serve as a liaison to the Incident Commander designated by emergency responders. Trained responders may enter a 'hot zone' only when wearing appropriate protective equipment. Personnel entering the hot zone shall be briefed on the plan before entering. All communication devices shall be tested prior to entry into the hot zone. A decontamination corridor shall be established prior to entry into the hot zone. There shall be accountability taken of all personnel entering and leaving the hot zone. A back up team that has the same PPE shall be at the ready in the event of the entry team needs quick assistance. A decontamination team shall be ready to for after exiting the location (warm zone). There shall be a doffing station that is set up immediately at the end of the decontamination section that will allow the responders a safe place to remove their PPE. Only trained responders are authorized to risk exposure to chemicals for purposes of containing or stopping the material release.

The Emergency Response Coordinator or a designee will be responsible for notifying the appropriate regulatory agencies and, if necessary, the Emergency Response Contractor or mutual aid groups. Appendix 2 includes a list of emergency contacts and agencies that may be notified in the event of an emergency. The incident will be documented and kept on file.

3.1.4 Evaluate

During the implementation phase of the emergency, response, action and progress shall be analyzed by the Emergency Response Coordinator constantly. If the plan seems to be ineffective or unsafe the responders shall be removed from the hot zone and the plan shall be revised. The new plan shall be implemented, and that revised plan shall be analyzed for safety effectiveness again.

3.2 Evacuation Procedures

When notified to evacuate, site personnel shall do so in a calm and orderly fashion, keeping the following instructions in mind:

- Walk, don’t run. Help others who need assistance as long as doing so does not put you at greater risk.
- Stay upwind, upstream, and uphill whenever possible.
- Watch for other traffic and equipment on access roads and roadways.
- Be aware of ice/snow and loose gravel conditions.
- Drive safely.

Site personnel shall go to the primary designated muster area as identified in Appendix 1. If employees are unable to make it to the muster area, they should divert to the secondary muster area and immediately contact their supervisor for further instructions.

During evacuation, the Emergency Response Coordinator and/or Lead Technicians should ensure that every person on his/her crew has been notified and that evacuation routes are clear. Any person with a disability (mobility, hearing, sight, etc.) who requires assistance to evacuate is responsible for pre-arranging with someone in their immediate work area to assist them in the event of an emergency. Anyone knowing of a person with a disability or injury who was not able to evacuate will report this fact immediately to their supervisor. This information shall be communicated to emergency responders immediately upon their arrival if the disabled person has not been evacuated.

Once an evacuation is complete, the Emergency Response Coordinator or Lead Technician should account for all personnel. This accountability information shall be communicated to the emergency responders immediately upon their arrival. When a person is unaccounted for, the following information shall be communicated to the emergency responders:

- Name of the individual
- Disabled or not disabled
- Work location
- Last known location

3.3 Post Emergency Reporting Procedures

Following any emergency described in this plan, and in compliance with facility permits and other County and/or State requirements, an incident report will be prepared by the Emergency Response Coordinator and transmitted to the appropriate individuals and agencies after review by the Company Regional Manager.

The Emergency Response Coordinator shall compile all documentation and perform a post-emergency investigation. Immediate performance of this activity will aid in determining the exact circumstances and cause of the incident. Issues to be determined include:

- Causes of the incident.
- Effectiveness of the emergency response plan.
- Need for amendments to the response plan.
- Need for additional training programs.

The fire department will make the final determination regarding when the scene is safe to release the site to staff. In some circumstances the scene may need to be safeguarded for investigators to examine the event failures. If the event was caused by a criminal act, the O&M manager shall be guided by law enforcement for direction.

If the facility is not able to reopen due to the event, the O&M Manager will make a determination regarding continuity of operations for the facility in consultation with the Company Regional Manager.

4. Fire Incidents

All personnel working at [Site Name] are to be trained and should know how to prevent and respond to a fire emergency. All on-site personnel shall:

- Complete an on-site training program identifying the fire risks at [Site Name].
- Understand the protocol and follow emergency procedures should an event occur.
- Review and report potential fire hazards to the Emergency Response Coordinator.

No employee is required or permitted to place himself or herself in harm's way in order to facilitate extinguishment, evacuation, or rescue. All rescue operations will be performed by trained professionals upon their arrival.

4.1 Conditions Associated with Energy Storage Systems

4.1.1 Unique Challenges

Energy storage systems present a unique challenge for fire fighters. Unlike a typical electrical or gas utility, an energy storage system does not have a single point of disconnect. Whereas there are disconnects that will de-energize select parts of the system, batteries will remain energized.

The following hazards may be encountered when fighting fires in energy storage systems:

- Shock or arcing hazard due to the presence of water during suppression activities.
- Related electrical enclosures may not resist water intrusion from the high-pressure stream of a fire hose.
- Batteries damaged in the fire may not resist water intrusion.
- Damaged conductors may not resist water intrusion.
- Shock hazard due to direct contact with energized components.
- No means of complete electrical disconnect.
- Chemical spills.
- Toxic gases.
- Thermal runaway and explosions.

4.1.2 Fire and Water

Due to the hazards described above, care and consideration should be applied when considering fire suppression by means of water inundation within energy storage systems. But because water as an extinguishing agent is commonplace, the appropriate use of water should be assessed, *i.e.* whether water reacts with the chemistries present or whether it is not an appropriate extinguisher class. The local fire department should be informed of appropriate fire suppression methods for the energy storage system type as identified by the equipment manufacturer.

If unconventional fire extinguishers are required, local first responders should be alerted and trained on their use, including a familiarization drill. The appropriate and most suitable extinguisher should be recommended based on the specific needs of the site in accordance with guidance from the manufacture. This may include water in some cases, and in all scenarios its use should not be discouraged.

All fire extinguishing equipment, whether automatic or manual, shall be regularly inspected for functionality as per manufacturers' guidance.

4.2 Response to a Fire Incident

In the event of an incipient stage (beginning, small) fire, employees should notify adjacent individuals of this situation and exit the area. Only employees trained in the use of fire extinguishers or other manual fire suppression systems should attempt to use an extinguisher or system. Employees are not expected or authorized to respond to fires beyond the incipient stage (*i.e.*, fires that are beyond the beginning stage and which cannot be extinguished using a hand-held, portable fire extinguisher). The fire department should be immediately notified by dialing 911 when any type of unintended fire has taken place. Site management shall also be immediately notified of any emergency.

4.2.1 Fire External to Battery Container or Enclosure

- Call 911 and report the following:
  - Site name: [Site Name]
  - The address of the main entrance: [Address] or nearest site access point
  - Injuries, if any, and need for ambulance
- Make sure the immediate area of the fire is clear of personnel.
- Account for all employees, contractors, and visitors who were working in the immediate area of the fire. If any personnel are unaccounted for from the immediate fire area, a communication shall be made through out the facility in attempt to locate the person(s) missing. If the person(s) is equipped with a facility radio then an emergency transmission shall be communicated in attempt to locate the person(s).
- Contact the O&M Manager (if present) and Emergency Response Coordinator (if not the O&M Manager) immediately.
- Remove any obstructions (vehicles, material, etc.) that might impede response to the scene.
- Station available personnel at road intersections to stop traffic flow into the fire scene.
- Evacuate the energy storage system area immediately if the fire warning alarm sounds or fire warning lights illuminate.
- Proceed to the designated muster point for head count.
  - If onsite, the designated Emergency Response Coordinator will do a head count and relay any information/instructions.
- If you encounter heavy smoke, stay low and breathe through a handkerchief or other fabric; move away from the area.
- Assist anyone having trouble leaving the area so long as doing so does not put the assistor at additional risk.
- Attempt to extinguish the fire ONLY if you have had the appropriate training and proper firefighting agent for the type of fire. Refer to the specific safety data sheet.
- Do not leave the designated muster point until advised to do so. If risk (e.g. smoke) requires evacuation of the muster point, the secondary muster point (designated on the map in Appendix 1) will be used and that fact announced via radio and alarms as available.

- The Emergency Response Coordinator will issue an ‘all clear’ only when the fire department informs them that it is safe to do so.
- The energy storage system is not to be accessed until the O&M Manager or designated Emergency Response Coordinator gives authorization.

4.2.2 Fire Internal to Battery Container

- Call 911 and report the following:
    - Site name: [Site Name]
    - The address of the main entrance: [Address] or nearest site access point
    - Injuries, if any, and need for ambulance
- Make sure the immediate area of the fire is clear of personnel.
- Account for all employees, contractors, and visitors who were working in the area of the fire. If any personnel are unaccounted for from the immediate fire area, a communication shall be made through out the facility in attempt to locate the person(s) missing. If the person(s) is equipped with a facility radio then an emergency transmission shall be communicated in attempt to locate the person(s).
- Contact the O&M Manager (if present) and Emergency Response Coordinator (if not the O&M Manager) immediately.
- Contact the Operations Center and Manager (if present).
- Evacuate the area immediately if the fire warning alarm sounds or fire warning lights illuminate.
- Remove any obstructions (vehicles, material, etc.) that might impede response to the scene.
- Proceed to the designated muster point for head count.
- If onsite, the designated Emergency Response Coordinator will do a head count and relay any information/instructions.
- If you encounter heavy smoke, stay low and breathe through a handkerchief or other fabric.
- If there is a second means of egress that is clear of smoke, that egress path will be used and a radio transmission or other type of communication shall be made stating that the clear egress point for other personnel to use for escape is the second means of egress.
- Assist anyone having trouble leaving the area so long as doing so does not put the assistor at additional risk.
- The fire suppression system is designed to work in a contained environment. **DO NOT** open the doors until it has been determined that the agent has been fully released and a pre-determined amount of time has passed to ensure no hazards are present, and with approval of emergency personnel and Subject Matter Expert.
- **DO NOT** put anyone in harm’s way to save the battery equipment in the container.
- Once the Fire Department arrives, provide them with the following -
    - All applicable SDS documents
    - Assistance isolating equipment electrically
    - This emergency response plan

    - A liaison to remain with the fire department Incident Commander as needed
- Do not leave the designated muster point until advised to do so. If risk (*e.g.* smoke) requires evacuation of the muster point, the secondary muster point (designated on the map in Appendix 1) will be used and that fact announced via radio and alarms as available.
- The O&M manager and/or Emergency Response Coordinator (if not the O&M manager) will issue an 'all clear' only when the fire department informs them that it is safe to do so and the site (or portions of it) can be reoccupied or normal working conditions can be resumed again.
- The energy storage system is not to be accessed until the O&M Manager or designated Emergency Response Coordinator and the emergency responders give authorization.

In the event of a fire incident, the designated operations personnel responsible for the safe shutdown of the plant will open switchgear to ensure the grid side of the plant is de-energized and isolate the batteries as best able to (i.e. verify the AC and DC breakers are open in the inverter). The Fire Department needs to understand that some of the equipment (batteries) will remain energized no matter what actions are taken, and the recommended option is containment. Batteries remain energized even if all the contactors, breakers, and switches have been opened.

4.2.3 After a Fire

Hazards after a fire should be identified at the time of installation such that recommendations for personal protective equipment (PPE) are available for clean-up crews and hazardous materials (HAZMAT) teams. This may include respirators to protect personnel from toxic gas that continues to be generated from hot cells. Firewater retention and cleanup measures may be required by local regulations. Once first responders have turned the site back to [The Company], the Subject Matter Expert, in coordination with the Emergency Response Coordinator, shall direct on-site personnel on procedures for securing the site for safety and pending any investigation.

In addition to the gas generation risk, cells that remain hot also pose a delayed ignition risk, whereby heat in the cell may transfer to undamaged adjacent cells or remaining active material and reignite the fire. As such, fire-damaged equipment must remain monitored for [a period identified in consultation with equipment manufacturer and SME].

Care should be taken to ensure that damaged batteries containing energy have been safety de-energized in accordance with disposal procedures, if possible, before handling and disposal. If unable to completely de-energize batteries involved in a fire, care should be taken with handling or dismantling battery systems involved in fires as they may still contain hazardous energy levels.

4.3 Site Maintenance and Housekeeping

- Fire extinguishers shall be inspected monthly as per NFPA 10.
- Fire extinguishers shall not be obstructed and should be in conspicuous locations with appropriate signage as per NFPA 10.
- Combustible material shall not be stored in mechanical rooms, electrical equipment rooms, or energy storage system enclosures.
- Outside dumpsters shall be kept at least five (5) feet away from combustible materials and the lids should be kept closed.
- Materials or equipment storage is not allowed in electrical equipment rooms, or near electrical panels.
- Electrical panel openings must be covered.
- Power strips must be plugged directly into an outlet and not daisy-chained and should be for temporary use only.
- Extension cords and flexible cords should not be substituted for permanent ones.

5. Chemical Release

5.1 Hazardous Materials

An inventory of hazardous materials shall be maintained in the [onsite location] and provided in advance to first responders, including fire and ambulance services. Materials typically on site include:

- [List of hazardous materials]

In the event of a breach of energy storage system containment, hazardous materials that may be released include:

- [List of hazardous materials]

Only personnel who are properly trained in accordance with 29 CFR Part 1910.120(q)(6) may respond to hazardous chemical releases.

5.2 Spill Response Procedures

An emergency spill kit is maintained in the [location], identified on the map in Appendix 1. This kit includes, at a minimum:

- Absorbent socks, pads, or pillows
- Disposal bags and ties
- Safety glasses
- Rubber gloves
- Appropriate neutralization medium for liquid present
- Hazardous labels

- Bag of Life-Dri absorbent or equivalent
- Shovel
- Broom

A formal notification process shall be initiated when a hazardous material spill or potential spill is first observed. Immediate actions are necessary. The first individual who discovers a spill (spill observer) will be responsible for initiating notification and response procedures. Only employees that are properly trained in accordance with 29 CFR Part 1910.120(q)(6) may respond to hazardous chemical releases. [Site Owner] is responsible for providing spill recognition and response training for personnel. At least one trained employee shall be on duty at all times.

The first person to witness the spill shall follow these procedures:

1. Make an assessment of the incident as observed.
2. If the incident can be safely controlled, take steps to do so (e.g., turn off source of spill).
3. Notify the Emergency Response Coordinator and provide as much information as possible.

The Emergency Response Coordinator shall follow these procedures in the event of a spill:

1. Notify Supervisors.
2. Make sure all personnel are removed from the spill area.
3. Take immediate actions to minimize any threat to public safety (verify the spill area has been cordoned off).
4. Secure the source of the spill, if safely possible to do so.
5. Maintain close observation of the spill.

Cleanup may range from very simple removal of minor spills, to installation of skimmers around large spills or between sensitive areas and spills for longer, prolonged cleanups. Cleanups shall be conducted as per OSHA regulations (part 1910). Cleanups can be on pavement or on soil surfaces. On-site personnel shall be trained in the proper use of the cleanup materials. The Emergency Response Contractor or other contracted – and appropriately certified – waste management company may provide cleanup and remediation services. It is strongly recommended that all contractors determine a disposal site in advance of a spill incident.

5.3 Reporting Major Spills

After initial spill response has begun, notification and reporting to agency personnel shall occur. [state-specific response requirements go here, referencing relevant document(s) which may be included in an appendix] The following procedures should be followed when reporting major spills:

- Never include information that has not been verified.

- Never speculate as to the cause of the incident or make any acknowledgment of liability.
- Do not delay reporting because of incomplete information.
- Notify persons/agencies and document notification and the content of the message.
- For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the Emergency Response Coordinator shall notify the National Response Center at (800) 424-8802.

Other agencies which may need to be consulted include, but are not limited to, the [County/City] fire department, [County/City] Public Works Department, state police, [Locality] Police Department, State Department of Toxic Substances, OSHA, [State Environmental Quality Authority], and (if relevant) [State Water Authority].

6. Medical Emergency

6.1 Medical Emergency Response Procedures

If an employee is injured, or an accident has occurred on site and first aid is not enough treatment for the emergency, 911 must be called. The call to 911 can be made by phone by any available site personnel. The caller must state to the dispatch that they are at the "[Company, Site Name]." A second notification will be made to the O&M Building, to inform others of the situation.

[Site Name] employees certified in first aid/cardiopulmonary resuscitation (CPR) may administer aid if they have completed training. Regularly-present employees with first aid/CPR training are identified on the emergency information notice board and employees shall be aware of who on staff is so certified. At all times when the site is staffed, at least one first aid certified member of staff shall be present. The location of first aid kits and automated external defibrillators (AEDs), if present, shall be identified by appropriate signage and indicated on the map in Appendix 1.

All employees shall designate a personal emergency contact, which shall be kept on file.

6.1.1 Serious Injury

The following procedures apply for serious medical injuries such as loss of consciousness, heart attack, bone fractures, neck trauma, or severe burns.

1. If life threatening, call 911.
2. Notify Operations and/or Safety Managers.
3. Provide name, exact location, number of injured persons, and brief description of incident.
4. On-site personnel shall meet EMS responders at site entrance and direct them to location of incident.
5. Do not leave or move the injured unless directed to by Safety Managers or EMS responders.

6. Administer first aid if necessary.
7. The site manager shall inform the employee’s personal emergency contact.
8. Document incident and keep on file.

6.1.2 Attending an Incident

When attending an incident, the following procedures apply:

1. Clear a path to the injured person for Operations and/or Safety Managers and assign personnel to assist with signaling EMS responders to the location of the incident.
2. Identify location of Project Site entrance nearest to the incident and notify EMS responders.
3. Operations and/or Safety Managers shall meet EMS responders at site entrance.
4. Direct and accompany EMS responders to location of incident.
5. Follow all directions of EMS responders.
6. Contact management personnel and/or subcontractors.
7. Document incident and keep on file.

6.1.3 Medical Facilities

The nearest medical facility to the project site is:

[Hospital Address]

Directions from site entrance:

[Turn-by-turn directions, and link to online map directions]

6.2 Non-Emergency Safety Incident

6.2.1 Notification of Minor Incidents

In the event a safety incident occurs where emergency response is not required (first aid treatment, near miss, etc.) work is to be stopped immediately and reported to the Emergency Response Coordinator and/or Lead Technician. Risk will be reassessed, adequate controls implemented, and the situation made safe before resuming the task. The event will be documented and kept on file.

6.2.2 Heat Illness

When the temperature exceeds 95 degrees Fahrenheit (35 degrees Celsius), or is expected to be so during the course of a shift or work project, the O&M Manger will hold short staff meetings to review the weather report; reinforce heat illness prevention with all workers; and provide reminders to drink water frequently, to be on the lookout for signs and symptoms of heat illness, and inform them that shade can be made available upon request.

Employees shall have free access to potable drinking water provided and located as close as practicable to the areas where employees are working. Where drinking water is not plumbed or otherwise continuously supplied, it shall be provided in sufficient quantity at the beginning of the work shift to provide one quart per employee per hour for drinking for the entire shift. Employers may begin the shift with smaller quantities of water if they have effective procedures for replenishment during the shift as needed to allow employees to drink one quart or more per hour. The frequent drinking of water shall be encouraged.

7. Security Incidents

7.1 Bomb Threat

7.1.1 The purpose of this plan is to give direction to all site personnel in the event [Site Name] is a target of an actual or threatened bomb assault/attack.

Anyone receiving a bomb threat shall:

- Treat the caller with courtesy and respect. Complete the Bomb Threat Report (Appendix 6). Use this sheet as a reference while talking with the caller making the threat.
- Attempt to obtain as much information as possible. See the “Bomb Threat Checklist” (Appendix 7).
- Immediately notify the [Site Name] Emergency Coordinator by phone. Stop all radio transmissions from this point on until cleared by the Emergency Coordinator or other competent authority. Radio transmissions can activate electronic detonating or timing devices.

The Emergency Response Coordinator will immediately notify 911. The Emergency Response Coordinator shall:

- Evaluate the threat and determine the appropriate course of action to take.
- Notify law enforcement and/or ambulance.
- Evacuate the facility as necessary.
- Coordinate evacuation of any part of the surrounding community with local authorities as needed.
- Coordinate search of the site with proper authorities.

7.1.2 If any suspicious item(s) are found, they are not to be touched. Barrier tape will be used to mark the area where the suspicious item(s) are by extending a continuous line of tape beginning immediately in front of the suspicious item(s) and extending to just outside the room exit. This will help guide local authorities to the suspicious item.

The Emergency Response Coordinator will ensure that the "All Clear" message is communicated once the threat has passed or is no longer present.

7.2 Chemical/Biological Agent Threat

The procedures described previously for a bomb threat should be used for a chemical or biological agent threat. Refer to Appendix 8 for a copy of the phone report when receiving such a threat and Appendix 9 for a checklist.

Any person that is exhibiting signs and symptoms from a chemical or biological agent should be isolated from other workers and be prepared for transport by EMS.

7.3 Sabotage or Vandalism

Anyone detecting any act or threat of any act of sabotage or vandalism will immediately notify the Emergency Response Coordinator. The Emergency Response Coordinator will evaluate the situation and decide what actions to take. The following options should be considered and/or implemented:

- Notification of 911.
- Corrective action as required, providing that no person will risk injury.
- Evacuation of the facility.

7.4 Active Shooter

In an active shooter situation, employees should:

1. Quickly determine what actions to take to protect life: options include run, hide, and fight (described in the DHS' Ready.gov site). Use best judgment based on the specific circumstances of the incident. Getting away from the shooter(s) is the top priority. Call 911 when in a safe location and warn/prevent individuals from entering an area where an active shooter may be if possible.
2. When encountering responding police, remain calm and follow any and all instructions from the officers. Officers may shout commands and push individuals to the ground for his/her safety as well as their own. When law enforcement personnel arrive at the scene, personnel should be aware of the following:
    - Follow all official instructions from police;
    - Remain calm, think, and resist the urge to panic;
    - Immediately raise hands and spread fingers;
    - Keep hands visible at all times;
    - Put down any items;
    - Avoid making sudden or quick movements toward officers;
    - Do not point, scream, or yell;
    - Do not ask for help from the officers when evacuating;
    - Proceed in the direction as advised by the officers; and
    - Provide all relevant information to police.

8. Environmental Hazards

8.1 Flooding and Flash Flood

Flash flooding is a result of heavy localized rainfall such as that from slow moving, intense thunderstorms. Flash floods often result from small creeks and streams overflowing during heavy rainfall. These floods often become raging torrents of water which rip through riverbeds or canyons, sweeping everything with them. Flash flooding can occur within 30-minutes to six hours of a heavy rain event. In hilly terrain, flash floods can strike with little or no advance warning. Distant rain may be channeled into gullies and ravines causing flash flooding in minutes. In the event of a flash flood, the following procedures shall apply:

- During periods of thunderstorms, always remain alert to heavy rains in your immediate area or upstream from your location. It does not have to be raining at your location for flash flooding to occur.
- Do not drive through flooded areas. Even if it looks shallow enough to cross.
- Do not cross flowing streams on foot where water is above your ankles.
- Be especially cautious at night. It is harder to recognize water danger then.
- Do not attempt to outrace a flood on foot. If you see or hear it coming, move to higher ground immediately.
- Be familiar with the land features where you work. It may be in a low area, near a drainage ditch, or small stream.
- Stay tuned to weather forecasts and updates for the latest statements, watches, and warnings concerning heavy rain and flash flooding in the Project Area.
- Waiting 15 to 30 minutes, or until high water recedes, is a simple safety measure.

8.2 Tornado

Upon the issuance of a tornado warning, O&M personnel will evacuate the site and report to the pre-designated shelter area, to be determined prior to O&M personnel arrival. In the event O&M personnel are outside and unable to evacuate to the shelter, the following procedures will be followed:

- Lie flat in a nearby ditch or depression, covering the head with the hands. Be aware of the potential for flooding.
- O&M personnel are safest in a low, flat location and will be instructed to not get under an overpass or bridge.
- O&M personnel will be instructed to never try to outrun a tornado in congested areas in a vehicle. It is safest to leave the vehicle for safe shelter.
- O&M Personnel are instructed to beware of flying debris.

Following tornado or high wind events, the site facility will be evaluated by O&M personnel for damage. All repairs will be performed under standard operational procedures.

8.3 Lightning Storm

In the event a lightning storm is within 10 – 30 miles and approaching the Site, the following procedures shall apply.

- Notify Operations and/or Safety Manager, and all on-site employees.
- Stop work safely and head to staging and laydown yards in vehicles.
- Remain at staging and laydown yards, get update on weather conditions.
- If storm/lighting is still approaching the Project Site, get in and stay in company or personal vehicles that have rubber tires only.
- If safe enough to do so, take cover in on-site designated shelters.
- Once storm passes, remain in cars/trucks for at least 30 minutes depending on passing storm severity, and wait for an “OK” from the O&M Manager or Emergency Response Coordinator in charge of monitoring the storm.

8.4 Winter Storm

Before winter approaches, the facility will ensure adequate supplies, including:

- Rock salt or similar products to melt ice on walkways.
- Sand to improve traction.
- Snow shovels and other snow removal equipment.
- As needed, service agreement(s) with snow removal vendors.

When winter weather threats exist, the facility will monitor local news channels for critical information from the National Weather Service (NWS). Be alert to changing weather conditions. Winter storm watches, warnings, and advisories are issued by local National Weather Service Forecast offices.

Depending on the severity of the winter storm, the Facility Manager (or designee) will give direction to personnel regarding site staffing/closure.

8.5 Seismic Event

Earthquakes may strike with little to no advance warning. As such, when an earthquake does occur, it is important to stay as safe as possible. Be aware that some earthquakes are actually fore-shocks and a larger earthquake may subsequently occur. Also, be aware that many earthquakes are accompanied by aftershocks after the main event has occurred. If an earthquake occurs minimize your movements to a few steps to a nearby safe place and if you are indoors stay there until the shaking has stopped and you are sure exiting is safe.

The following actions should be followed for personnel indoors:

- Drop to the ground and take cover by getting under a sturdy piece of furniture and hold on until the shaking stops. If there isn't a desk or sturdy piece of furniture near you, cover your face and head with your arms and crouch in an inside corner of the building.
- Stay away from glass, windows, outside doors and walls, and anything that could fall such as lighting fixtures or furniture.
- Use a doorway for shelter only if it is in close proximity to you and if you know it is a strongly supported load-bearing doorway.
- Stay inside until the shaking stops and it is safe to go outside.

The following actions should be followed for personnel outdoors:

- If you are already outdoors stay there.
- Move away from buildings, structures, light poles, and utility wires.

Once in the open stay there until the shaking stops to prevent being hit by falling debris.

Following seismic events, the site facility will be evaluated by O&M personnel for damage. All repairs will be performed under standard operational procedures.

9. Cybersecurity

Cyber security testing should be an integral part of the energy storage system lifecycle; systems should be secure by design. Once in operation, ensure continuous secure operation by monitoring, risk assessment and patching.

A process should be created and put in place to ensure continuous hardening of the energy storage system. The principle of hardening is making sure that the attack surface to site and equipment is limited by:

- Only necessary network service ports should be open, others should be closed.
- Only necessary software should be installed on the device, other software should be removed.
- Development environments and source code should not be installed on production devices.
- Remote access protocols that use plain text communication should not be used.
- Software that stores passwords unencrypted should not be used.

Acronyms

AC	Alternating Current
AED	Automated External Defibrillator
CAMEO	Computer-Aided Management of Emergency Operations
CHEMTREC	Chemical Shipping Regulation & Incident Support
CFR	Code of Federal Regulations
CPR	Cardiopulmonary Resuscitation
DC	Direct Current
DHS	Department of Homeland Security
EMS	Emergency Medical Services
ERP	Emergency Response Plan
FDC	Fire Department Connection
HAZMAT	Hazardous Materials
ICS	Incident Command System
MSDS	Material Safety Data Sheets
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NRC	National Response Center (U.S. EPA)
NWS	National Weather Service
OSHA	Occupational Safety and Health Administration
O&M	Operations and Maintenance
PPE	Personal Protective Equipment
SDS	Safety Data Sheets
SERC	State Emergency Response Commission
SME	Subject Matter Expert

Appendices

Appendix 1: Map of Site

[To include site boundaries, primary and secondary (etc.) entrances, emergency information notice board, emergency stop switch, first aid kit location(s), AED location(s), fire department connections, emergency spill kit location, etc.]

Appendix 2: Evacuation Map

[To include primary and alternate evacuation routes, exits, primary muster point, and secondary muster point]

Appendix 3: Referenced Titles and Roles

Note that some of these responsibilities may be combined within the duties of single individuals.

Company Regional Manager: A Company Regional Manager is an individual not directly responsible for the day to day operation of the site, nor for the immediate response during or immediately after an emergency, but who does bear responsibility for post-event assessment and broader planning, recovery, and learning from experience. The Regional Manager would typically bear the responsibility for ensuring incident records are maintained. Such a manager should also ensure a safety-based culture pervades across sites and ensure that O&M Managers are ensuring that training for safety is at the core of operations.

Emergency Response Contractor: An Emergency Response Contractor is an outside organization or individual who is contracted to undertake certain aspects of emergency response (e.g. spill management) but is not otherwise responsible for the strategic coordination of a response, nor is part of typical operation of a site. Care should be taken to ensure such contractors understand the broader picture of site safety and are aware of broader emergency response protocols (such as, but not limited to, the breadth of topics covered in this Plan).

Emergency Response Coordinator: The Emergency Response Coordinator takes control of the emergency and any resources necessary until the emergency has been eliminated and the necessary cleanup and/or restoration are complete. This person shall lead the incident reporting. The emergency response coordinator is typically the O&M Manager; in her/his absence, the Lead Technician or other designated person shall assume this role. All personnel on site shall know who the Emergency Response Coordinator on duty is during their time on site. Remote operators shall likewise know who the Emergency Response Coordinator is for any given shift.

The Emergency Coordinator or a designee will be responsible for notifying the appropriate regulatory agencies and, if necessary, the Emergency Response Contractor or mutual aid groups. Appendix 2 includes a list of emergency contacts and agencies that may be notified in the event of an emergency. The incident will be documented and kept on file.

The Emergency Response Coordinator will direct the following activities during an emergency:

- Ensure the safety of all personnel.
- Evaluate if operations in the affected area should be shut down.
- Take precautions to prevent or limit the spread of fire or explosions.
- Isolate affected area and provide direction for radio announcements.
- Determine the source/cause of the emergency and evaluate the primary and secondary hazards to allow a full-scale, safe response.
- Ensure that appropriate internal and external notifications are made.
- Coordinate outside assistance from public or private organizations.
- Implement other appropriate response provisions as necessary.

The Emergency Response Coordinator should be accredited in accordance with NFPA 70/70E and the National Electric Safety Code (NESC). If s/he is not, someone who is (e.g. the O&M Manager) must be present in emergencies to interface with electrical equipment above 50 volts.

Incident Commander: The on-scene ranking officer, representing the agency with incident jurisdiction. The Incident Commander authorizes incident objectives and strategies that collectively delineate a course of action.[1] The Fire Department designates an Incident Commander as the primary incident manager; it should not be used by civilian organizations that are operating at an incident with emergency responders.

O&M Manager: The Operations and Maintenance Manager is the individual responsible for the normal operation and upkeep of the energy storage system on a day to day basis. This includes standard operating conditions and routine scheduled or responsive maintenance activities.

Lead Technician: A Lead Technician is an on- or off-site individual responsible for the operation of a site from a performance and technical perspective. Such responsibilities may lie with the O&M Manger or with a remote operator.

Site Manager: A Site Manager supervises the personnel for a site. The Site Manager is ultimately responsible for implementation of the company's written procedures and practices.

Subject Matter Expert (SME): An individual and designated secondary contact with detailed working knowledge of the energy storage system and incident command systems. The SME should have ready access to information on state of the system, status and meaning of alarms, etc. The SME's contact information must be available to the Emergency Response Coordinator and first responders, as well as others via information on the emergency information notice board.

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[1] Federal Highway Administration. *Glossary*. https://ops.fhwa.dot.gov/publications/ics_guide/glossary.htm

Appendix 4: Emergency Contacts

TITLE	INDIVIDUAL	TELEPHONE NUMBER
O&M Manager / Emergency Coordinator	Name	999-999-9999 - Office 999-999-9999 - Cell
Subject Matter Expert	Name	999-999-9999 – Cell
Secondary SME Contact	Name	999-999-9999 – Cell
Manufacturer Safety Representative	Name	999-999-9999 - Cell
Lead Technician	Name	999-999-9999 - Cell
Alternate Emergency Contact	Name	999-999-9999 - Cell
Company Regional Manager	Name	999-999-9999 - Office 999-991-9999 - Cell
Company Asset Manager	Name	999-999-9999 - Office
Company Control Center	Operator On Duty	999-999-9999

Emergency Services & Contactors	Telephone Number
OFFSITE EMERGENCY ASSISTANCE	
Fire/Police/Ambulance	911
State Police	911
Hospital: ([Hospital name]) [Hospital address]	999-999-9999
EMERGENCY SPILL RESPONSE CONTRACTOR	
[Contractor Company]	999-999-9999
AGENCY NOTIFICATIONS	
NRC (24-hour) (Report Oil Spills)	800-424-8802
State Department of Public Health and Environment	999-999-9999
ADDITIONAL ASSISTANCE	
Police Department (non-emergency)	999-999-9999
State Poison and Drug Center	800-999-9999
U.S. Pipeline & Hazardous Material Safety Administration help line	1-800-467-4922 infocntr@dot.gov
EQUIPMENT ASSISTANCE	
[Equipment manufacturer point of contact]	999-999-9999

Appendix 5: Incident Report Form

HAZARDOUS MATERIALS INCIDENT REPORT

INITIAL CONTACT INFORMATION

(Check one): _______ REPORTED/ACTUAL INCIDENT _ DRILL/EXERCISE

1. Date/Time of Notification: ______________________ Report received by: _______________
2. Reported by (name & phone number or radio call signs): ______________________________
   ____
3. Company/agency and position (if applicable): ______________________________
4. Incident address/descriptive location: ____
   ____
   ____
5. Agencies at the scene: ____
   ____
6. Known damage/casualties (do not provide names over unsecured communications): _____
   ____
   ____

CHEMICAL INFORMATION

7. Nature of emergency: (check all that apply)
   ___ Leak ___ Explosion ___ Spill ___ Fire ___ Derailment ___ Other

   Description: ____
   ____
   ____
   ____
8. Name of material(s) released/placard number(s):____________________________
9. Release of materials:
   _______ Has ended ______ Is continuing. Estimated release rate & duration:_____________
10. Estimated amount of material which has been released:___________________________
11. Estimated amount of material which may be released: ___________________________

12. Media into which the release occurred: _________ air _________ ground _________ water
13. Plume characteristics:
    a. Direction (Compass direction of plume):______________c. Color: ___________________
    b. Height of plume: _________________________________d. Odor:____________________
14. Characteristics of material (color, smell, liquid, gaseous, solid, etc) ____________________
15. Present status of material (solid, liquid, and gas):_____________________________________
16. Apparently responsible party or parties: ______________________________________

Note: THIS INCIDENT REPORT IS ONLY AN EXAMPLE. IT CONTAINS SOME OF THE INFORMATION REQUIRED TO REPORT AN INCIDENT TO THE SERC. Go to www.ecy.wa.gov/epcra to obtain a reporting form for businesses to submit to the SERC. This form can be used at an incident, if applicable.

ENVIRONMENTAL CONDITIONS

17. Current weather conditions at incident site:
    Wind From:________________ Wind Speed (mph):____________Temperature (F): _________
    Humidity (%): ______________Precipitation: _________________Visibility: ______________
18. Forecast:____
19. Terrain conditions:____

HAZARD INFORMATION

(From ERP, MSDS, CHEMTREC, or facility)

20. Potential hazards:____
21. Potential health effects:____
22. Safety recommendations:____
23. Recommended evacuation distance: ____

IMPACT DATA

24. Estimated areas/ populations at risk:____

25. Special facilities at risk: ____
____

26. Other facilities with HAZMAT in area of incident: ______________________
____

PROTECTIVE ACTION DECISIONS

27. Tools used for formulating protective actions
_________ a. Recommendations by facility operator/responsible party
_________ b. *Emergency Response Plan*
_________ c. Material Safety Data Sheet
_________ d. Recommendations by CHEMTREC
_________ e. Results of incident modeling (CAMEO or similar software)
_________ f. Other: ____

28. Protective action recommendations:
_____ Evacuation _____Shelter-In-Place _____Combination _____No Action
_____ Other ____

Time Actions Implemented
____
____
____

29. Evacuation Routes Recommended: ________________________________
____

EXTERNAL NOTIFICATIONS

30. Notification made to:
_________ National Response Center (Federal Spill Reporting) 1-800-424-8802
_________ CHEMTREC (Hazardous Materials Information) 1-800-424-9300
_________ State Emergency Response Commission
_________ SERC written follow-up forms

31. Other Information: ____
____

Source: Washington State Emergency Response Commission. Local Emergency Planning Committee (LEPC) Hazardous Materials Emergency Response Plan TEMPLATE. September 2011. http://www.ecy.wa.gov/epcra

Appendix 6: Bomb Threat Report

*** * * KEEP CALLER ON THE LINE AS LONG AS POSSIBLE! * * ***

Exact words of caller:

____

____

Questions to ask the caller:

1. When is the bomb going to explode? ____
2. Where is the bomb right now? ____
3. What kind of bomb is it? ____
4. What does the bomb look like? ____
5. Why did you set the bomb? ____
6. Where are you calling from? ____
7. What is your name? ____

Try to determine the following

IDENTITY:
- male
- female
- adult
- juvenile (age? ______)

VOICE:
- loud
- high-pitched
- deep
- raspy
- pleasant
- disguised
- broken Other: _____________________

ACCENT:
- local
- not local
- foreign
- regional _________________

RACE:
- Caucasian
- Black
- Hispanic
- Asian

Other: __________________

SPEECH:
- educated
- average
- illiterate
- obscene

Other: __________________

MANNER:
- calm
- angry
- rational
- irrational
- coherent
- incoherent
- deliberate
- self-righteous
- laughing
- intoxicated

BACKGROUND NOISES:

- office machines
- factory machines
- bedlam
- trains
- quiet
- voices
- mixed sounds
- airplanes
- music
- traffic
- party

Other: ___________________

If the voice is familiar to you, who did it sound like? ____

Additional Information: ____

____

Date____/____/_____ Time: ______:______ a.m./p.m. Received by: __

Appendix 7: Bomb Threat Checklist

Mail Threat:

_______1. Handle documents as little as possible to preserve fingerprints.

_______2. Hand deliver immediately to O&M Manager.

Phone Threat:

_______1. Complete Bomb Threat Form.

_______2. Deliver completed form to O&M Manager.

_______3. Notify Supervisor immediately.

O&M Manager:

_______1. Gather all information regarding threat.

_______2. Decide upon course of action.

_______3. Coordinate searches with proper authorities.

Suspicious Objects:

_______1. DO NOT TOUCH OR ATTEMPT TO MOVE!

_______2. Notify Police—911.

Evacuation:

_______1. Announce over public address system, give location where to assemble. Do not use the radio.

_______2. Enlist volunteers to remain and shut down site.

Re-entry:

_______1. Determined based on:

    _______a. "All-clear" given by bomb disposal unit.

    _______b. O&M Manager's judgment that danger is passed.

_______2. Full report prepared.

Appendix 8: Chemical/Biological Agent Threat Report

*****KEEP CALLER ON THE LINE AS LONG AS POSSIBLE*****

Exact words of caller:

____

____

Questions to ask the caller:

1. What chemical or biological agent is it? ______________________________
2. When is the agent going to be released? ______________________________
   (date) (time)
3. Where is it right now? ______________________________________
   (Building) (Floor) (Room)
4. Who put it there? ______________________________________
5. What does it look like? ______________________________________
6. What will cause it to spread? ______________________________________
7. What will trigger it? ______________________________________
8. Where did you get the agent? ______________________________________
9. Why are you doing this? ______________________________________
10. What is your name? ______________________________________
11. What is your telephone number and address? ______________________________

Try to determine the following

IDENTITY:	• male	• female	• adult	• juvenile (age? _______)	
VOICE:	• loud	• high-pitched	• deep	• raspy	• pleasant
	• disguised	• broken	Other: ______________________		
ACCENT:	• local	• not local	• foreign	• regional: __________________	
RACE:	• Caucasian	• Black	• Hispanic	• Asian	
	Other: ___________________				

SPEECH:
- educated
- average
- illiterate
- obscene

Other: ____________________

MANNER:
- calm
- angry
- rational
- irrational
- coherent
- incoherent
- deliberate
- self-righteous
- laughing
- intoxicated

BACKGROUND NOISES:
- office machines
- factory machines
- bedlam
- trains
- quiet
- voices
- mixed sounds
- airplanes
- music
- traffic
- party

Other: ____________________

If the voice is familiar to you, who did it sound like? ____

Additional Information: ____

____

Date____/____/_____ Time: ______:______ a.m./p.m. Received by: __

Appendix 9: Chemical/Biological Agent Threat Checklist

Mail Threat:

______ 1. Handle documents as little as possible to preserve fingerprints.

______ 2. Hand-deliver immediately to O&M Manager.

Telephone Threat:

______ 1. Complete the Chemical/Biological Threat Report form.

______ 2. Deliver completed form to O&M Manager immediately.

O&M Manager:

______ 1. Gather all information regarding threat.

______ 2. Decide upon course of action.

Searches:

______ 1. Comprehensive—To be conducted by trained law enforcement personnel only.

Suspicious Objects:

______ 1. Do not touch or attempt to move.

______ 2. Notify police.

Evacuation:

______ **1. Make a site-wide announcement and give location where to assemble.**

______ **2. Enlist volunteers to remain and shut down site.**

Re-entry:

______ **1. Determined based on:**

- ______ **a. All-Clear given by competent authority**
- ______ **b. O&M Manager's judgment that danger has passed**

______ **2. Full report prepared.**

Final Report

Considerations for ESS Fire Safety

Consolidated Edison and NYSERDA
New York, NY

Report No.: OAPUS301WIKO(PP151894), Rev. 4
February 9th, 2017

Project Name:	Considerations for ESS Fire Safety
Customer:	Consolidated Edison and NYSERDA
Contact Person:	Britt Reichborn-Kjennerud
Date of Issue:	February 9th, 2017
Project No.:	PP151894
Organization Unit:	O&G Corrosion Control/Energy
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Task and Objective:

Please see Executive Summary.

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Reference to part of this report, which may lead to misinterpretation, is not permissible.

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0	2016-11-01	First Issue	Davion Hill		
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Executive Summary

This report summarizes the main findings and recommendations from extensive fire and extinguisher testing program that evaluated a broad range of battery chemistries[1]. The testing was conducted through much of 2016 on behalf of the New York State Energy Research & Development Authority (NYSERDA) and Consolidated Edison, as they engaged the New York City Fire Department (FDNY) and the New York City Department of Buildings (NY DOB) to address code and training updates required to accommodate deployment of energy storage in New York City. This executive summary can be read as a standalone summary of the main project findings and recommendations.

The main conclusion from the program is that installation of battery systems into buildings introduces risks, though these are manageable within existing building codes and fire fighting methods when appropriate conditions are met. This statement comes with caveats. There is a need to clarify a universal finding in this program: in the case of heating by fire or thermal abuse all batteries tested emitted toxic gases. It should also be noted that the average emissions rates of equivalent masses of plastics exceed those of batteries. Every battery tested emitted toxic gases (Table 3 on page 29); however, this can be expected from most fires.

The toxicity of the battery fires was found to be mitigated with ventilation rates common to many occupied spaces. While it was found that all batteries tested emitted toxic fumes, the toxicity is similar to a plastics fire and therefore a precedent exists. The batteries exhibited complex fire behaviors that led to abundant water use; however, it was found that the extinguishing requirements for batteries need not be excessive if an intelligent, system-level approach is taken that includes external fire ratings, permits direct water contact, and implements internal cascading protections. The general outcome of the work is that fire safety considerations are applicable to all the batteries tested in this program, even though vanadium redox and lead acid electrolytes were not observed to be flammable. The data presented in this report supports these findings.

All energy systems carry with them a risk in their deployment; however, the risks identified in this study are manageable within the limits of today's engineering controls for safety when appropriate conditions are met. The resulting requirements in codes, if implemented, are within the boundaries of the typical built environment.

The batteries tested in this program are as follows:

1. Li-ion NCM (4 vendors)
2. Li-ion $LiFePO_4$ (2 vendors)
3. Li-ion LTO
4. Lead Acid
5. Vanadium Redox
6. An additional Li-ion chemistry described as BM-LMP

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[1] Chemistries are listed in the Appendix on page 107

In addition, at the request of FDNY the following extinguishing agents were tested:

1. Water
2. Pyrocool
3. F-500
4. FireIce
5. An aerosol agent

Greater detail is found within the report. It is suggested the reader use cross references provided in the report to see where technical information can be found that supports these findings. This report extensively uses cross references so that the reader can begin reading at any point in the document and quickly find relevant supporting information in other sections of the document, similar to a handbook.

Sections Directly Informing Code Development and Training

1. Locations (see Locations and Ventilation on page 48)
2. Ventilation rate (see Locations and Ventilation on page 48, as well as the Appendix, page 65)
3. Enclosures, fire rating (see Fire Rating, page 40)
4. Capacity limitation dependent on space (see Room Capacity Limitations on page 56)
5. Clearances (see Clearances page 55)
6. Monitoring, Detection, and Alarms (see page 55)
7. Fire suppression and Water Requirements (see Extinguishing, page 45 as well as the Appendix, page 68)
8. Emergency Response (see Guidance for First Responders on page 34 and Frequently Asked Questions, page 8)

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FINAL REPORT: NYSERDA / Consolidated Edison BESS Program

Considerations for ESS Fire Safety

Work conducted by:

Consolidated Edison and NYSERDA Disclaimer
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1.0 ACKNOWLEDGEMENTS

The battery and extinguishing companies identified below all donated their products for testing in this project. The Con Edison - NYSERDA team and DNV-GL are extremely grateful for the generosity and engagement with this project by these companies. We also thank the key stakeholders for their significant contributions to this effort.

NCM 1: LG Chem
NCM 2HE and NCM 2HP: Samsung SDI
NCM 3: Kokam (donated by Sunverge)
NCM 4: Electrovaya
LFP 1: BYD
LFP 2: XO Genesis
T 1: Toshiba
BM-LMP: C4V
VR 1: UET
PBA 1: EnerSys
Aerosol agent: Fireaway Inc. (product Stat-X)

2.0 ACRONYMS

ACH – Air Changes per Hour
AHJ – Authority Having Jurisdiction
BESS – Battery Energy Storage Safety
BIC – Building Information Card
BMS – battery management system
BM-LMP – Bio-mineralized Lithium Mix-Metal Phosphate
BSCAT – Barrier-Based Systematic Cause Analysis Technique
BTM – Behind the Meter
CFM – Cubic Feet per Minute
CFR – Code of Federal Regulations
CHP – Combined Heat and Power
CID – Current Interrupt Device
CO – Carbon Monoxide
COF – Certificate of Fitness
C-rate – charge rate
DCE – Duty Cycle Eccentricity
DMC – Dimethyl Carbonate
DOB – New York City Department of Buildings
DOD – depth of discharge
EC – Ethylene Carbonate
EDS – energy dispersive spectroscopy
ERPG – Emergency Response Planning Guidelines
ESS – Energy Storage System
FAQ – Frequently Asked Questions
FID – Flame Ionization Detector
FDNY – New York City Fire Department
FEA – Finite Element Analysis
FMEA – Failure Mode Effects Analysis (sometimes FMECA to include “Criticality”)
FTA – Fault Tree Analysis
FTIR – Fourier Transform Infrared Spectroscopy
GPM – Gallons Per Minute
HAZID – Hazard Identification
HCl – Hydrochloric Acid
HRR – Heat Release Rate
HCN – Hydrogen Cyanide
HF – Hydrofluoric Acid
HVAC – Heating, Ventilation, and Air Conditioning
IDLH – Immediately Dangerous to Life and Health
IE – Independent Engineer(ing)
IEC – International Electrotechnical Commission
IFC – International Fire Code
IPP – Independent Power Producer
LEL – Lower Explosion Limit
LMO – Lithium Manganese Oxide
LTO – Lithium Titanium Oxide
NYSERDA – New York State Energy Research and Devlopment Authority
NAVSEA – Naval Sea Systems Command
NCA – Nickel Cobalt Aluminum
NCM – Nickel Cobalt Manganese

NIOSH – National Institutes for Occupational Safety and Health
NFPA – National Fire Protection Association
NHTSA – National Highway and Traffic Safety Administration
NRTL – Nationally Recognized Test Laborator
PBA – Lead Acid
PC – Polypropylene Carbonate
PID – Photo Ionization Detector
PPE – Personal Protective Equipment
PVC – Polyvinyl Chloride
SCBA – self contained breathing apparatus
SEI – Solid Electrolyte Layer
SOC – State of Charge
SOP – Standard Operating Procedures
SME – Subject Matter Expert
UL – Underwriter's Laboratories
UN – United Nations
UPS – Uninterruptible Power Supply
VOC – Volatile Organic Compounds
VRLA – Valve Regulated Lead Acid

3.0 HOW TO USE THIS DOCUMENT

This document is designed to inform codes writing procedures and first responder training. It can be considered a reference and handbook for this purpose. To that end, the document is structured around key ingredients to codes as determined by a survey of building and fire codes for energy-related machinery and devices.

Executive Summary: This section can be considered the consolidated list of findings and recommendations from the NYSERDA/Con Edison Battery Energy Storage System (BESS) Program.

Frequently Asked Questions (FAQ): This may be considered the main guide of the document, cross referencing to relevant sections of the report, and also serving as an introduction to the topic.

Recommendations: This is the main deliverable of the document. Essential data is provided to support recommendations, detail is left to the appendix. Recommendations and main findings are within the document text in **bold**.

Appendix: Supplementary reference data needed to communicate the recommendations, but as useful reference for detailed background. The Appendix begins on page 65. The appendix is separated in two parts that represent supporting information: a literature review on past fire incidents and data, and a confidential appendix which can be omitted for the public version of the report.

Literature References: Whenever possible, literature references are provided for independent confirmation of facts, figures, or assertions. Literature references are found in "References" on page 62.

Cross references: Whenever possible, cited data or key conclusions that are relevant to other sections of the report are cross referenced by section title and page number.

4.0 TESTING METHODOLOGY

Four different lithium chemistries (LTO, LFP, NCM, BM-LMP), lead acid, and vanadium redox batteries represented by nine unique battery types from eight different manufacturers were tested. For the Li-ion batteries, these included prismatic cells as well as pouch cells, but no cylindrical cells. For the lead acid and vanadium redox batteries, testing was largely focused on the battery electrolytes. Modules were also provided for large scale burn testing. A more explicit description of the test plan is included in the Appendix.

4.1 Cell Testing

The cells tested ranged from 1.2 to 200 Ah with an average of 52 Ah, excluding the electrolytes from vanadium redox and Pb acid cells that were tested separately. All cells were heated with 4 kW of radiant electric heat in DNV GL's Large Battery Destructive Testing Chamber (see Figure 1). All cells were placed inside the chamber and exposed to heat until they vented. Upon venting, some cells self ignited. For those that did not, hot point ignitors were placed in the upper half of the chamber and were activated once lower explosive limit (LEL) reached 50% to prevent an explosion. Many cells vented enough gas to lead to a flashover in the chamber upon activation of ignitors. In addition to heaters and ignitors, the chamber also contained ambient and inlet air temperature thermocouples, two thermocouples on each cell (top and bottom) and eight thermocouples in a cube shape around the cell to act as a thermopile for Heat Release Rate (HRR) calculations; four were level with the cell while four more were eight inches above the cell. There was one additional thermocouple in the center exhaust stack of the abuse chamber. In addition, swatches of Morning Pride personal protective equipment (PPE) material were placed in the unit above the cell to assess the effect of the fire and offgas on firefighter PPE. Cells were tested at 25, 50, 75 and 100% state of charge (SOC).

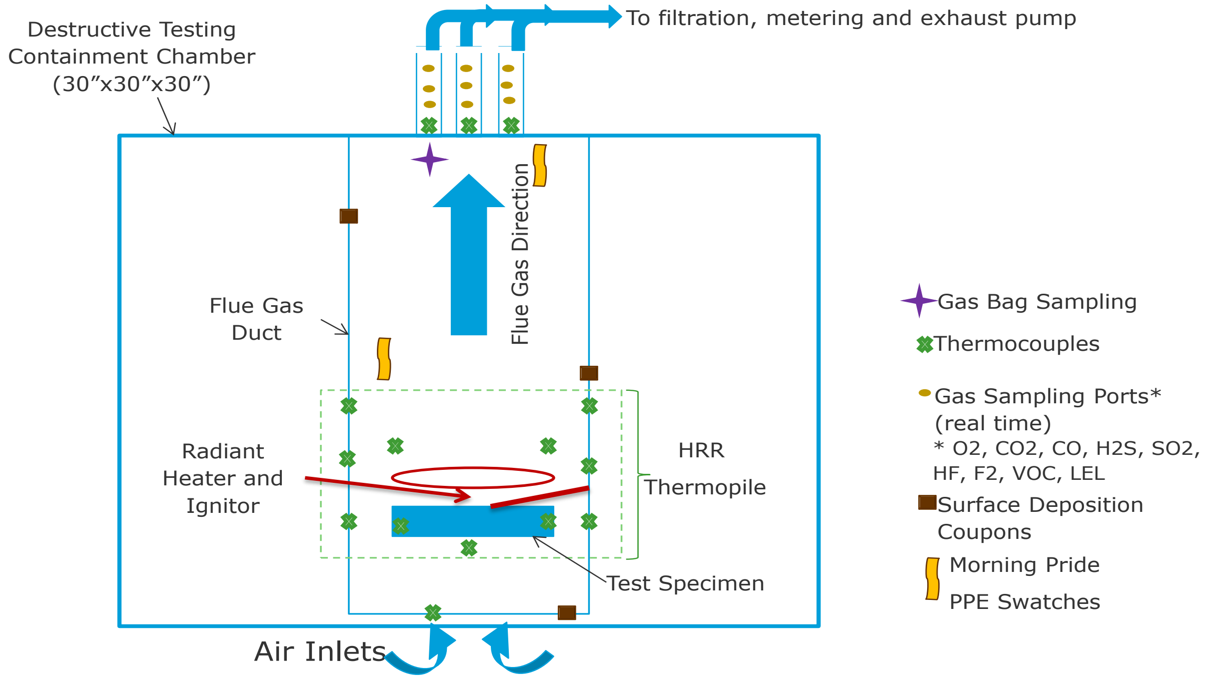


Figure 1 **Diagram of the abuse chamber used for fire testing of batteries in the BESS program.**

Finally, gas sampling was performed by a Gasmet DX4000 Fourier transform infrared spectroscopy (FTIR) gas analyzer. This analyzer monitored HCl, HF, HCN, CO, CO_2, O_2, SO_2, NO, NO_2, and a range of hydrocarbons including methane, ethane, ethylene, benzene, toluene, and others. In line with the FTIR analyzer were MSA Ultima sensors for O_2 (redundant measurement), H_2, and F_2/Cl_2. A final MSA sensor was placed directly off the chamber for flammability measurements. The sensor was of the catalytic bead type and was factory calibrated to non-specific gas for total LEL measurement. This was deemed suitable as a range of flammable gases were expected and calibration to one may show improper bias. In addition to the gas sensors, gas capture bags were set up off of the exhaust stacks. Select gas bag samples were taken periodically and were used to verify the FTIR measurement.

For extinguishing, the abuse chamber was fitted with a 2.5-gallon water can with an extinguishing trigger. The can was pressurized and engaged by a temperature trigger, with an in-line electronic solenoid valve for actuation. Once a single temperature exceeded 350°C, the solenoid was opened and the extinguisher released. The can was typically filled with 1 gallon of liquid and the entirety of the can was emptied. In one test, an 8-second pulse of water was used and the solenoid reclosed. The extinguisher nozzle was fixed approximately 10 inches from the battery, to the side and about 3 inches above. The nozzle was a fogging mist nozzle, and because of proximity, tank pressure was reduced to 75 psi to allow better saturation. All cells for extinguisher testing were tested at 90% SOC.

For large scale testing, a purpose built propane torch was constructed by Fire Force Inc, a builder of aircraft fire simulators. This torch was used to apply a direct propane flame to battery modules which were placed in a walled off shipping container shown in Figure 2 and Figure 24. The "room" was approximately 10 feet into the trailer, with one end being the trailer door and having a man door installed into a double sheeted drywall wall on the interior wall. A series of ventilation ports were cut into the room to allow for ventilation testing (two high, two low, one roof) and positive and negative ventilation were tested. In addition, two sprinklers were piped into the room for suppression testing. Most tests were conducted with doors open; however, two tests were conducted with the container closed to test ventilation. In addition to the sprinklers, hose suppression was used at times as well to assess effectiveness.

4.2 Module Testing

DNV GL and Rescue methods constructed a partially enclosed outdoor burn facility for module testing for all Li-ion battery types where modules were provided. The module sizes ranged from 7.5 to 55 kWh. Burns were conducted directly with a propane torch. A steel grate was hung from the ceiling of the burn enclosure at a height of approximately 4 feet. Below the grate a pan was constructed to catch water runoff from extinguishing. Two sprinkler heads were installed above the burn location and were fed with a 2.5-inch line reduced to a ½-inch pipe from a hydrant and pumper truck at the burn site.

Venting ports were constructed above and below the burn platform to control ventilation and also provide sampling locations. The doors to the burn chamber could be opened or closed to test the effect on oxygen, toxicity, and heat release of the fire (Figure 2).

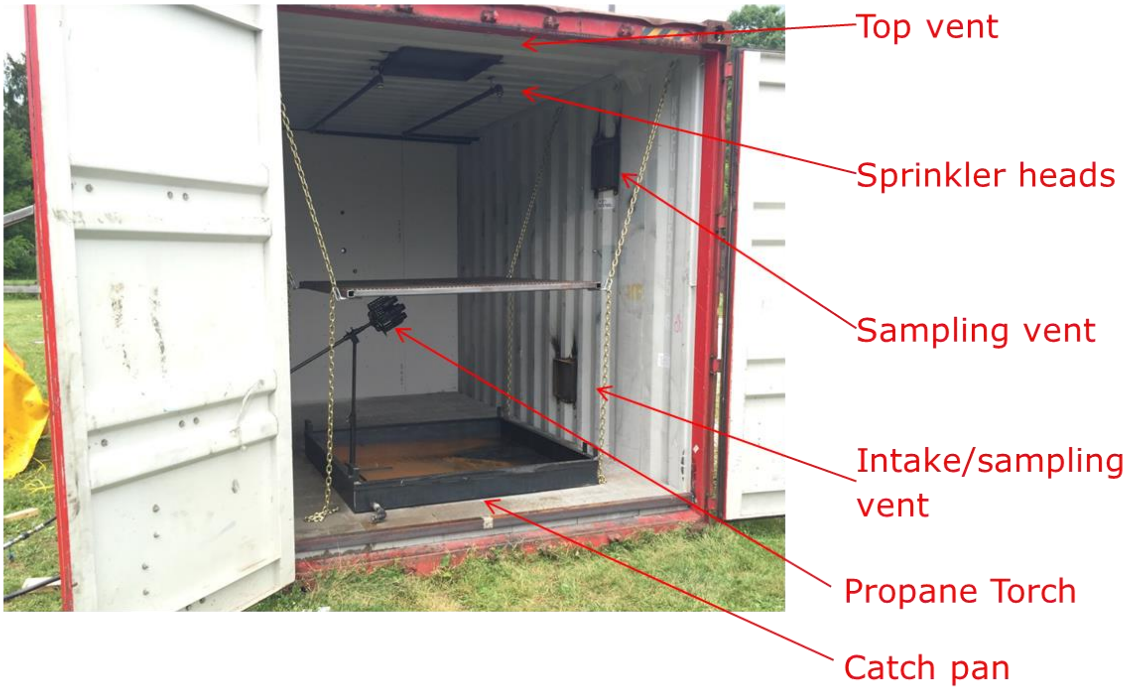


Figure 2 **Configuration of module burn site.**

5.0 CONSIDERATIONS FOR SYSTEM TYPES AND LOCATIONS

As of 2016, energy storage systems to be deployed in the near-term market will have differentiating characteristics dependent on size and location.

5.1 Large versus Small Systems

The testing results have been translated to scalable metrics for ventilation and fire suppression such as cubic feet per minute of air flow per kilogram of battery mass (CFM/kg), and gallons per minute of water flow per kilogram of battery mass (GPM/kg).

The reasons for this are several:

- Large systems and small systems should have an intelligent means of addressing ventilation and fire suppression with a scalable metric that correlates to size or mass is preferable to meet this challenge, rather than an arbitrary kW, kg, or kWh number as what is proposed in some codes as shown in Table 5.
- Energy and power densities for systems are perpetually evolving and improving. Arbitrarily prescribing a kW, kWh, or kg number to limit system installation threatens the value proposition of energy storage as energy density increases in the future
- With an energy density metric, it is possible to translate CFM/kg or GPM/kg to CFM/kWh or GPM/kWh with a single calculation. The same can be done for power density such as CFM/kW or GPM/kW. Lastly, it is possible to translate these numbers to CFM/ft^3 or GPM/ft^3 as is used by the fire service. All of these metrics are scalable and can be calculated depending on context. Because battery mass and energy

density will continue to evolve, these metrics will capture that evolution as codes follow the market.

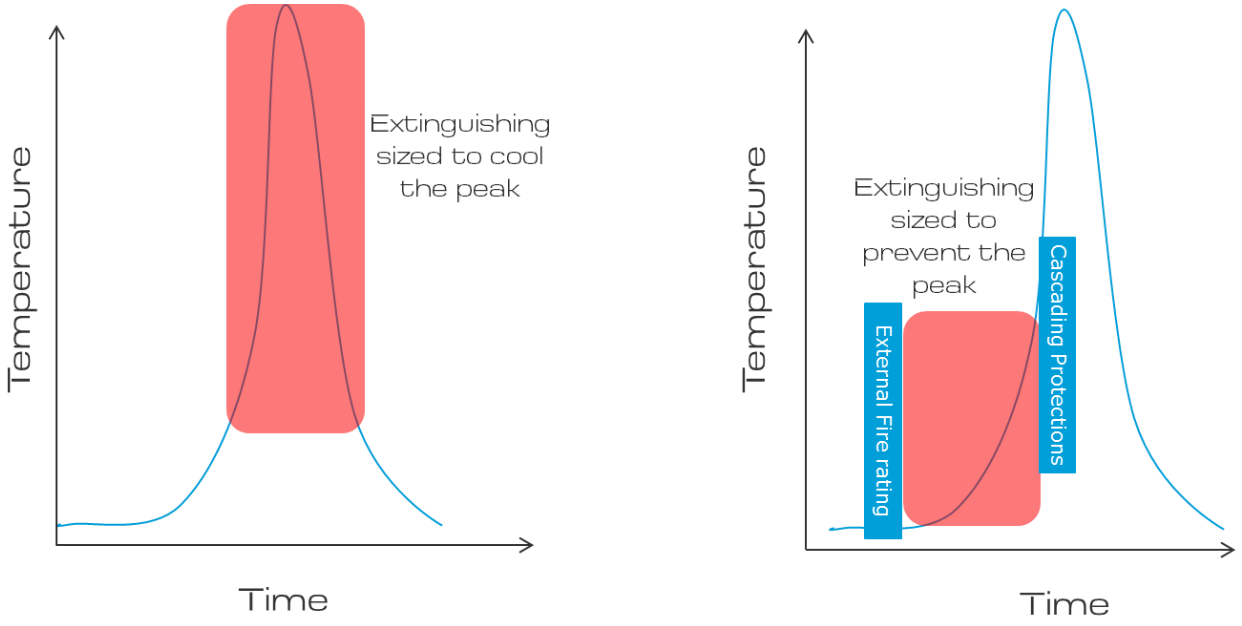
- Many small systems are dependent on the ventilation and fire suppression in the space, and there should be a means to check if the host-infrastructure is adequate.
- Large systems may have standalone ventilation and fire suppression equipment.
- One of the main stakeholders of this report is the New York Fire Department (FDNY) and consequently most United States (US) fire departments, and they are familiar with GPM and CFM units of measure for firefighting and codes.

5.2 Occupied versus Non-Occupied Spaces

As discussed, the proposed codes in many standards organizations shown in Table 5 become increasingly prescriptive as energy equipment becomes installed in occupied spaces. Non-occupied spaces (such as outdoor energy storage containerized systems, for example) may have less restrictive codes for ventilation or clearance.

The water flow calculations presented in this document are addressing a key issue in battery safety. Over-reaction to the threat of thermal runaway has led to recommendations for "copious amounts of water" [12] for the extinguishing of Li-ion battery systems. Such recommendations inflate the perceived water requirement. The reasoning for this is logical; it is better to err on the side of caution and advise first responders to use as much water as possible to indirectly cool the battery system.

This work has demonstrated that excessive water need not be the design criteria but should instead be considered part of an intelligent set of safety systems including external fire ratings, internal cascading protections, and fixed suppression systems to slow the propagation of heat in a combined manner such as in Figure 3. If a systems approach to safety is taken, the water requirements may be far less severe. If and when first responders need to react to a system fire, it may be the case that these systems be overridden or overcome, and a "copious amounts of water" approach may be desired. **Therefore water requirements for the codes and water requirements for first responders are separate issues.**



Reactive Approach

Proactive Approach

Figure 3 **A proactive, system level approach to extinguishing need not prescribe excessive levels of water if the system also contains a high external fire rating as well as internal barriers to prevent cascading.**

5.3 Challenges with Proposed Codes

The findings from this program indicate that scalable metrics are appropriate for sizing ventilation and water requirements for building sites. A summary of proposed codes is shown in Table 5. For example, in proposed changes to the International Fire Code IFC 608, 20 kWh is cited as a threshold for battery sizes or 600 kWh in a room. The code also proposes 3 feet of clearance between battery arrays. Such prescription threatens the value proposition of energy storage as energy and power density metrics have been increasing rapidly over the last 5-8 years. Limitations placed on kWh or kW will directly limit the energy service function of the device and will therefore limit the market. Providing scalable safety metrics, however, will allow the market to be flexible within safety limits.

6.0 NEW FINDINGS AND ANSWERS TO FREQUENTLY ASKED QUESTIONS IN BATTERY SAFETY

The findings of this program directly address some common misperceptions in battery safety. It is therefore helpful to address some of them directly in this section. These questions are an aggregation of questions posed during the testing program by FDNY, battery vendors, and other stakeholders. Reading through this section may serve as an adequate introduction to the topic and will also guide the reader through the report and its logic.

Question: Are the commonly cited battery fires in the media due to spontaneous ignition events?

Finding: No. The Literature Review (an addendum to this report) covers several incidents in detail. In the context of fire risk and firefighting for batteries, it is helpful to summarize the abuse tests that are performed in United Nations (UN) 38.3, the required testing scope in order to ship and transport Li-ion batteries. The eight separate tests in UN 38.3 are a checklist of nearly all physically conceivable abuses that could cause a Li-ion battery to catch fire. These abuse events are:

1. Low ambient pressure
2. Overheating
3. Vibration
4. Shock
5. External short circuit
6. Impact
7. Overcharge
8. Forced discharge

All of the safety incidents commonly reported in the general media can be traced to one of these abuse mechanisms. In some cases, contaminants in the battery (as a result of manufacturing defects) weaken the ability of the battery to withstand instances of these eight abuse factors. In general it is good practice to avoid any scenario that may introduce the threat of any action on the above list. Three items in particular (overheating, external short circuit, and impact) are the abuse mechanisms that have increased probability of occurring to a battery during and after a fire. The fire is the most obvious heat source, but subsequent heating may occur internally once batteries reach critical temperatures (typically > 120^{o}C). Short circuiting may occur by contact with tools or equipment or by water. Items #7 and #8 are electrical stimuli that are typically monitored and controlled by active safety barriers in the battery management system (BMS).

Question: How is the battery industry handling safety today?

Finding: For most energy storage projects that are not paid for on the "balance sheet", the typical independent engineering (IE) verifications that are required in the wind and solar industries apply to energy storage projects as well. During the technology review, performance and safety analyses are performed. This may include a review of accredited testing, certifications, and other hazard-consequence analyses. DNV GL routinely supports this with risk analysis to look at the overlap between energy storage system (ESS) safety functions and the site (see "Why Bowtie Models?" on page 74); particularly for energy storage projects that are a portfolio of behind-the-meter devices deployed across a geography in a mix of commercial and industrial applications. In some cases for larger installations a heat and plume study is performed to determine clearances. Such practices are common to energy and petrochemical sectors prior to the commissioning of any new project. IE practices are described in "Present Day Industry-Accepted Safety Practices for Energy Storage Projects" on page 31.

Question: Are battery fires more toxic than plastics fires?

Finding: In general, no, with conditional exceptions. The average emissions rate[2] of a battery during a fire condition is lower per kilogram of material than a plastics fire, as shown in Figure 5. However, the peak emissions rate (during thermal runaway of a Li-ion

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[2] Emissions concentration in ppm averaged over total minutes of burn time

battery, for example) is higher per kilogram of material than a plastics fire, as shown in Figure 4. This illustrates that a smoldering Li-ion battery on a per kilogram basis can be treated with the same precautions as something like a sofa, mattress, or office fire in terms of toxicity, but during the most intense moments of the fire (during the 2-3 minutes that cells are igniting exothermically) precautions for toxicity and ventilation should be taken. It should be noted that if Li-ion battery modules are equipped with cascading protections, the cell failure rate may be randomized and staggered. The randomized failure rate limits the toxicity and heat release rate of the fire.

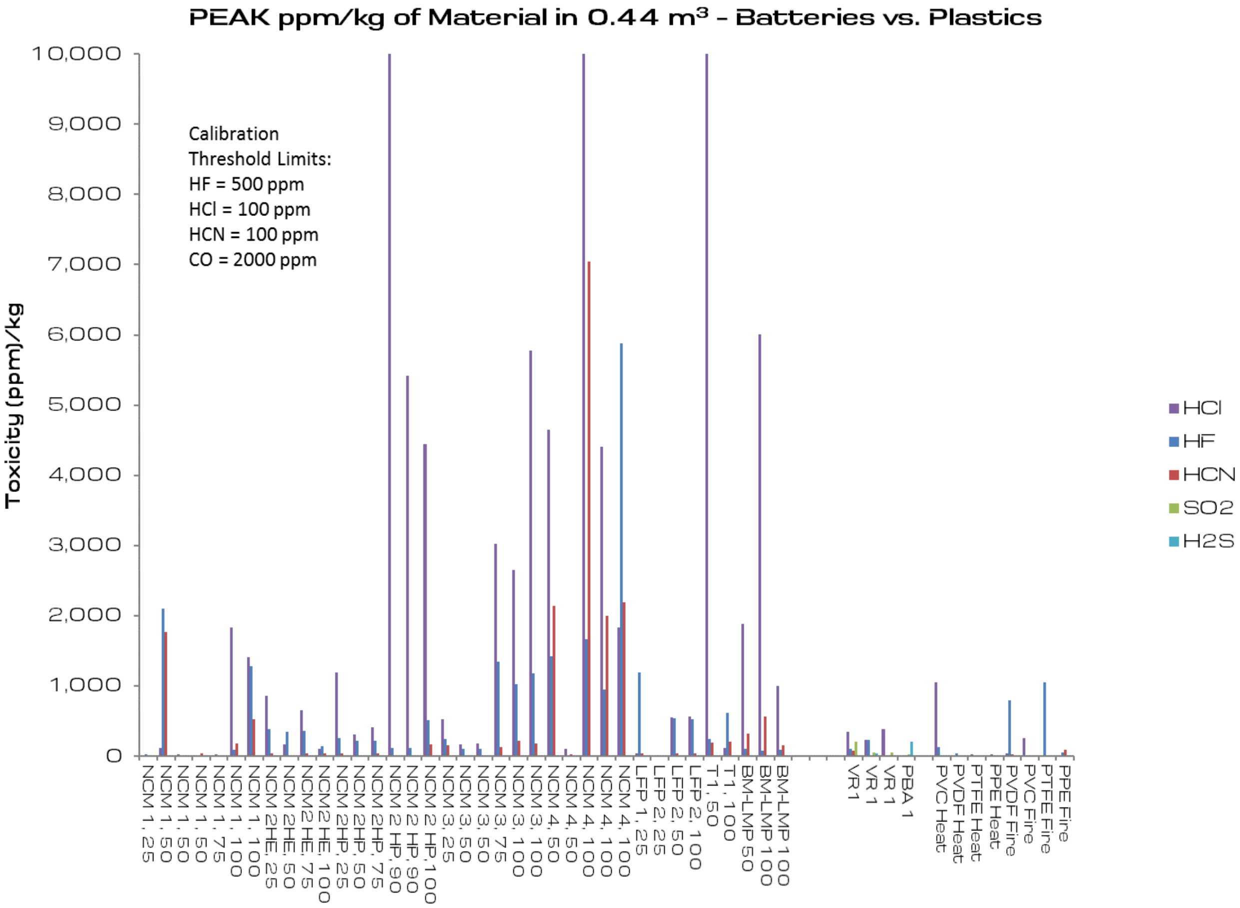

Figure 4 **Peak ppm per kg (in a 0.44 m³ volume) for all batteries tested as compared to plastics.**

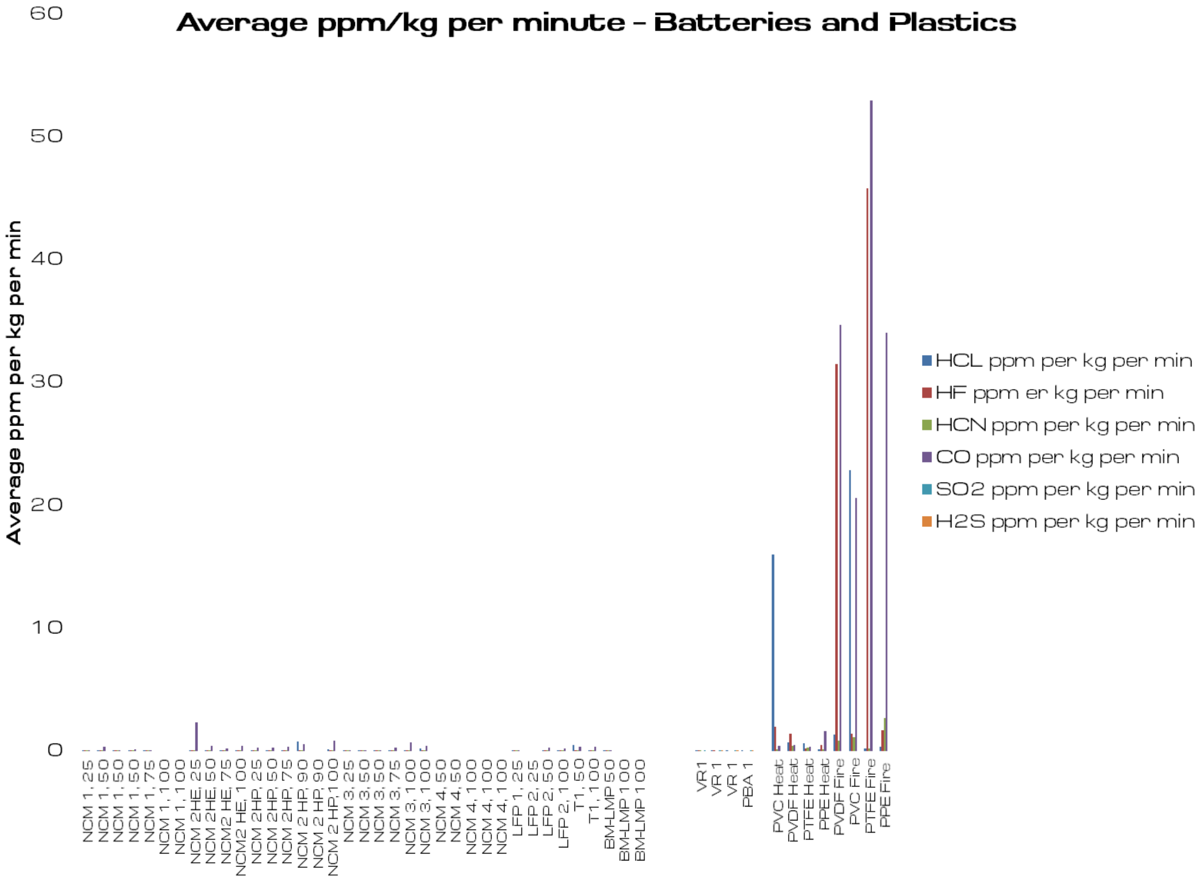

Figure 5 **Average emissions per kg per minute of test mass for plastics vs. batteries.**

Question: Is standard firefighter turnout gear adequate protection from a battery fire?

Finding: DNV GL and the provider of turnout gear (Honeywell Morning Pride) did not note any degradation in PPE as a result of exposure to fire test conditions when the gear was fit on a mannequin and exposed to the fire directly. Therefore first responders equipped with standard issue turnout gear may have protection against the toxic gas species observed under these tested conditions. Limited electrical protection was also observed without modifications to PPE, based on the conditions tested. Rescue Methods used common MSA Altair four- and five-gas sensors during full scale testing. Rescue Methods worked with Honeywell to test turnout gear, and one recommendation from Honeywell was that the general materials integrity of the jacket should withstand most species measured in this testing, cautioning that sustained exposure to Chlorine can have a degrading impact on Kevlar. It should be noted that HCl was observed in the battery fire testing and is also a common byproduct from combustion of most plastics in similar or greater volumes per kilogram of burning material.

Question: Are any batteries excluded from the ventilation requirement?
Finding: Because the volume of the room plays a key role in dictating the ventilation rate, batteries in larger rooms will have lower air changes per hour (ACH) requirements and the size of the room will have a buffering effect on the peak emission rate. The vanadium redox and lead acid batteries tested both emitted HCl upon heating, starting as low level emission around 100-150^{O}C (see Figure 6 for vanadium redox and Figure 8 for lead acid). The findings in this program demonstrate that HCl plays a dominating role in ventilation rates for battery systems in enclosed spaces, and because it is common for all battery types tested, ventilation recommendations (in section "Locations and Ventilation" on page 48) are universal for all battery types. **However, it should be noted that in the smallest unit of failure scenarios, the recommended ventilation rate of 0.25 ACH is well below the typical rating of 3-4 for most general spaces which means that vanadium redox and Pb acid batteries, as well as single cell failure modes for Li-ion, are already within the implied code requirements** [27]. Laboratories and server rooms can have ACH ratings > 10. Therefore the DNV GL recommendation for air change rates > 0.25 ACH is already exceeded by the building code in most instances.

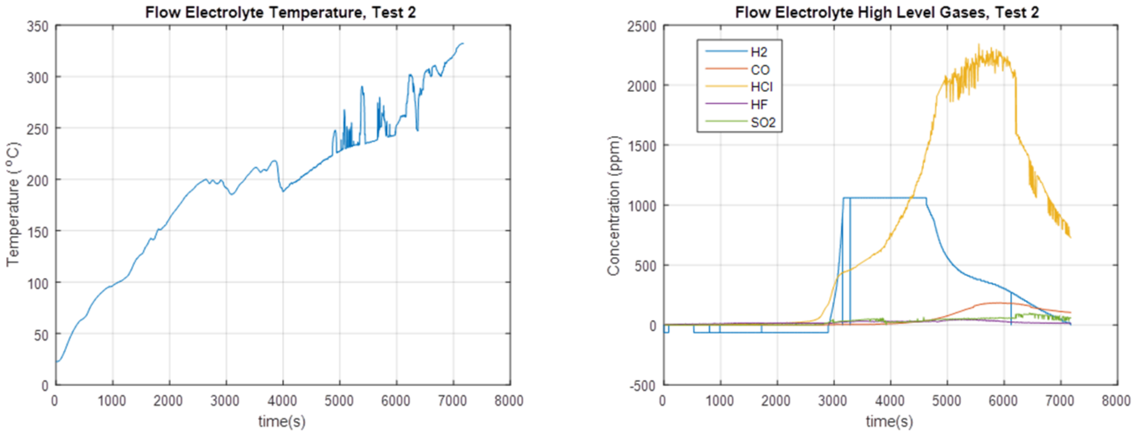

Figure 6 **Emission of HCl was observed from the vanadium redox flow electrolyte.**

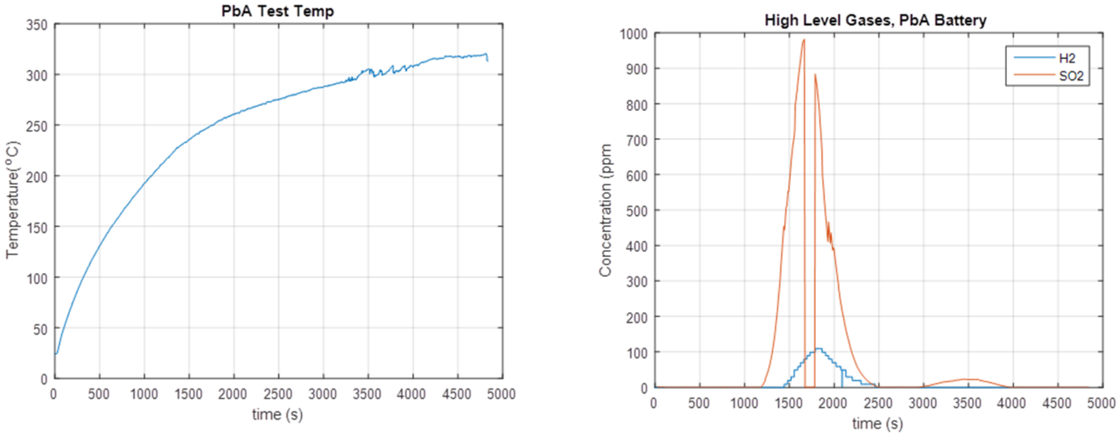

Figure 7 **Heating of Pb acid electrolytes yielded SO_2.**

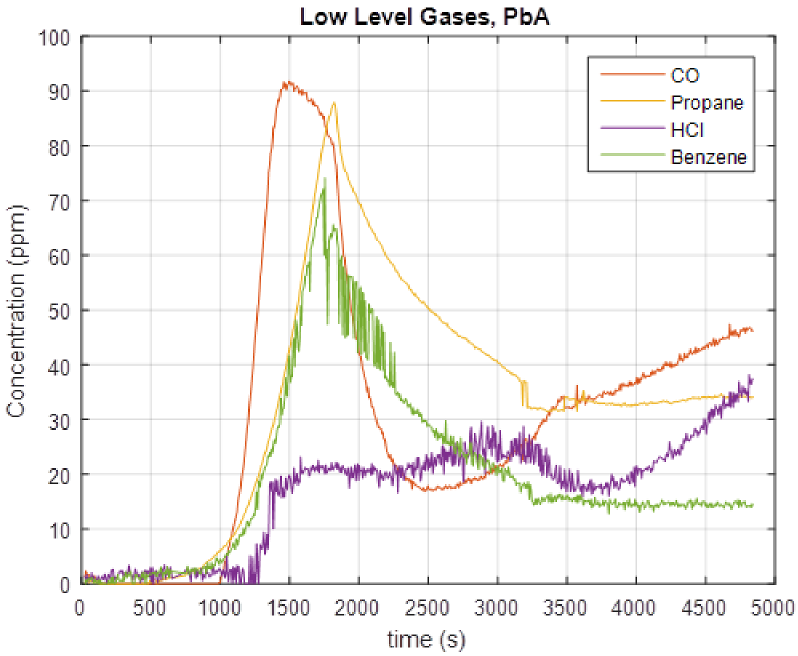

Figure 8 **Heating of Pb acid electrolytes also yielded HCl.**

Question: What kind of testing is required to certify the safety of battery systems?
Finding: The most commonly referenced system level safety testing the US is Underwriters' Laboratories (UL) 1973. For marine and automotive applications, International Electrotechnical Commission (IEC) 62619 covers many of the same requirements and has a more stringent pass/fail criteria to demonstrate limited cascading between cells. The US market appears to be moving toward UL 9540 which includes aspects of UL 1973 and UL 1642 (for cell safety) in addition to an up-front failure mode effects analysis (FMEA) on the system. As mentioned, such a risk analysis should also include the site under unique circumstances. It is also conventional to have a third party inspect the field installation and provide a sign-off for the local authority having jurisdiction (AHJ). Globally, UN 38.3 is the most widely recognized safety testing for Li-ion battery cells and is a requirement for transport. The results of accredited safety testing are an indicator of the strength of the barriers in a risk model.

Question: Do battery systems have an external display of error or health?
Finding: Yes, in a limited way. The present codes in NYC for uninterruptible power supplies (UPS) require a system health display panel. A primary concern for first responders is lack of knowledge about what is happening inside the battery system upon being called to the scene, which impacts their ability to deem a site under control and then hand off control of the site to the property owner. Some engagement between the systems integration, project development, and first responder community is needed to discuss viable solutions for such a panel, or whether the intent of the panel is met through other means (such as an emergency hotline or remote data access by phone or other means).

Question: Do battery fires re-ignite?
Finding: The term "re-ignition" is a misnomer due to the factors described in the incident history of Li-ion battery fires. Upon extinguishing, great care must be taken to assure that **all electrical, thermal, and mechanical abuse factors** are neutralized. If any remain, it

poses a hazard for *continuing* (not reigniting) the fire. Therefore, it is technically inaccurate to classify this as re-ignition if the primary cause of the hazard is never removed. After a fire, a battery module or system may contain intact cells that still have DC voltage, meaning there is a persisting electrical hazard (Figure 11). Water shorting out cells, for example, is a genuine risk (such as was witnessed in the Chevrolet Volt crash test or the flooded Fisker cars [15,17]). In addition, if the heat deep within the module has not been removed, that heat poses a continued thermal hazard. DNV GL and Rescue Methods witnessed this effect during testing as shown in Figure 9, the cause of which was lack of thermal barriers between cells. DNV GL replicated this effect in more controlled laboratory tests in Figure 10 and observed that temperatures between battery cells can be 300°C higher than the exterior during extinguishing unless there is a means to remove internal heat or prevent its transfer between cells. First responders should be cognizant that all electrical, thermal, and mechanical hazards have been mitigated before deeming a battery fire fully extinguished.

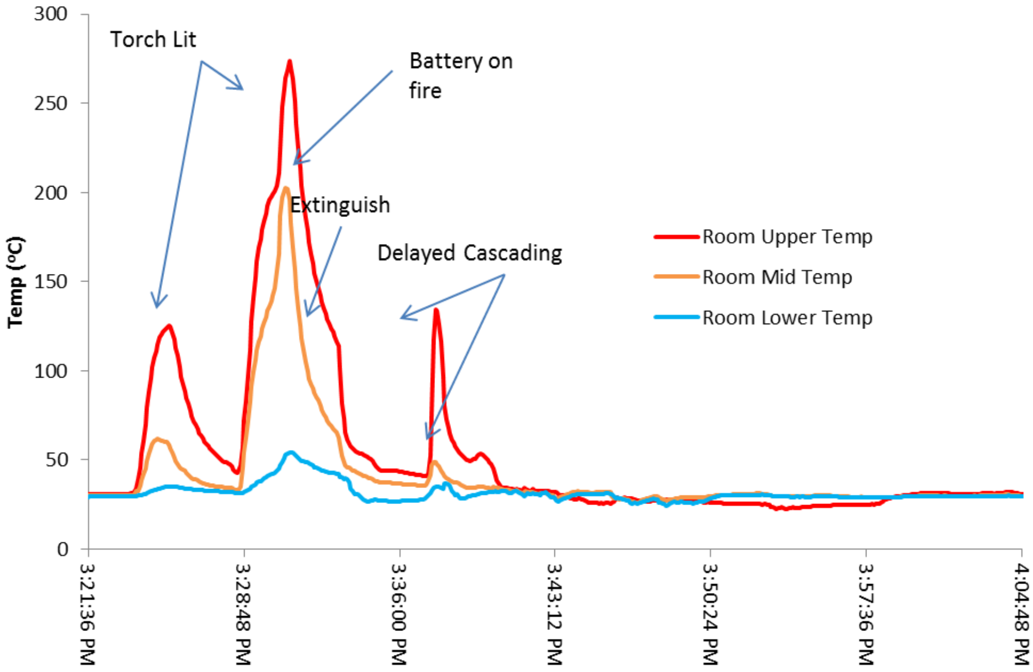

Figure 9 **Observation of delayed cascading during extinguishing in a module without cascading protections.**

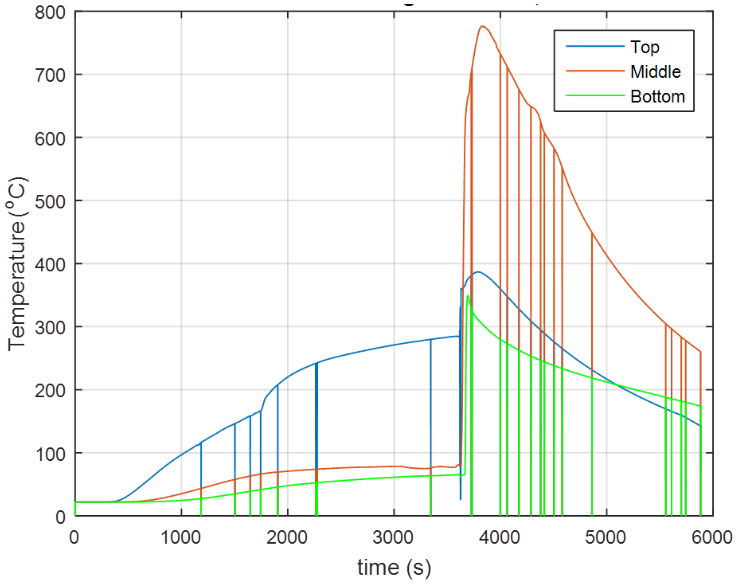

Figure 10 **Internal temperatures between two sandwiched pouch cells remained 300°C higher than external faces after aerosol extinguishing.**

Question: What is the time frame for delayed ignition?
Finding: As mentioned previously, this is entirely dependent on whether the residual hazard is electrical, thermal, or mechanical. If these measures are successfully taken then no delayed ignition should occur. In the case of thermal abuses, DNV GL witnessed the residual heat cause a delayed cascading event within 10 minutes (Figure 9). In the case of the Chevrolet Volt that shorted across the battery pack terminals after the National Highway and Traffic Safety Administration (NHTSA) crash test, the shorting event occurred 3 weeks later and was a separate hazard event.[15] Again, the delay was due to the time it took for the coolant to leak and eventually short the battery; it is not the battery that caused this event but the electrical short hazard introduced by the coolant. Therefore if all electrical, thermal, and mechanical hazards are monitored, controlled, or mitigated, first responders should be able to assess the risk of delayed cascading during the first encounter and the minutes or hours after extinguishing. The signature of any abuse due to shorting, crush or penetration, or residual heating is climbing temperature on the battery, which can be monitored by the system thermocouples (if they are still intact and the data is provided remotely) or by handheld thermal sensors or infrared (IR) monitors.

Question: How long does it take for a Li-ion battery to go into thermal runaway if it is being heated?
Finding: This is entirely dependent on the rate of heat absorption into the cell. DNV GL observed in this work and other projects that a Li-ion cell can smolder for more than an hour if the heat transfer rate is slow. By the time temperatures near 120°C (248°F) were reached, all Li-ion batteries tested (including $LiFePO_4$ and LTO chemistries) offgassed and/or ruptured. If the threshold near 120°C is never crossed, the battery may smolder and gas but never ignite unless an external spark ignites the flammable gases emitted from it. It was common for $LiFePO_4$, LTO, and the BM-LMP cells to offgas without flame, but their offgas composition contains the same flammable and toxic constituents as batteries with higher temperature failures.

Question: Are there risks of electric shock?

Finding: During extinguishing, Rescue Methods did not observe transfer of electricity from the battery system to the first responder through the water stream. Some sparks were observed to be thrown during the active burning of some modules. Arcing was also observed when the batteries were disturbed, such as when they shorted to metal tools or the metal support structure upon which they sat. The turnout gear worn by the firefighters provided adequate protection such that no evidence of shock was observed in the conditions of this test program. The shock hazard, as shown in Figure 11, is presented by stranded energy in the form of DC voltage in the remaining intact cells.

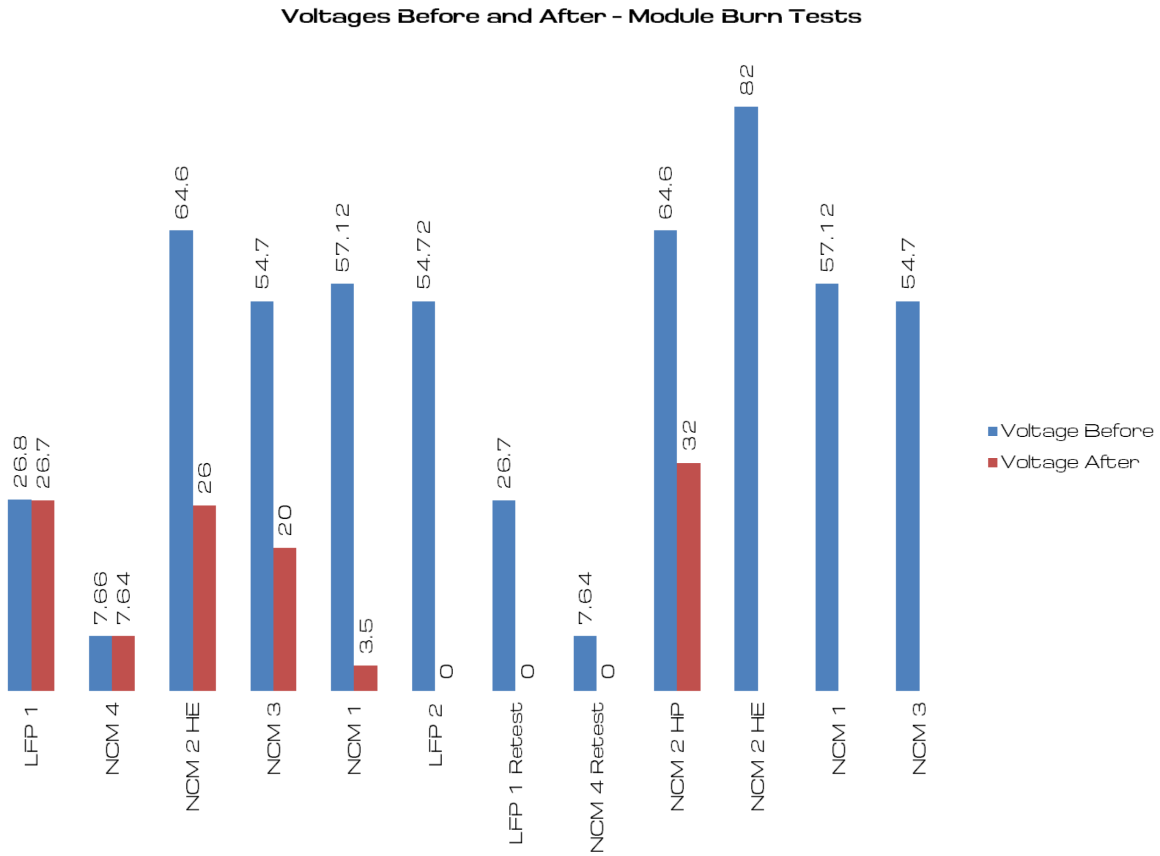

Figure 11 **Some battery modules still had residual voltage after fire testing.**

Question: Is water a sufficient extinguisher?

Finding: DNV GL's testing indicates that all extinguishers have benefits and drawbacks, including water. Every extinguisher that DNV GL tested put out the flame on battery cells, including the aerosol. During module testing, all extinguishers tested knocked out the flame but in some cases the flame rekindled once the stream was removed because the battery was still hot enough to ignite the remaining fuel. The ideal battery fire extinguisher would be both highly thermally conductive and highly electrically insulating. Water is the former but not the latter. Deionized water is both until it dissolves contaminants from the fire, including ash and soot. In DNV GL's testing, it was found that other extinguisher types could have equal or poorer heat removal capability to water, but all were electrically conducting due to their reliance on water as a dispersion medium. (Figure 29) Gases or aerosols—due to lack of thermal mass, poorer thermal conductivity, and restricted access to the deep seated heat source—were not observed to cool as quickly as water can. Water has been historically recommended because of its ability to cool. It was found in this program that water cools best, with the potential unwanted side effect of shorting other cells.

Question: Do battery fires require "copious amounts of water" to be extinguished?
Finding: If appropriate precautions are not taken to limit propagation between cells in the module design, then the water requirement could be described as "copious" as NHTSA coined in 2012. [12] The total content of water is entirely dependent on the water contact efficiency with the battery cells (see the regression coefficients in Figure 36 and the GPM example calculation in Figure 31). This language is anecdotal, however, and requires some quantification. As mentioned previously, lack of barriers between cells results in a deep seated and inaccessible fire (Figure 10). In practice, this would result in the use of more water to cool and contain a battery fire. The use of "copious amounts of water" potentially introduces the unwanted effect of shorting out other cells, thereby perpetuating the fire. The water amount need not be so excessive if heat can be removed from the between cells, and cells have limited ability to transfer heat to nearest neighbors. DNV GL found through testing that this water amount could be increasingly reduced as strategies to direct cooling were learned (Figure 12).

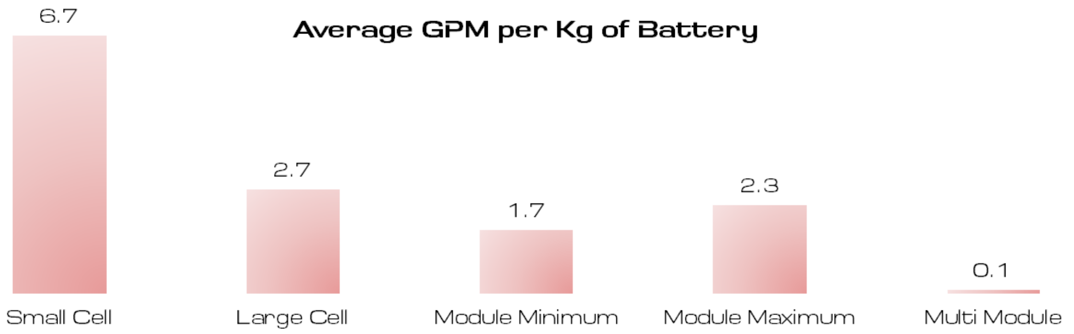

Figure 12 **Progression toward lower water requirements as testing progressed.**

Question: What about fire suppressants other than water?
Finding: DNV GL found that all suppressants put out the fire including an aerosol. The most effective agent for cooling the fire is water. (Figure 29)

Question: Is FM-200 sufficient as an extinguisher?
Finding: FM-200 was not included in the test scope of this program. DNV GL did, however, obtain permission from an aerosol manufacturer to test their product, which succeeded in putting out the cell fire. The testing demonstrated that the cooling rate for the aerosol is less than the liquids (a direct consequence of less thermal mass in a gas versus a liquid, and a reduced effect from latent heat of vaporization). If gases have less thermal mass to take heat from the batteries, then it is the assumption that all gas-based agents are likely to cool less effectively than water. For this reason DNV GL recommends a staged extinguishing approach as demonstrated in "Extinguishing" on page 45.

Question: Do the other extinguishing agents produce slippery conditions?
Finding: DNV GL and Rescue Methods did not observe slippery conditions with the use of the other agents during full scale testing.

Question: Is a 2 ½" hose line with 250 GPM sufficient to put out a battery fire?
Finding: This is dependent on the battery size. DNV GL translated the findings to both GPM/kg and GPM/kWh of battery mass (Table 9). In general, however, if the water can be targeted at the deep seated, highest temperature areas of the fire, it will be most effective and the water requirement will be reduced. It is demonstrated as an example in Table 7 that 250 GPM is more than sufficient for typical battery systems on the market, provided that cascading protections and external fire rating requirements are also met.

Question: How much water is required?
Finding: DNV GL found in Table 17 and Table 9 that a minimum of 0.07-0.1 GPM/kg of battery mass can accomplish both extinguishing and cooling for a battery fire. Accommodation for increasing energy density can be accomplished by dividing this number by the energy density (in Wh/kg) and multiplying by 1000 Wh/kWh.

Question: Is the water extinguisher requirement for batteries significantly larger than what is already prescribed in the built environment?
Finding: This need not be the case if battery firefighting is considered at a system level. Residual heat within a battery module was observed in this program, demonstrating that **battery modules equipped with cascading protections will have a reducing effect on water flow rate requirements because less water will be needed to cool them.** This has direct economic impacts on the overall system installation cost. In Figure 3 it is demonstrated how the combined effect of external fire rating and internal cascading protections works to limit the heat transfer rate, thereby reducing the overall water requirement. Overall, DNV GL found that it is conceivable that water flow requirements would not exceed what is already seen in the built environment when appropriate room volumes are considered (compare Table 10 with Table 8).

Question: Will the ventilation rates for battery systems be excessive?
Finding: They need not be excessive if the appropriate room volume is considered. (Compare Table 10 with Table 8.)

Question: What are the differences in safety considerations for outdoor vs. indoor systems?
Finding: Please cross reference to "considerations for System Types and Locations". Outdoor systems may have standalone safety equipment such as fixed suppression systems and self-contained heating, ventilation, and air conditioning (HVAC). The risk to the site should be considered in all cases, which is intended to be addressed in the FMEA required by UL 9540. A risk analysis should guide stakeholders toward a probable risk consideration during project commissioning. This probability-driven analysis helps avoid over- or under-prescribing safety systems. Outdoor systems may have different or lower ventilation requirements, but their size and proximity to inhabited structures may dictate heat or plume considerations in the event of fire (see Figure 25 and considerations in" Present Day Industry-Accepted Safety Practices for Energy Storage Project" on page 31). Indoor systems may be dependent on the building infrastructure for ventilation and fire suppression. If that is the case, the risk analysis should identify if these systems are adequately sized, using the guidance identified in Table 9.

Question: Are residues left behind after a battery burns?
Finding: There is potential for residues. DNV GL found traces of vanadium after boiling the vanadium redox electrolyte. In the EDS (energy dispersive spectroscopy) scan from the scanning electron microscope, coincident detection of both V and O could indicate vanadium oxide dust (Figure 13). The vanadium peak is low; however, there is no other component of the test that would contribute it other than the vanadium redox electrolyte. Oxygen can also be sourced from various oxides that form on metals. In addition, some Pb residue was swabbed from the burn container where Pb acid batteries were tested, but it was in low amounts and limited to immediate proximity of the burn specimen. Traces of metals were observed in the interior of the battery abuse chamber after Li-ion testing. In addition, the pH of runoff water from the module burn tests was measured to be anywhere from pH 6 to pH 11. However, many of the same contaminants found from plastics fires were common to those found from battery fires. In any case, the precautions recommended for PPE and self-contained breathing apparatus (SCBA) during overhaul apply to solids residues and dusts as well. Bare skin contact with residues should be avoided, as is good practice in the aftermath of most fires.

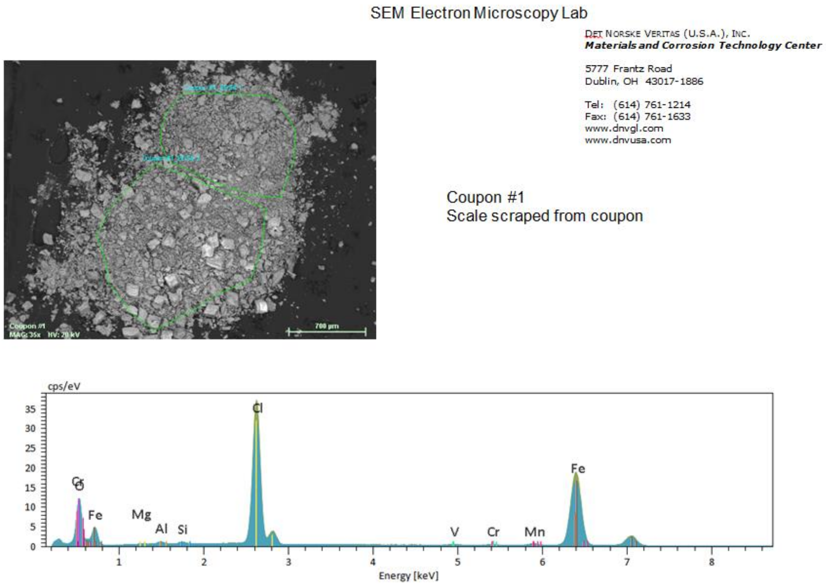

Figure 13 **Residue analysis from a coupon hung in the headspace of the vanadium redox boiling test.**

Question: Are certain form factors of cells safer than others?
Finding: DNV GL saw that unconstrained pouch cells, if given the opportunity, will inflate and then burst catastrophically under extreme heating conditions (Figure 14). However, pouch cells are compressed when engineered into modules, so a free-floating pouch cell is not a realistic representation of a field system. DNV GL did notice, however, that controlled venting of cells is necessary to reduce their volatility. The ability to vent and relieve pressure is critical to whether the cell's failure is benign or sudden. **This illuminates the fact that trapped gases are the cause of explosive failure.** It should be noted that DNV GL did not directly witness any exploding battery cells during testing. However, flashovers of the contained gases within the test chamber were a frequent occurrence for all Li-ion batteries tested.

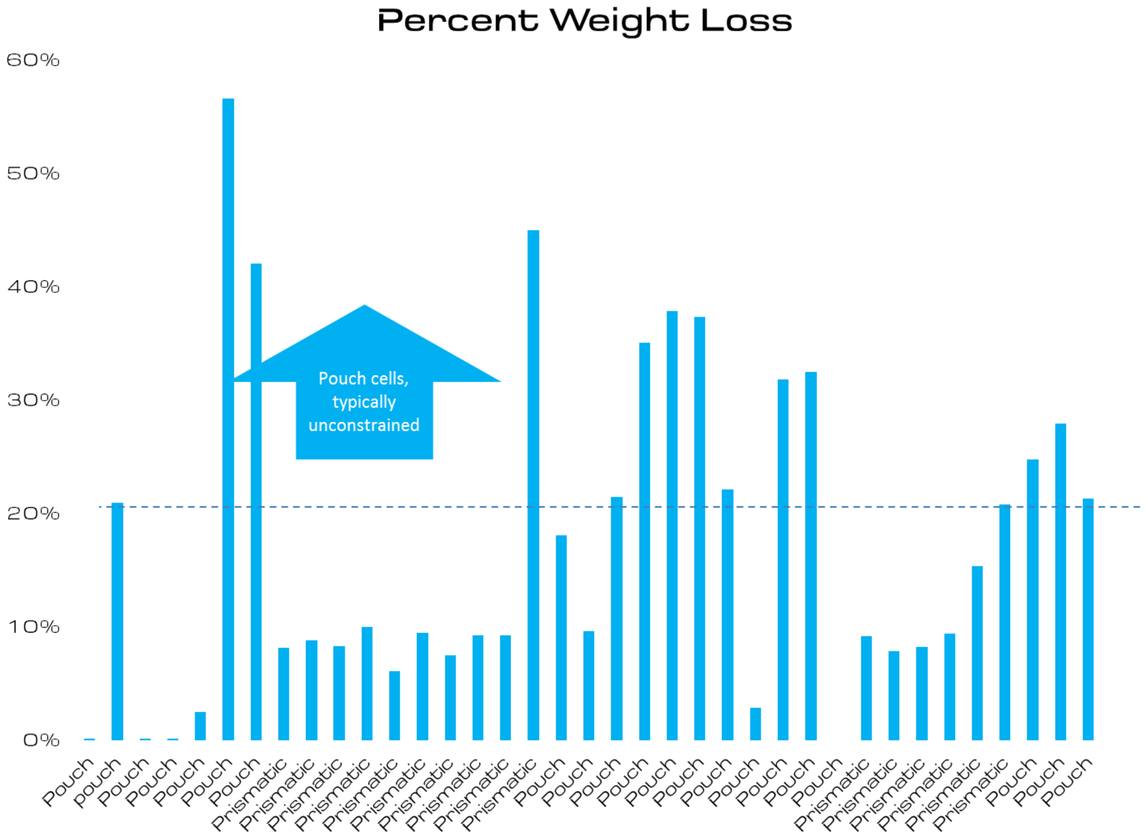

Figure 14 **Percent of mass loss as a function of cell form factor.**

Question: Will Li-ion batteries explode?
Finding: In this program DNV GL tested dozens of Li-ion batteries and could not conclusively say that any of them "exploded." DNV GL has conducted hundreds of abuse tests on cells in other programs and has not conclusively observed an event where a battery exploded or was the source of a rapid energy event. What is a highly repeatable condition, however, is the degree to which the test chamber fills with flammable gases before those gases ignite. The flashover event could be very rapid. The explosion hazard is not the battery itself, but the gases it may generate. Therefore the requirements for stress-relief by venting of the cells (described above) and the ventilation of the space are emphasized throughout this report.

Question: How long would it take for flammable gases to explode?
Finding: This is entirely dependent on the emissions rate and the ventilation of the surrounding area. It is shown in Figure 5 that the emissions rate varies for all batteries but the diagram indicates the upper and lower boundaries of emissions limits. The emissions rates corresponded to 0-57% mass loss over a period of 13-83 minutes. CO is the primary signature of flammable gases. Sensors detecting CO may be cross-sensitive to hydrogen. Many flammable gas sensors are non-equally cross sensitive across a family of hydrocarbons and provide a general "LEL" audible warning. The emissions rates observed from batteries are included in Table 1.

Table 1 **Statistics on cell failure rates for the entire test program including all Li-ion variants.**

		Single Cell Emissions Statistics			
		Average	*Std Dev*	*Min*	*Max*
	Mass Loss	18%	14%	0%	57%
	Duration (min)	41.7	17.1	13.0	83.0
Average ppm per kg per min in 1 m^3	**HCl**	0.057	0.150	0.000	0.719
	HF	0.009	0.010	0.000	0.032
	HCN	0.003	0.005	0.000	0.027
	CO	0.279	0.440	0.000	2.341

Question: What is the energy of the explosions from battery offgas?
Finding: DNV GL did not observe batteries exploding directly, but did observe the energy of flammable gas flashovers. The energy of these events is proportional to the concentration of gases in the enclosed volume. The power of these events (or the heat release rate) is significantly variable depending on the volumes of gases, the duration of their release, the resulting mixture, and the rates of their ignition, DNV GL observed considerable scatter in the HRR (Figure 15). The HRR was observed to be anywhere from 2-8 kW with 100-800 g of released materials. This brackets the value from 2.5-80 kW/kg. By comparison, burned specimens of common furniture items have demonstrated a mass weighted HRR of 32-260 kW/kg. [51] It was found during testing that long periods of smoldering for the batteries resulted in reduction in mass prior to the peak event, which likely produced much of the scatter observed in the measurements.

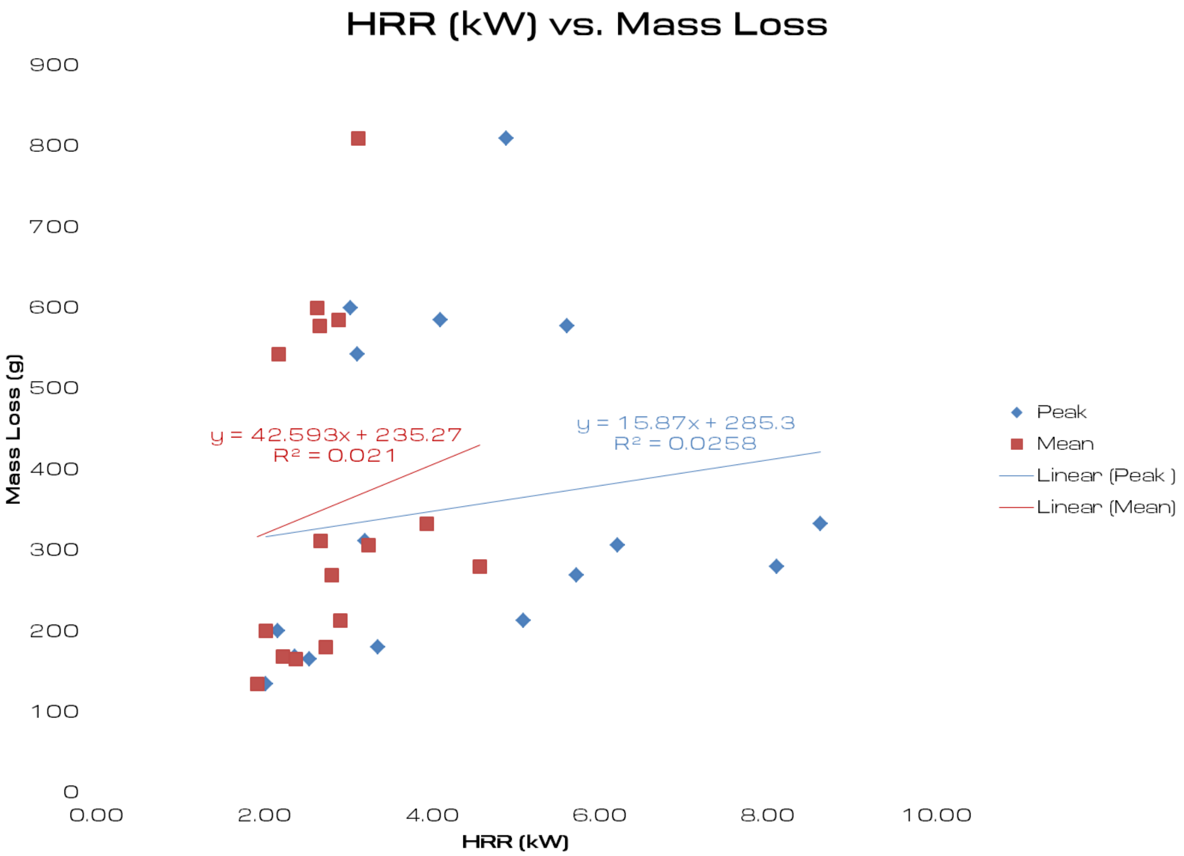

Figure 15 **Relationship of heat release rate (kW) per gram of mass lost.**

Question: Is the ventilation rate governed by the LEL or Immediately Dangerous to Life and Health (IDLH) limits ?
Finding: IDLH. The concentrations of HCl reach a threatening level much faster than the concentrations of flammable gases. Therefore by sizing the ventilation requirement to the IDLH of HCl, the flammability concern is also mitigated. See Figure 16 and related figures starting on page 23.

Question: What are the ventilation requirements for batteries?
Finding: DNV GL quantified and produced suggested ventilation rates in Table 9. The suggested ventilation rates range from 0.02-0.03 CFM/kg or 0.2-0.32 CFM/kWh. This translates to roughly 0.25 ACH in many cell failure scenarios, climbing to as high at 10-14 ACH in the worst case (see Figure 16 on page 23 and related figures). It should be noted that laboratory spaces, pharmacies, or some manufacturing environments can also have an ACH of 10 or higher (compare Table 15 and Table 8). Therefore, the ventilation rates in most buildings will meet or exceed the ventilation required for the battery system in single cell or low mass failure modes.

Table 2 **Average release rate for battery materials over a 30 minute time period.**

Materials	30 min Release Rate (kg/s)
HCl	2.36E-07
HF	1.74E-07
HCN	1.74E-07
CO	2.00E-07

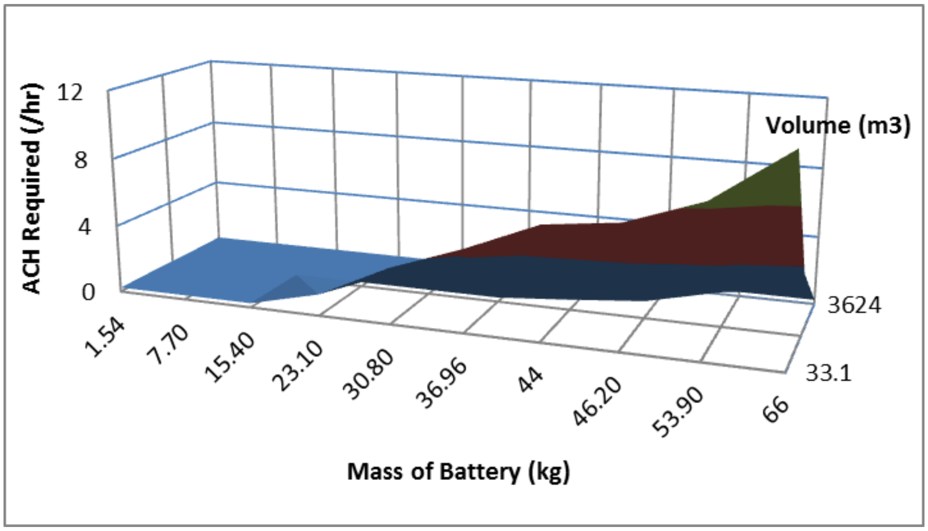

Figure 16 **Estimated ventilation rates (air changes per hour) as a function of room volume and mass of battery undergoing failure for HCl.**

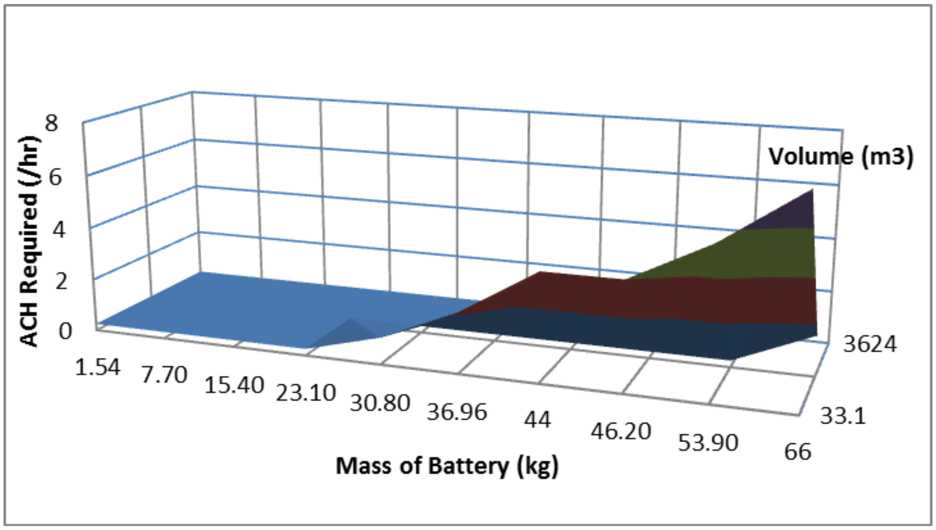

Figure 17 **Estimated air changeover rate (air changes per hour) as a function of room volume and battery mas undergoing failure for HCN.**

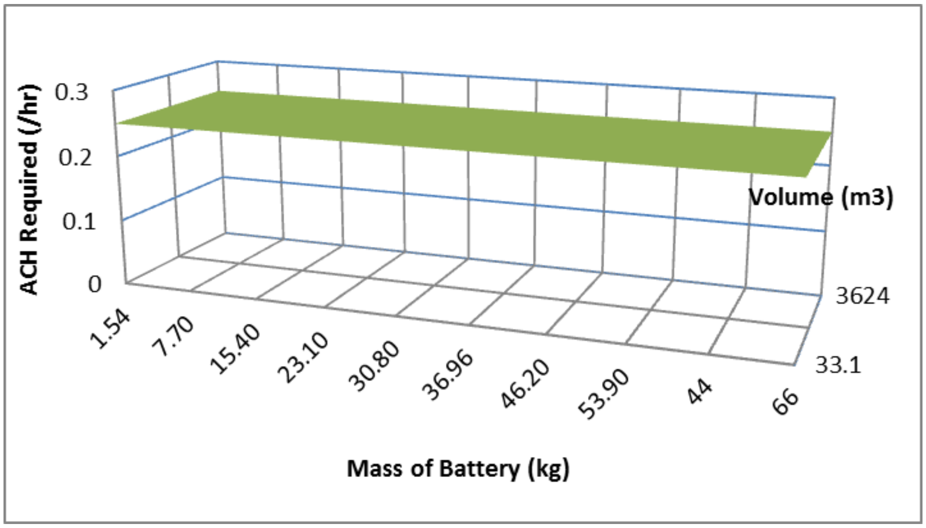

Figure 18 **Estimated air change over rate (air changes per hour) as a function of room volume and battery mass undergoing failure for CO. Because the IDLH of CO is much higher, there is little dependency on battery masses at these scales.**

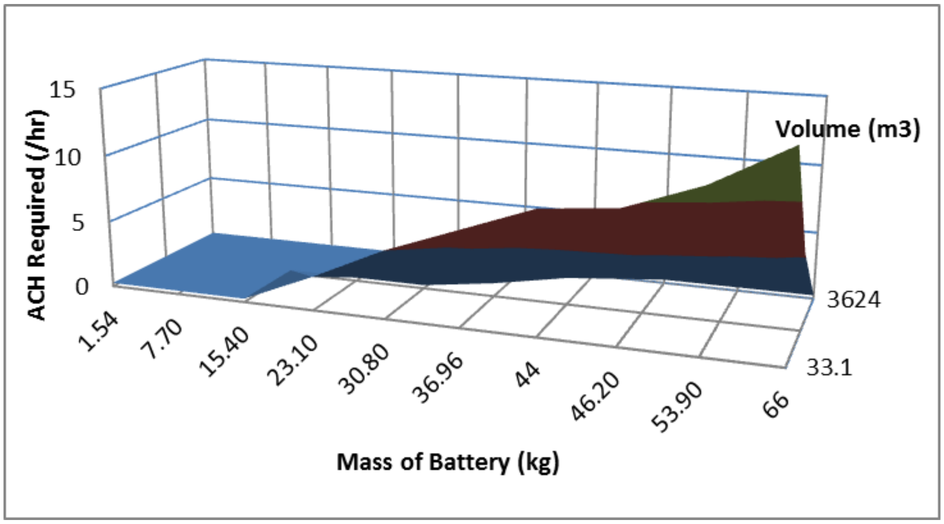

Figure 19 **Estimated air change rate (ACH) as a function of room volume and battery mass during failure for HF.**

Question: Is HF emitted from batteries?
Finding: Yes. HF was observed in all of the Li-chemistries. Vanadium redox also demonstrated HF emissions in 2 out of 3 tests, even after a complete overhaul of the test equipment to remove the possibility of contaminants affecting the result (see Figure 20 as well as Figure 5). However, it is HCl, not HF, that governs the ventilation and toxicity consideration. It was found that on a per kilogram basis, the average emission rate of HF in a plastics fire can be higher than the average emission rate of a battery fire (compare Figure 4 to Figure 5). From this study it was found that the ventilation requirements for

anything less than 15 simultaneously burning battery cells are the same for HCl and HF (see Figure 16 and related figures starting on page 23).

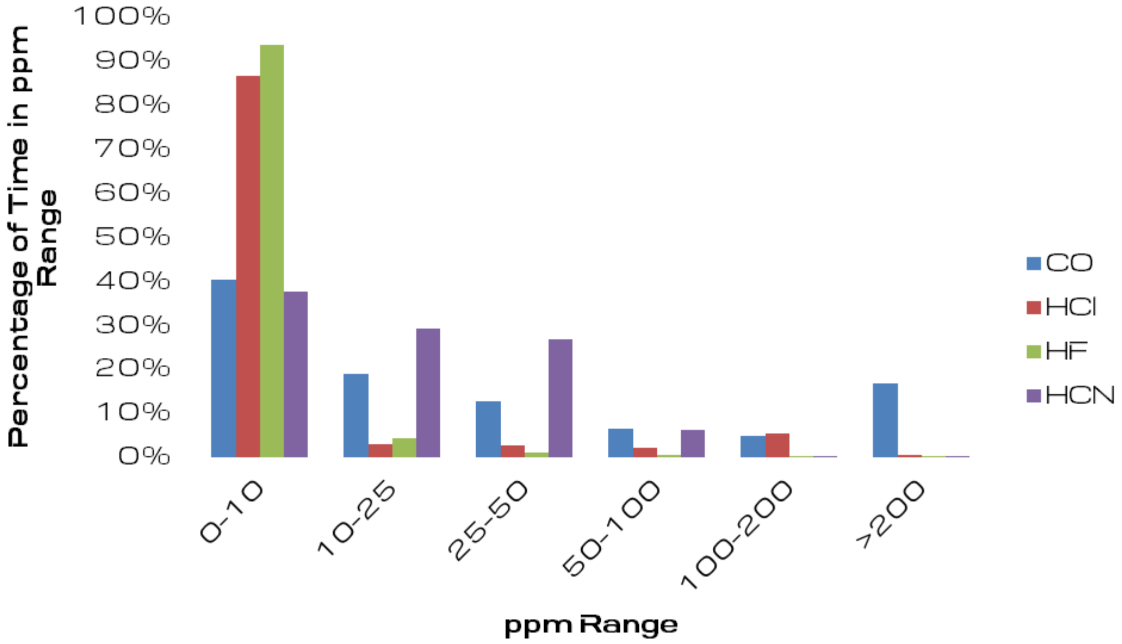

Figure 20 **Representative emissions histogram from a Li-ion battery.**

Question: Is the combined LEL of the flammable gases lower than any of the gases alone?
Finding: Yes. This phenomenon is described by Le Chatelier's Mixing Rule which states that the combined LEL of a mixture of gases is the sum of the weighted ratios of volume to LEL for each individual gas species. Because the emissions rates are constantly varying and therefore never in a prolonged chemical equilibrium such that this simplified textbook solution may apply, DNV GL was able to observe that ignitions occurred as low as 400°C at CO concentrations as low as 3,000 ppm. (Figure 21) Frequently observed gases of C_2H_4, CO, and CH_4, if coexisting in a mixture, have the lowest autoignition temperature of 490°C and 100,000 ppm, respectively (see below):

- C_2H_4 = 2.7% (27,000), 490°C
- CH_4 = 5% (50,000), 537°C
- CO = 10% (100,000), 609°C

As expected the combined LEL is indeed lower than the individual components but as mentioned above, **the ventilation requirements should be set by the IDLH, which should exceed and override LEL considerations. Therefore LEL is less of an immediate concern than IDLH.**

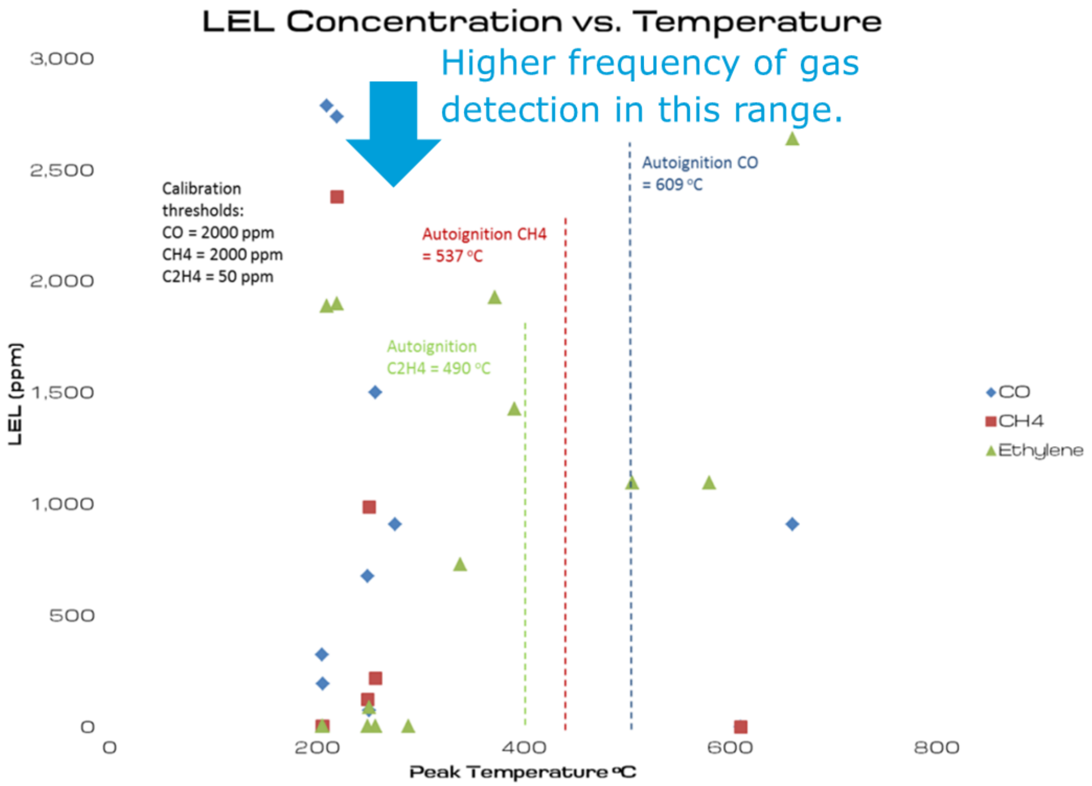

Figure 21 **The combined LEL and autoignition temperature of mixed gases emitted from Li-ion batteries may be as low as 3,000 ppm and less than 400°C, as flammable gases were ignited and burned off above this temperature.**

Question: What is the explosion risk?
Finding: The battery is not the source of an explosion risk, but the flammable gases generated from it are. These gases need to be vented to reduce the risk. Because the ventilation rates are dictated by the lower IDLH thresholds than the LEL thresholds, ventilation sized to the IDLH should exceed the ventilation requirement for explosion hazards.

Question: Are Li-ion batteries more volatile with higher states of charge?
Finding: Yes. There is a very direct increasing relationship between mass lost and the SOC before failure as shown in Figure 22. However, the BMS limits the SOC of the battery intentionally for both longevity and safety reasons. As shown in the figure, the decline in mass loss is significant as the SOC of the battery is decreased from 100% to 90% or 80%. As many battery systems limit the upper electrochemical SOC range to 80-90%, a significant safety precaution has already been made. It should be noted that the GPM/kg and CFM/kg metrics found in this program are inherently conservative because they include the peak emission rates observed at 100 % SOC and they also capture the short lived peak emission events. In reality, a system fire spends most of its time smoldering, and if the BMS is properly functioning, no cells should be at 100% SOC.

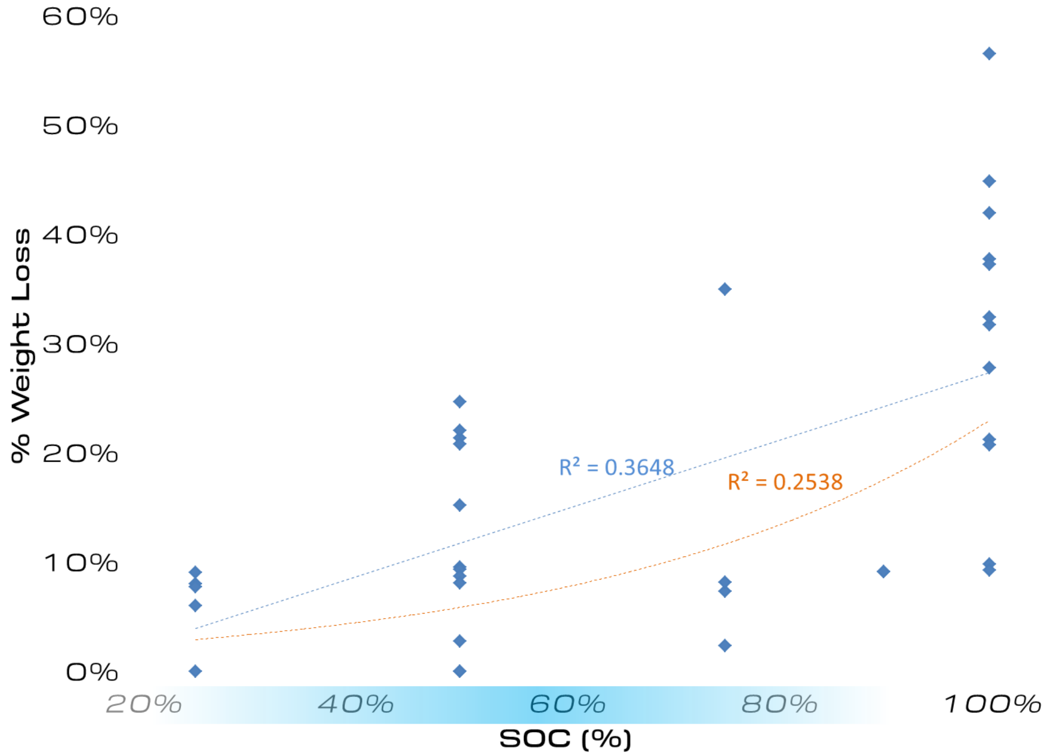

Figure 22 **For Li-ion batteries, the mass loss is directly proportional to the state of charge prior to failure.**

Question: Are some battery chemistries safer than others?
Finding: No battery tested in this program is excluded from toxicity concerns in a fire. In general, it is good advice to treat a battery like any fuel should be treated, and make note that risk is context specific and weighted. In Figure 23 it is evident that iron phosphate, BM-LMP, and titanate batteries have lower heat release rates and less flammability, as does vanadium redox and lead acid which did not exhibit flammability. However, it was shown in Figure 5 that all batteries have varying degrees of emissions of HCl, HF, CO, HCN, and potential SO_2 and H_2S. Because many of them have plastic casing, the plastic itself is a toxicity and flammability hazard. Therefore, there is no single battery chemistry in this testing program that should be excluded from toxicity considerations in an enclosed space or near a populated building. Furthermore, the source of toxicity may be as much plastic componentry as it may be attributed to electrolytes. **Because the toxicity risk is similar to plastics, it is DNV GL's recommendation that toxicity be treated equally across chemistries.** In the case of batteries with non-flammable electrolytes, adequate precautions should be demonstrated that polymer cases or other flammable materials are sufficiently protected against external fire in order to warrant any reduction in the water requirement, if any. It should also be noted that the water requirements for Li-ion batteries need not be excessive if the fire safety measures are viewed as a system rather than standalone requirements. Lastly, it should also be noted that the low level ACH requirements for vanadium redox and Pb acid are well below the typical 2-4 ACH ventilation requirement in most occupied spaces, so the existing infrastructure may be adequate in many instances.

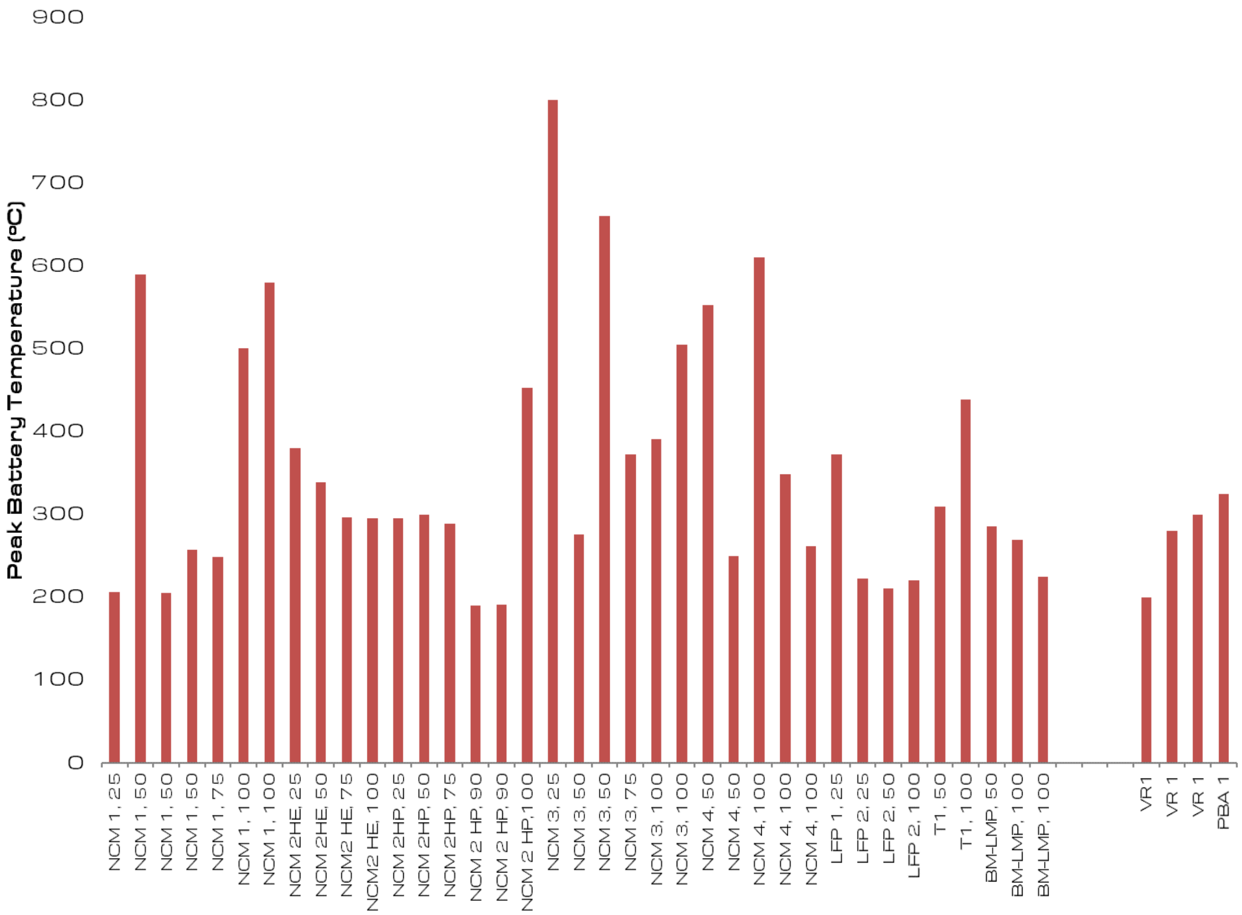

Figure 23 **It is generally true that LiFePO4, LTO, and BM-LMP batteries demonstrate lower than average temperatures during failure. The temperatures indicated for Pb acid and vanadium redox batteries is the peak heating temperature, as these electrolytes did not demonstrate flammable or exothermic properties as they were tested.**

Question: What is the solubility of liberated gases, and are some of them consumed by fire?
Finding: The solubility of the gases observed is shown in Table 3. Those consumed by fire have an indicated flammability limit and autoignition temperature.

Table 3 **Inventory of Toxic and Flammable Hazards found in this Study**

				Concentration (ppm unless otherwise noted)				NFPA Codes (F=flammability, H=health, R=reactivity, S=special)				
	Chemistry	**Relevant Batteries**	**Detected State**	**LEL (Lower Explosion Limit)**	**IDLH (Immediately Dangerous to Life and Health)**	**Solubility in Water (mg/L)**	**Auto Ig. Temp (°C)**	**F**	**H**	**R**	**S**	**Ref.**
Methane	CH_4	Li-ion	Gas	50,000	5,000	22.7	537	4	1	0		NJ DOH
Carbon Monoxide	CO	All	Gas	12,500	1,500	27.6	609	4	2	0		CDC.gov
Benzene		All except PbA	Gas	12,000	3,000			3	2	0		CDC.gov
Ethane		Vanadium Redox	Gas	30,000				4	1	0		CDC.gov
Ethylene	C_2H_4	Li-ion	Gas	27,000	-	2.9	490	4	2	2		Matheson MSDS
Hydrogen	H2S	Pb Acid, Li-ion	Gas	40,000	-			4	0	0		CDC.gov
Hydrogen Sulfide	H2S	VR, PbA	Gas	4,000	300	4,000.0	260	4	4	0		CDC.gov
Hydrogen Fluoride	HF	All except PbA	Gas	-	30	miscible	-	0	4	0		CDC.gov
Hydrogen Chloride	HCl	All	Gas	-	100	720.0	-	0	3	1		CDC.gov
SO2	SO2	VR, PbA	Gas	-	100	94,000.0	-	0	3	0		CDC.gov
Hydrogen Cyanide	HCN	All except PbA	Gas	-	50	miscible	-	4	4	2		CDC.gov
Nickel	Ni	Li-ion	Residue / Powder					1	3	0		
Manganese	Mn	Li-ion	Residue / Powder					3	3	3		
Cobalt	Co	Li-ion	Residue / Powder	-	-	Insoluble		0	1	0		
Lithium	Li	Li-ion	Residue / Powder					2	3	2	~~W~~	
V2O5 Dust	V2O5	VR	Residue (V)	-	35 mg/m^3	0.8	-	0	3	0		CDC.gov
Pb Vapor, salts, dust	Pb	PbA	Residue	-	700 mg/m^3	10^-5 to 4400	-	0	2	0		CDC.gov

Question: Can batteries be "neutralized" by immersing them in water after an incident?

Finding: Partially. Immersion in water provides adequate cooling to prevent violent thermal runaway, but it may not neutralize voltage. DNV GL found the following results should be considered prior to doing so:

- Batteries may have residual voltage on damaged and exposed terminals. (Figure 11) Handling of the battery may produce a shock hazard.
- Batteries persistently gassed even under water. The primary measured component of that gas was CO, though the handheld CO sensors are cross sensitive to H_2.

- For most tests the water runoff was slightly acidic measuring pH 6-7. In one case, however, the water became alkaline climbing to pH 10-11 after a few hours of submersion. This case was observed for a battery that was highly consumed in the fire.
- Batteries did not climb in temperature after submersion, indicating that even if cells short circuited, their temperature was never permitted to climb to thermal runaway conditions.
- Some battery cells still had voltage on them after 24 hours of submersion. While some cells may have shorted, not all shorted. The water did not have any additives such as salt to make it more conductive.

Question: Was hydrogen generated as a result of electrolysis during submersion?
Finding: Possibly, high levels of CO (10-100ppm) were detected on the four and five gas meters right above the submersion pools. These electrochemical sensors are cross sensitive to H_2. High levels of CO were also detected on the FTIR during and after testing though, suggesting that CO generation is real and any cross sensitivity from H_2 is low as CO is the dominant gas. This was further supported by data from cell testing not involving submersion.

Question: How much hydrogen was emitted?
Finding: During cell testing DNV GL witnessed > 1000 ppm (sensor max value) on a few occasions. Hydrogen was not observed directly during submersion, though CO was measured. CO sensors can be cross sensitive to hydrogen. The lower flammability limit for ethylene and related species is 3.6%, which is lower than hydrogen at 4%. Therefore the greater flammability risk is presented by ethylene carbonate decomposition due to its greater volumes, higher emissions rates, and similar volatility. This is supported by gas bag sampling, which showed far higher levels of hydrocarbon gases than H_2, which was still well below the LEL.

Question: Are the liberated gases lighter or heavier than air?
Finding: The molecular weight of air is generalized at 29 g/mol. By comparison the molecular weights of the main gases observed from battery fires are shown below (in g/mol). It can be seen that HCl is heavier than air. Another observation from testing is that the gases are typically hot, which means they are rising as part of the plume.

- CO: 28.01
- HF: 20.01
- HCl: 36.4
- HCN: 27.02

Question: Should exhaust fans be intrinsically safe or grounded?
Finding: DNV GL used an exhaust fan during module testing (Figure 24). After several consecutive fire tests the heat and smoke eventually overstressed the fan. However, it was not observed that the fan ignited the gases. Consideration of intrinsically safe fans may be necessary in sensitive locations.

Figure 24 **Smoke plume rising through door gaps and out of top vents in the burn container.**

Question: Should exhaust fans be variable speed?
Finding: Based on the nonlinear behavior of emitted gases (Figure 16 and related figures) a variable speed fan should be a consideration. This may be a more cost effective solution than a highly rated fan running continuously which may exceed the minimum ventilation requirement of ~0.25 ACH. A variable speed fan can accommodate the low level ventilation rate for the majority of the time, with the capability to ramp up in the event of failure.

Question: How were gases measured in this testing?
Finding: DNV GL used a Gasmet DX4000 FTIR gas analyzer during cell testing supported by MSA Ultima sensors for IR transparent gases and LEL. The FTIR was used again for module testing. In addition, for module testing, Rescue Methods used MSA Altair handheld four- and five-gas sensors. These tools were used for both LEL and toxicity monitoring. LEL was measured via a photo ionization detector (PID) (10.6eV bulb) on the handheld sensors.

7.0 PRESENT DAY INDUSTRY-ACCEPTED SAFETY PRACTICES FOR ENERGY STORAGE PROJECTS

It is important to place this report in the context of what is actually occurring in energy storage project development today. Presently there are over 400 stationary storage systems comprising 1,200 MW operating around the world, with 600 MW of electrochemical energy storage in the United States [5].

The types of battery energy storage systems being deployed are both utility solutions at the multi-MW scale in consolidated sites, typically with energy storage batteries housed in shipping-container like systems with integrated BMS, ventilation and cooling, and fixed fire suppression. Smaller, behind the meter energy storage systems are designed to be deployed near the customer and controlled as an aggregate fleet. These smaller systems have a BMS and may have active cooling, but rarely have integrated fire suppression. Shipping container systems are typically located outdoors and are MW scale, whereas behind the meter systems are typically sited at a commercial site (or potentially residential) and may be indoors, and will have ratings in 10’s of kW.

Energy storage can be utility owned or it can be owned by an independent power producer (IPP). Much of the US energy storage market is presently being driven by IPPs. The IPP may monetize the energy storage asset through utility contracts or a commercial power purchase agreement. Some IPPs have the balance sheet to pay for energy storage projects themselves, but many seek financing. With financing comes insurance to underwrite risk in both the finance and safety of the project. **Because of these additional parties that are exposed to financial risk, a performance and safety review are a critical piece for financing an energy storage project, which is performed by an independent engineer (IE).**

Independent Engineering is a field of service where independent third-party engineers review the technical specifications of energy projects and provide an assessment of financial or technical project risk. The practice of hiring an IE is common in the wind and solar industries and is now industry practice for energy storage projects. Many insurers and lenders require an IE report – and must feel comfortable with the findings of the report – in order to finance or underwrite an energy storage project. The first step in most IE reports on storage is a review of the technology which will include performance and safety aspects. The IE functions are typically performed during or prior to permitting and before project commissioning, as shown in Figure 25.

In the context of safety the IE is tasked with independently evaluating the adequacy of safety systems appropriate to the project. With the business case and project site(s) identified, the AHJ is likely to become aware of the project when the project developer is seeking permit(s). The AHJ will typically respond with requirements, which may be few or many, at which point the project developer takes actions to fulfill them in order to secure the sites as quickly as possible. Project finance may be secured or will be sought in parallel to this process. Because the project developer is encouraged to obtain the IE report by the financial stakeholders, it is most cost effective for the project developer to use the IE report to simultaneously satisfy requirements for the AHJ and the financial parties. The objectivity of the report should increase comfort in the transaction(s) between parties. Therefore at the request of the project developer, the IE report is written in the context of generalized project specifications so that it may enable as many transactions as possible. Therefore it is never the case that more than one IE report is generated for identical projects because it is a cost that can be practically avoided. It is also common practice for large aggregated projects of similar system types to have inspections performed on a subset of sites.

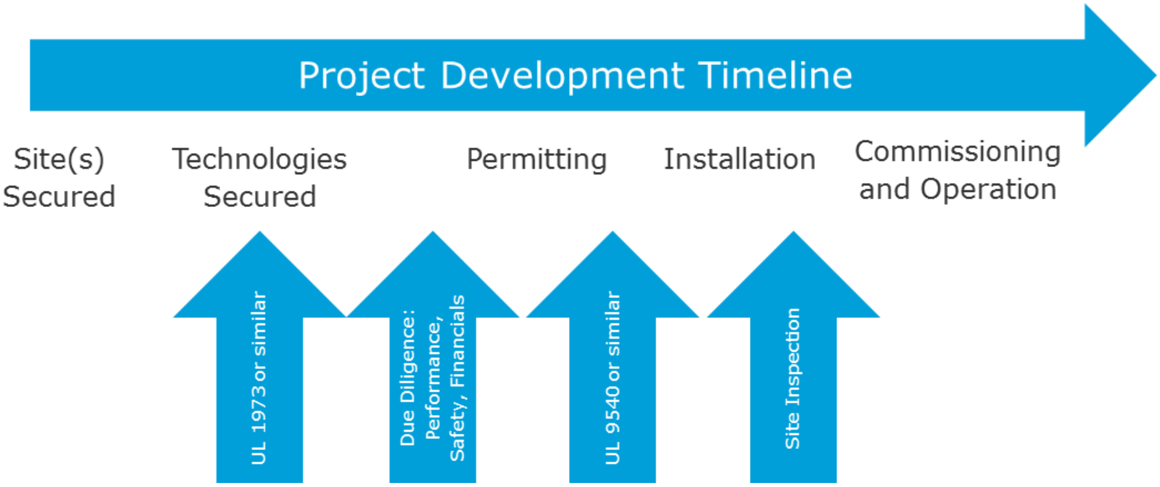

Figure 25 **Project development timeline and the implementation of FMEA or other safety review for the site.**

For an outdoor container system, the IE may provide the following services related to safety:

- Assessment of the adequacy of the safety systems
- Assessment of the safe perimeter around the site
- Emergency response plans
- Review or recommendations of materials to be provided to the local AHJ for permitting or code review
- Adequacy of firefighting equipment
- Impact of a fire scenario on the site or surrounding area, which may include a plume study if residential or populated areas are nearby
- Risk model for the site

For an indoor system, the following IE services related to safety may be requested:

- Review of safety testing
- Assessment of the adequacy of safety systems
- Recommendations on the requirements for indoor room locations
- Adequacy of cooling and venting
- Review of fire ratings
- Inspection of installation
- Risk analysis related to the system and its site(s)

In the case of behind the meter systems, this review is usually done at the **project portfolio level** unless specific site considerations require local review.

8.0 GUIDANCE FOR FIRST RESPONDERS

Many of the questions in the FAQ were intended for first responders, who wish to know what should be done upon encountering a fire that involves a battery.

The first and foremost finding from this report is that the **equipment available to present day first responders can be considered adequate for battery fire fighting** with additional considerations.

8.1 Considerations for Permitting and Siting

If a building or site information summary is available, it should state whether there is a battery on site and its chemistry. The primary concern upon approaching the scene should be HCl toxicity and rising temperatures, and the potential for the fire to expand if it has not already.

- **FMEA, siting, and standard operating procedure (SOP) development:** UL 9540 requires an FMEA for ESS permitting and siting. In addition, DNV GL recommends an FMEA be performed on any system or project portfolio, particularly for behind-the-meter applications.
    - A risk analysis involves review of all potential failure modes for their likelihood of failure and the resulting consequence to determine the total risk. As this process serves as a deep dive into the design and operation of the unit, this process would provide valuable insight for code officials and first responders to better understand the risks and potential faults they may be dealing with during emergency situations.
    - Requesting participation in this process would serve as the best opportunity to become involved in the development process and would allow AHJs and the fire service to best understand the system in the least intrusive way to the project developer (since an FMEA may be required regardless of AHJ participation).
    - In addition to FMEA involvement, DNV GL recommends all AHJs and fire departments perform a walk through for all large ESS in their jurisdictions and develop SOPs according to their level of comfort with the electrical risks. Though small home systems may not exceed 48 VDC and be easily disconnected from the AC source, larger utility scale systems may exceed 1,000 VDC and 10,000 VAC. Again, even prompt disconnect of AC voltage does not eliminate voltage on the DC side.
    - DNV GL recommends all fire departments with large ESSs or ESS portfolios in their jurisdictions work with project developers or system manufacturers to provide emergency contacts and readily available subject matter experts (SME) who can quickly advise fire departments on system status and risks associated with the current fire environment.
    - Finally, DNV GL recommends fire departments and first responders work with system and project developers to understand the level of risk and their appropriate response. A single cell failure in a large containerized system need not require the entire system be destroyed with water. However, a

system with an unknown internal hazard may pose risks to the surrounding environment or to fire fighters and may be better handled via a defensive posture than entry and attack.

8.2 Considerations for Operations at the Scene

Upon arriving at a fire scene, the following considerations should be made:

- Has on-site extinguishing already been triggered?
- Is the system gassing?
- Is the temperature of the system rising?
- Are flames visible?
- Is there a site representative or SME available?

Answers to the above questions will indicate whether the system fire has already peaked or if it is expanding. Support from an SME, an information display panel, or other form of emergency contact will greatly aid in assessing the risk.

If the system is gassing but onboard suppression (if any) has already triggered, and temperatures are remaining stable, it is likely that a single cell or module fire has occurred and been isolated, and may have been managed by the onboard system. Additional suppression may not be required in this case. Eventually, the system will need to be ventilated to remove the internal atmosphere, but only if temperatures have remained stable for approximately 60 minutes.

The list below summarizes key points from this study that are directly relevant to firefighters and other first responders. This section may stand on its own as an independent part of this report and may be distributed to fire departments and first responders nationwide independent of this document. It is not intended to serve as an SOP on its own, but should inform the response and development of SOPs for situations involving ESS. There has been much said about ESS fires in the past which has led to several myths about these fires. DNV GL wishes to dispel the falsehoods while promoting real world, data driven facts when dealing with these systems. Ultimately, findings suggest that while these systems are unique in the combination of threats posed, none of the threats on their own are unfamiliar to firefighters, and they remain manageable so long as certain points are known and followed.

- **Toxicity:** In general, battery fires resemble plastic fires in terms of emission of toxic gases including CO, HCl, HF, HCN, Benzene, and Toluene
    - The average toxicity of the fire is equivalent to many plastics on a per mass basis. Li-ion fires will have short peaks of toxicity as individual cells randomly fail.
    - However, battery fires, even once extinguished, continue to emit CO as long as the batteries remain hot.
    - DNV GL and Rescue Methods (RM) recommend continued monitoring of CO from ESS fires, especially in enclosed spaces, and the continued use of personal protective equipment (PPE), including self-contained breathing apparatus (SCBA), until CO levels are shown to be at normal levels. These practices may include monitoring for HCl, if applicable or possible.

- **Ventilation:** Though integrated ventilation will be recommended for indoor systems, it may not always exist or prove adequate to remove heavy smoke, especially in cases where the surrounding environment is fully involved or the battery is rapidly overtaken.
    - DNV GL and RM recommend sufficient firefighting ventilation, ideally negative pressure, to remove fire gases from enclosed areas.
    - The batteries themselves emit flammable gas and fully involved or improperly ventilated systems may pose a lower explosive limit (LEL) or flash hazard.
    - DNV GL and RM recommend monitoring of LEL levels in the fire ground and surrounding environment to determine if intrinsically safe ventilation is required.
    - Partially burned systems may continue to emit flammable gas even after the fire is extinguished as long as the cells remain hot. Proper cooling of the system is key to remove prolonged fire risks.
- **Temperature:** Climbing temperature is an indicator of increasing risk.
    - If flames are visible and temperature is rising, the system may have more than one battery cell or module engulfed.
    - If temperatures are rising rapidly (>1 ˚F per minute) and temperatures on the battery are approaching anywhere near 100 ˚C (212 ˚F), cooling will be required with water.
    - Monitoring with handheld infrared (IR) thermometers, if available, should provide an assessment of risk.
- **Delayed Cascading Ignition:** On site responders should assess that all thermal, electrical, or mechanical stimuli that may act on the system have been mitigated.
    - In the short term, when cells appear to "reignite" after seconds or minutes, it is almost always a result of incomplete removal of heat from the system, or an electrical short due to liquids or water. Prevention of cascading between cells may be addressed by proper cascading protections in the system, which may retard extinguishing and external cooling but also mitigates the free movement of heat internally in the batteries which can ignite previously undamaged cells. DNV GL refers to this phenomena as delayed ignition.
    - In some cases, the only way to halt this process is to let the system burn itself out (but this may not be practical) or continue to drown the battery until this process stops as the battery finally cools. This decision should be made based on the circumstances of the fire ground.
- **Shock Hazards**: Cells that have not been burned may remain intact in systems and modules.
    - Shock during water suppression (via conduction into the water spray) was not observed in this program.
    - Beware of arcing if batteries are disturbed. Turnout gear was observed to provide shock protection under the conditions tested in this program, but do not touch arcing equipment.
    - Stranded energy in partially burned batteries will likely remain an issue in any system that is extinguished unless it has consumed itself entirely. DNV GL

found that even in systems that appeared thoroughly damaged, live cells and stranded energy can remain. These cells may pose a shock/arcing risk and can reignite if physically damaged, reheated, or allowed to short.

- **Extinguishing:** DNV GL tested several water based extinguishing agents and found none to be as effective for cooling as water. These included PyroCool, F500, and FireIce.
  - The most challenging aspect of the battery fire is its deep-seated nature. Access to the heat source is necessary to provide adequate cooling.
  - Cooling the battery once flames are knocked down is the most important aspect of containing battery fires. The tested agents proved slightly less effective than water at cooling the cells. On a module level, there was no evidence to suggest these agents perform better than water.
  - Because many encapsulating agents, including foam (AFFF) are intended to blanket the fire, and a battery fire needs to have heat removed as quickly as possible, DNV GL generally recommends against using foam for ESS fires. Foam has been tested in other projects and used in real world ESS fires. In testing in other projects, it failed to perform better than other agents.
  - The aerosol may prove effective at knocking down flames from ESS. Gas based agents may suppress the flammability of contained atmospheres with high explosive gas content; however, in the case of severe ESS fires where these agents would be tasked to suppress flammability, cells may be producing heat above the autoignition temperature of their flammable gases. This may result in fire if oxygen were reintroduced to the system. DNV GL recommends gas-based systems be backed up by water-based suppression when cooling becomes a necessity, in combination with cascading protections in the modules and systems.
  - Though water proved most effective for cooling, water and any water-based agent introduces shorting risks when applied on a full system. This may exacerbate the situation in addition to presenting a collateral damage risk.
  - Several entities, including DNV GL, have advised that class D fire extinguishers and agents be investigated for use during the incipient stage of the fire. Based on the findings from this program, DNV GL views the deployment of classical class D agents as impractical due to the short lived peak of a cell fire and its deep seated nature, which prevents direct access.
  - RM’s experience during suppression testing suggests forced access to the interior of battery systems may be difficult or inadvisable for first responders. In this case, water should be used to provide indirect cooling on the outside of the system to prevent spreading.
  - Water use inside the system, if applicable, should be done with care to avoid shorting neighboring and surviving cells, i.e., the failing module should be isolated and targeted. Fully involved systems may be compromised enough to allow better water penetration. Fully involved systems posing a risk to surrounding life and property, or neighboring systems, should be suppressed immediately and heavily to avoid spreading.

  - If the fire appears to be stable and not expanding, periodically stop water flow and monitor temperatures. Note that the temperature may "spring back" after water extinguishing stops, but it should plateau and stabilize if the fire fuel has been consumed.
  - Observe for water shorting other cells. They may begin to heat, meaning the deep seated heat remains.
  - Repeat extinguishing process as needed, while ventilating the area as much as possible.
  - If the battery system has closed doors, do not open them unless absolutely necessary or it has been determined that opening the doors will not introduce new hazards. Forced entry is discouraged unless a prior access plan has been described.
  - Suppression of large, fully involved systems may take more time than fires of similar size with different fuels. It is recommend fire service personnel continue to suppress with water for as long as required and then ensure the system is fully cooled throughout once suppression appears complete.

8.3 Guidance for Isolation and Overhaul

After burning, the removal and isolation of the batteries demonstrated real-world hazards that may be encountered in the overhaul stages of fighting a battery fire. Residual live DC voltages in intact battery cells, and damaged but still live bus bars within modules after a fire represent an electrical shock hazard (see Figure 11). During testing, it was found that firefighters were not shocked while wearing standard turnout gear when arcs and sparks resulted from disturbance of the debris. **For this reason it is recommended that whenever possible, first responders need not open or otherwise disperse burned battery modules and wait for an experienced liaison to arrive on site and take ownership of the site after extinguishing has been achieved.**

As shown in Figure 26, submerging battery modules in water provided adequate cooling to slow and prevent delayed cascading thermal runaway in the remaining battery cells; however, the batteries persistently off-gassed even under water. The primary gases detected in the bubbles generated were CO and possibly hydrogen. The figure demonstrates the bubbles observed even after submersion for over 30 minutes.

Even after submerging, some batteries generated a severely alkaline solution climbing to pH 10-11. Other solutions gradually became slightly acidic (pH 6). There was not a clear explanation for the pH behavior of the solutions, other than one of the most severely burned batteries created the most basic solution. **Therefore, if water submersion is used by first responders for isolating spent modules, preparation to deal with alkaline or basic water for disposal should be a consideration.**

Lastly, it was found that after extinguishing the persistent emission of CO was sometimes in quantities large enough to trigger threshold alarms on the gear worn by fire fighters. The persistent emission is perhaps a more insidious risk than the emissions during the fire, as the apparent climax of the fire has passed, and first responders may be inclined to remove their masks. **After extinguishing, continued ventilation and monitoring of the area with gas monitors is highly recommended.**

Figure 26 **Submerging batteries in water resulted in cooler temperatures, but slow shorting and persistent CO generation (bubbles).**

As the climax of the fire has concluded, but continued ventilation and monitoring is underway, first responders are left with the final challenge of determining when they can relinquish control of the area. There are several risks that first responders wish to avoid and they are prioritized by the list demonstrated on page 57. **It is highly recommended that battery systems installed within buildings have an established emergency contact list and a SME who can arrive on the scene to take over containment, cleanup, and eventual disposal of damaged battery equipment. This recommendation requires involvement from the project development and systems integration community.** This is a necessary risk transfer procedure to mitigate the first responder concern that they are responsible for damaged battery systems for hours or days after they have been involved in a fire or catastrophic safety event.

The following summarizes recommendations for overhaul procedures:

- **Overhaul and Stranded Energy:** As mentioned, stranded energy in the surviving cells remains a risk to first responder during overhaul and post fire operations.
    - Live or damaged but surviving cells may contain voltage that will cause arcing when shorted by debris or metal tools. This arcing may also serve as an ignition source to localized gases if hot batteries are still venting.
    - Firefighters should thoroughly avoid penetrating, cutting, or otherwise damaging batteries in the ESS, especially during overhaul, as live cells that are physically damaged or penetrated are subject to rapid venting.
    - Firefighters should avoid blindly reaching into cabinets to remove damaged batteries as DC energy may still remain active even if AC and site power is cut. It was observed that typical turnout gear provided adequate protection

against shocks in this testing; however, high voltage DC may penetrate PPE in cases where it is damaged or otherwise compromised, such as a torn glove or a exposure to sharp metals. These kinds of hazards were not studied in this testing program.

- DNV GL and RM recommend fire fighters continue to wear PPE and SCBA even during overhaul as CO levels may remain elevated even after flames are extinguished as batteries remain hot and continue to offgas. DNV GL recommends CO levels, especially in enclosed or unventilated spaces be monitored and SCBA worn until levels are shown to be safe.
- Complete submersion of damaged batteries in water provides cooling for damaged batteries; however, batteries continued to offgas CO. Because handheld sensors are cross sensitive to CO, H2 may have also been emitted while submerged. In addition, this did not always entirely neutralize the voltage on surviving cells. However, cells seem to remain stable once pulled from water and dried. Caution should be exercised when removing damaged batteries from enclosure/containment per the risks discussed above. Whenever possible, a relevant subject matter expert from the site, project owner, or manufacturer should provide guidance or control of removal.

9.0 FINDINGS RELATED TO CODES AND TRAINING

The following summarizes key recommendations from the report study. The findings are sorted in their relevance to sections of precedent codes.

9.1 Fire Rating

DNV GL testing has shown that naked cells[3] and modules exposed to direct fire are susceptible to failure within 10 minutes. However, systems deployed in the field, when exposed to external flame, are likely to sustain much longer durations because of the shielding and air gap provided by the enclosure since the cells and modules are not likely to be installed "naked" in an installed system. **Because many code precedents such as those shown in** Table 4 **and** Table 5 **require 1-hour fire ratings, and more conservative precedents require 2-hour fire ratings dependent on height above the ground floor, DNV GL recommends a minimum 1-hour fire rating with a 2-hour rating in areas with critical population density, and that the fire rating be considered as part of a system level approach to avoid cascading fires.** Exceptions to this general rule may include 1-hour requirement for outdoor locations, similar to combined heat and power (CHP) and backup generator requirements. The finite element analysis (FEA) model in Figure 28 demonstrates an Abaqus FEA model of a fire impinging on a generic battery system.

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[3] Cells not integrated into modules or systems

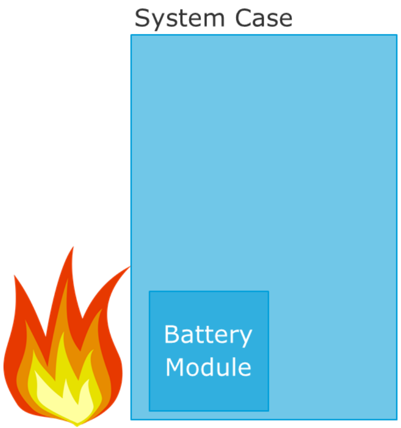

Figure 27 **Simplified diagram of fire impinging on the external wall of a battery energy storage system.**

The model demonstrates the heating effect on a battery module after 60 minutes of a 1000ºF fire (811K or 537ºC) impinging on a steel wall of 1/16" thickness, with a 1" air gap between the wall and the nearest inner battery module. For simplicity, the battery is assumed to be constructed of entirely aluminum or polypropylene in order to bracket the low and high temperature scenarios, because many battery modules are a composite of these or similar materials. After 60 minutes of exposure the model predicts the battery temperature to be 84ºC for the aluminum and 231ºC for the polypropylene[4]. Because a critical temperature for Li-ion batteries is ~120ºC, a conservative 2-hour rating on the system metal enclosure would slow heat absorption for the worst case polypropylene estimation.

The boundary conditions are a fixed wall temperature of 811K (537ºC or 1000ºF). Model components are a steel wall with temperature-dependent conductivity, an air gap (1 in) with temperature-dependent conductivity, and a composite battery case made of aluminium with fixed conductivity and polypropylene with fixed conductivity. The heat transfer modes are natural convection and conduction.

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[4] This may seem counterintuitive; the aluminum conducts heat away faster and therefore maintains a lower temperature than polypropylene.

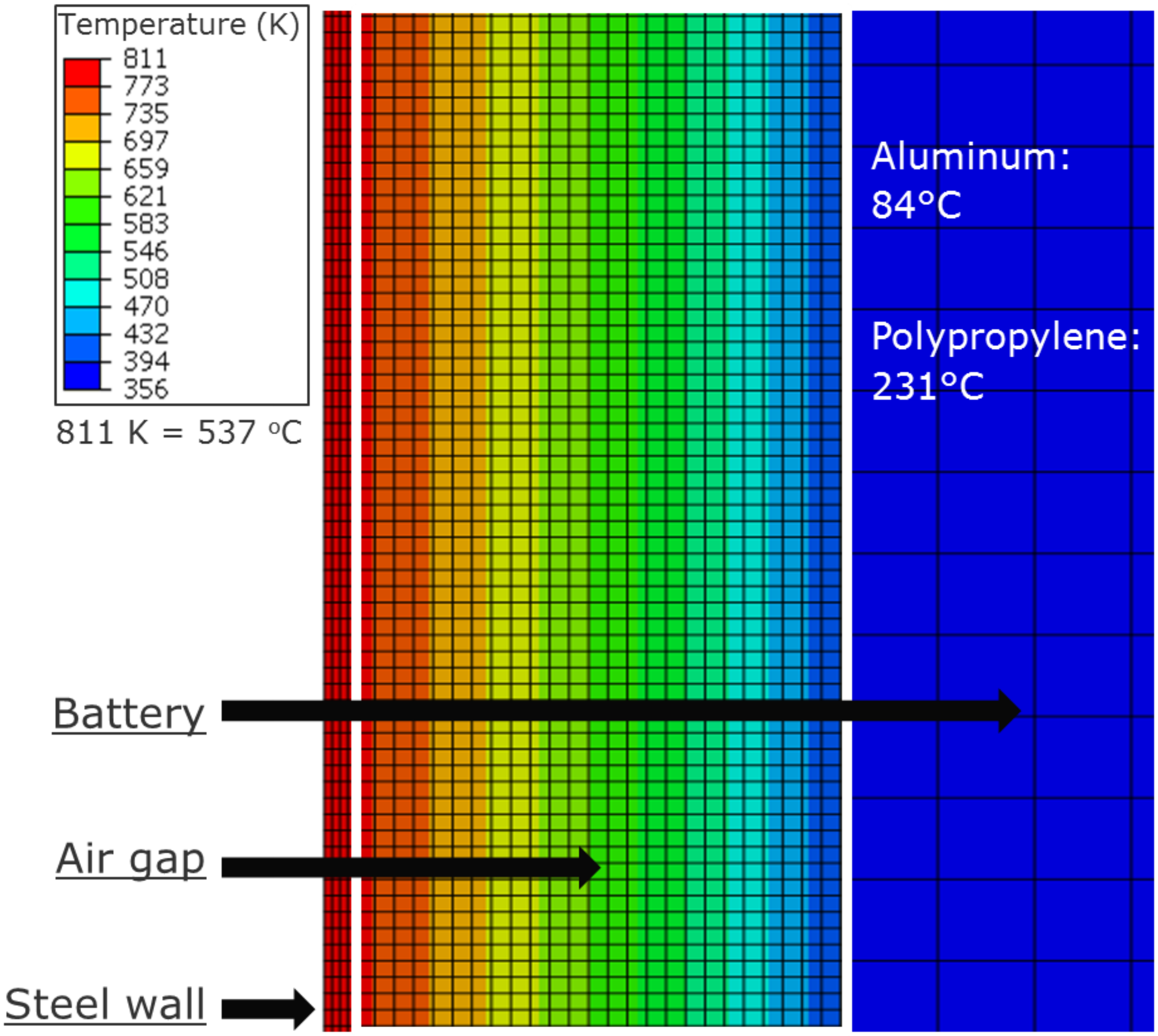

Figure 28 **Direct fire exposure model to a steel wall with a 1/16” thickness and 1” air gap between the wall and battery modules.**

Table 4 **Non-battery related codes for energy systems in buildings.**

	Non-Battery Codes			
Code Item	CHP	Backup Diesel Generator	Confined Spaces	OSHA Flammable Liquids 1926.152
Ventilation	Rated to maintain gas concentrations below 25% LEL of the fuel gas, or at an exhaust or makeup rate equal to 80 times the maximum leakage rate		Effective engineering controls required rather than dependence on respirators	Should be constructed to keep vapor at or below 10% of the LFL. Shall have pressure release capability to relieve pressure during a fire.
Fire suppression	Fully sprinklered	Automatic fire sprinkler system		Sprinkler, water spray, or CO2 or other system approved by nationally recognized test laboratory (NRTL).
Monitoring: Detection, alarm, display	Gas detection and alarm in supervised location		Monitor and display that potential hazardous atmosphere can be mitigated by forced ventilation	
Capacity limitation dependent on space	1 MW in dedicated room, 0.5 MW in boiler room	Fuel stored limited to 10 gallons		25 gallons outside storage cabinet, 60 or 120 gallons in cabinet depending on flammability category
Clearance		5 ft from other structures		3 ft wide aisle access
Thermal runaway protection	NA	NA	NA	NA
Fire rating	If indoors or in a dedicated room, 2-hour fire rating on external walls	Up to 2 hours		Compatible with NFPA 251-1969, 1-2 hour rating
Location	Outdoor, penthouse, boiler room, dedicated room	Outdoor, penthouse, boiler room, dedicated room		Electrical rated for Class I, Division I Hazardous Locations
Seismic rating	Appropriate for zone	Appropriate for zone	Appropriate for zone	
Accountable parties				
FMEA/HMA				
Inspections				
Signage				Flammable, keep away from open flames

Table 5 **Battery specific codes for battery systems in buildings, existing and proposed.**

	Battery Related Codes			
Code Item	**IBC**	**IFC 608**	**NFPA 1 Chapter 52**	**FDNY Certificate of Fitness (COF) B-29 (Uninterruptible Power Supply)**
Ventilation	307.1.1 Rooms shall have ventilation, batteries shall have venting caps	None for Li-ion		Required for Valve Regulated Lead Acid (VRLA) only, designed to limit H2 buildup to 1% of the entire room volume; Continuous ventilation = 1 CFM per ft^2 of room
Fire suppression	403.3 and 903.2 Not required in external structures with fire detection	**Proposed** Chapter 5 of NFPA 13.		Sprinklers not required but recommended. Portable Class ABC on hand.
Monitoring: Detection, alarm, display	907.2.23 Smoke detection system			Hydrogen monitoring or handheld detector for COF holder, system health status
Capacity limitation dependent on space		> 50 gallons electrolyte or 1000 lbs. Li-ion. **Proposed 20 kWh limit for single units, 600 kWh limit for total in a room.**	100 gallons of electrolyte (sprinklered) or 50 gal electrolyte (unsprinklered) or 1000 lb. Li-ion	50 gallons of electrolyte for Pb acid, VRLA, NiCd, or 1000 lbs. for Li-ion
Clearance		**Proposed** 3 ft between arrays no larger than 50 kWh. 5 ft from lot lines for outdoor.		
Thermal runaway protection			Required	Required for both VRLA and Li-ion
Fire rating	Table 509 1 and 2 hour ratings			
Location		**Proposed** no more than 75 ft above or 30 ft below fire access, exceptions on non-combustible rooftops		
Seismic rating	Appropriate for zone	Required for zone	Appropriate for zone	Appropriate for zone
Accountable parties				Equipment shall be under "general supervision" of certificate holder, in case of emergency there shall be a hazardous materials liaison, contact info available to fire command center
FMEA/HMA		HMA required		
Inspections				Performed by COF holder. Record keeping on site.
Signage				Warning against electrolyte or voltage. Battery information on Building Information Card.

9.2 Extinguishing

DNV GL tested a number of extinguishers during cell and module testing. During testing, DNV GL found that all extinguishers tested[5] could put out the fire if applied immediately upon detection of a thermal spike (indicating the immediate onset of thermal runaway). While extinguishing was accomplished with all extinguishers, water demonstrated the best ability to cool and maintain cool temperatures on the battery.

9.2.1 Class D and Deep Seated Fires

During testing, DNV GL witnessed firsthand how residual heat between batteries can lead to delayed cascading and prolonged extinguishing for battery modules. This highlights the importance of cascading protections between cells and inter-cell cooling in battery modules. Cascading protections can be tested by the UL 1973 internal fire test, the IEC 62619 internal propagation test, SAE J2929 propagation test, or similar standards. DNV GL recommends more stringent criteria such that a single cell failure cannot propagate to neighboring cells, with the intent of maintaining manageable heat release rates that can be otherwise managed by the water extinguisher flow rate and/or the system's external fire rating enclosure. This recommendation illuminates that the extinguishing solution and the module design are interlinked; a module with adequate cascading protection is more likely to be appropriately designed with a gas-based suppression system.

Because the consumption of a single cell is rapid, the metal fire fuels (Class D) are rapidly consumed and the fire evolves to Class A, B, or C quickly. **Because of the rapid evolution of a cell fire, DNV GL does not see an advantage to using a Class D extinguisher on a single cell or system fire.** This has direct implications for first responders who are accustomed to using water as their primary extinguishing agent. In the event of a single cell fire, cascading protections should limit propagation to other cells. First responders may still respond to a call reporting smoke, but in the best case scenario the fire has consumed itself and burned out. If a fixed suppression agent is installed within an enclosed environment containing the single failed battery cell, it may suppress flammability in the enclosed space. The use of water may be unnecessary at this point unless the fire has progressed. A key issue to be addressed in later sections is how the first responder is able to determine if this single cell fire has been mitigated or if further action (and water extinguishing) is needed, and hence some system health information, an emergency response phone line, or some other means to gain information on system health is a need that requires industry engagement to overcome. The first responder is not comfortable deeming the site extinguished and is technically responsible for the scene until this information allows them to make the decision to leave the control of the scene with a responsible party.

9.2.2 Cooling and Collateral Damage

Cooling is a secondary component of extinguishing that has not been previously discussed in the literature. In 2011, the NHTSA recommended “copious amounts of water” in an official release concerning the extinguishment of battery fires in hybrid and electric vehicles. [12] The intent and purpose of this recommendation was to introduce cooling to the fire.

DNV GL found that water extinguishes, cools, and maintains lower temperatures on a battery fire than other tested agents. As shown in Figure 29, water consistently maintained a 50-100°C sustained cooling advantage over equivalent volumes of other water borne

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[5] For the complete list of extinguishers tested, see the Appendix, page 82.

agents in the seconds and minutes following extinguishing. The behavior demonstrated in the figure is consistent for all battery types, with the heat decay duration, “reheat” period, and peak temperatures varying as a function of cell mass.

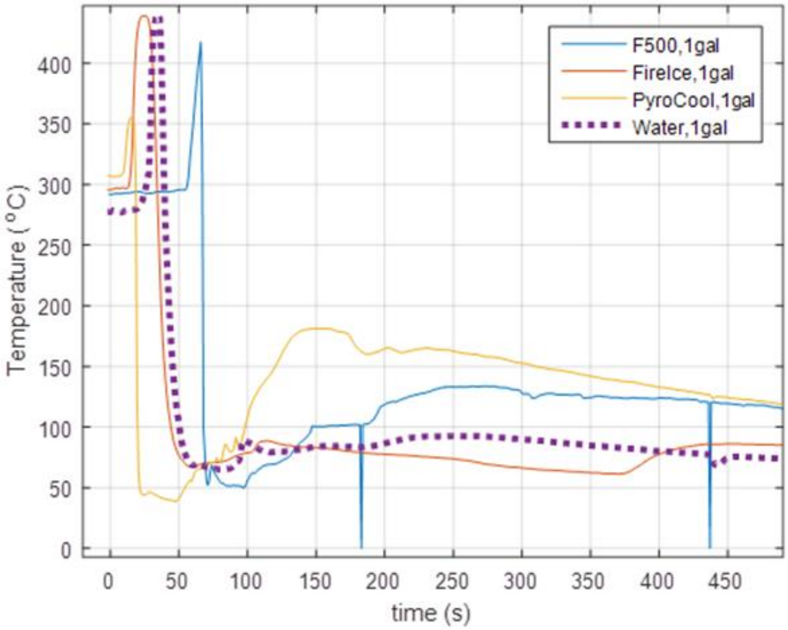

Figure 29 **Performance of water compared to other agents as water additives, top temperature of battery cell.**

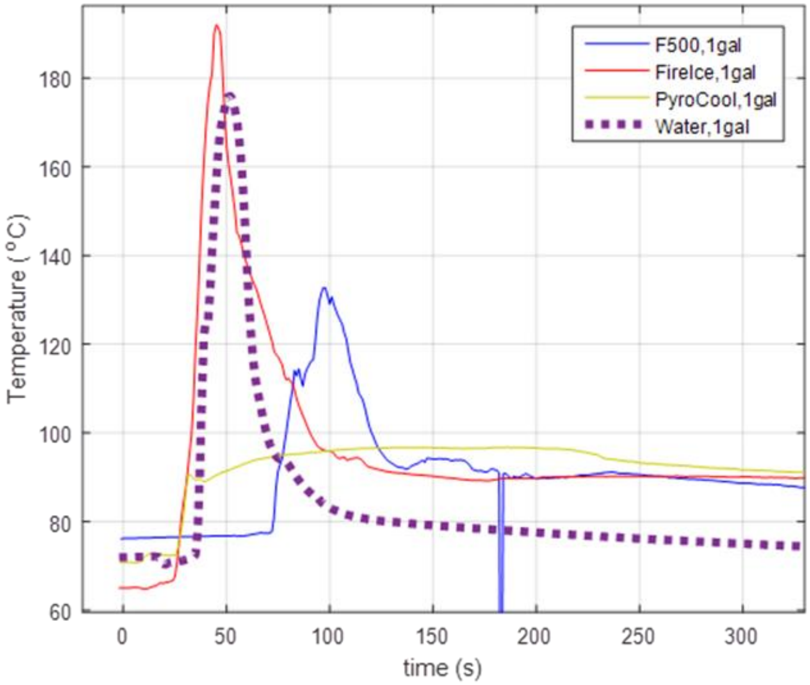

Figure 30 **Cooling performance of water compared to other extinguisher types, bottom temperature of cell.**

The initial cooling rate is nearly equivalent for all extinguisher types, but the thermal mass of the battery causes the extinguishing agent to evaporate as temperatures climb back to 250-275°C. Extinguishers were triggered the moment the battery fire climbed above 350°C. In each case 1 gallon of water was applied. In all instances the total extinguishing time spanned less than 60 seconds, or about 1 GPM.

The duration of this "reheating" is approximately 200s for non-water agents, whereas water is shown to reheat for about 100 seconds. Therefore, DNV GL saw no particular cooling advantage of water borne agents such as F-500, FireIce, or Pyrocool over water alone. (Figure 29) Some of these agents are encapsulators, which are designed to blanket a fire and insulate surrounding areas from heat; in an exothermic battery fire, trapping heat is undesirable. The figure demonstrates that cooling with water persistently achieves lower sustained temperatures after extinguishing, with as much as a 50-100°C advantage within 1-2 minutes of extinguishing (See appendix on page 76). This data demonstrates that water and all water borne agents reduce cell temperatures from > 400°C to near 50°C within 10-30 seconds. Water can maintain cell temperatures after extinguishing below 100°C even as the initial mass of water evaporates.

An additional vendor provided an aerosol agent to be tested. The aerosol was observed to extinguish the cell fire. The aerosol provides some initial cooling but does not reduce cell temperature until the exothermic reactions of the battery begin to decay. It was shown that the cooling ability of the aerosol was significantly less than water.

Because cooling is an inevitable need, a fixed suppression gas agent may reduce or mitigate flammability in an environment until ventilation and/or cooling strategies are implemented.

While the use of water demonstrates excellent cooling capability, it also potentially shorts out undamaged cells or neighboring modules. The use of water is a fully committed extinguishing tactic that is highly likely to result in a total loss of the asset.
Because it was noted that the aerosol test demonstrated extinguishment of the fire upon execution, aerosols can potentially serve as an initial attack for the fire followed by water as a backstop.

Therefore, DNV GL recommends the following:

- **Stage 1: If a system can limit cell cascading, a gas based suppression system may be considered for the first stage of fire fighting to extinguish a single cell fire and prevent flashover in a contained environment.**
- **Stage 2: If temperatures continue to rise or if an increasing level of smoke and gas is detected, forced ventilation and water extinguishing should be considered to cool the system and prevent further propagation of fire.**

Stage 1 provides an opportunity for avoiding collateral damage and total asset loss. Stage 2 provides a backstop for a situation when more than one battery cell is on fire. Both stages may also include some form of alarm or notification external to the battery system that notifies first responders of elevated risk.

9.3 Locations and Ventilation

DNV GL quantified that the gases emitted from a battery fire have somewhat differing toxicity and flammability risks across chemistries. However, mitigation of toxic or flammable gases is addressed with ventilation in all cases.

9.3.1 Outdoor Locations

Toxicity of the fire should be modeled to account for the impact on neighboring areas. The fire may be modeled in scenarios of increasing severity, such as a single cell fire of short duration, a module fire of short and long duration, and a total system fire.
The probability of fire, size of the system, plume contents, proximity of nearby buildings, wind direction, and duration of the fire will have an impact on the location of fencing and safety perimeters. It is the discretion of the project owner to consider these hazards.
DNV GL deploys a tool called PHAST for plume models [58] and uses the output to inform the risk analysis. This model directly impacts a FMEA, Bowtie, HAZID, or other hazard analysis as required by UL 9540 or standards with the same intent. It is implied by ANSI and IEEE 1547 updates that UL 9540 will be a requirement for energy storage projects, which includes FMEA for the system and related ancillary equipment. [25] As shown in Figure 25, it is common practice for a safety review to occur during permitting and prior to installation. This review may include the FMEA as required by UL 9540, or it can be part of an independent engineering review on behalf of the lender, project developer, or insurer.

9.3.2 Indoor Locations (Penthouse or Dedicated Room)

Emissions from batteries are simultaneously flammable and toxic during failure. The emissions characteristics of a Li-ion battery are shown in Figure 20. In all of the tests conducted in this program, this behavior was consistent among all Li-ion batteries. The figure indicates that 40-90% of the time, a single battery cell emissions rate corresponds to less than 10 ppm in a 0.44 m^3 volume. The peak event can exceed 200 ppm in this volume for a single cell, and it is short lived (2-3 minutes).

Similarly, it was found that vanadium oxide electrolytes emit HCl and HF, with HCl occurring in greatest quantities (see Figure 6 on page 12). Lead acid battery electrolytes emit SO_2 and HCl when heated (see page 12, Figure 7, and Figure 8). The mass and volume equivalent concentrations of emissions from all battery types are included in Figure 4 (peaks) and Figure 5 (average ppm per kg per minute).

A common toxic emission from all battery types was HCl. This is also common with plastics fires. Because the IDLH rating for HCl is low and the quantity of HCl emission is typically largest among the four toxic constituents monitored, the ACH rating is therefore governed by HCl. As shown in Figure 5 all battery types average lower than 2 ppm per kilogram per minute in the categories of CO, HF, HCN, and HCl emissions.

IDLH and Emergency Response Planning Guidelines (ERPG) values for HCl, HF, HCN, and CO are shown in Table 6. The term immediately dangerous to life or health (IDLH) is defined by the US National Institute for Occupational Safety and Health (NIOSH) as exposure to airborne contaminants that is "likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment."

- ERPG-1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.

- ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.
- ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

Table 6 **Immediately Dangerous to Life and Health (IDLH) for the emphasized toxic gases identified in the testing work.**

	IDLH (ppm)	ERPG-1	ERPG-2	ERPG-3
HCl	50	3	20	150
HF	30	2	20	50
HCN	50	n/a	10	25
CO	1200	200	350	500
SO_2	100	0.3	3	25

This dynamic and varying emissions rate was time-averaged and then charted as a function of air change over rate (air changes per hour, or ACH), of the battery mass undergoing failure, and the room volume. Because this time averaged calculation includes the nonlinear effect of higher emissions during the peak, this ACH calculation is overly conservative for 40-90% of the duration of the battery failure event. As mentioned previously and as shown below, HCl (Figure 16) governs the dominating air change over requirement because of the low IDLH value. The chart in Table 15 on page 67 converts ACH to CFM based on room size and approximate room footprint. In all cases the ACH rate is calculated to maintain gas concentrations below IDLH.

An air change rate of 0.25 ACH is sufficient for limited cell failure scenarios to mitigate HCl in the room sizes considered (see Figure 16). The peak emissions rate for up to 1.5 Li-ion modules (typical masses assumed) would require up to 11.5 ACH. This is within normal laboratory building ACH requirements, by comparison (Table 8 on page 51), and ASHRAE notes that 1 – 4.4 ACH is common in residential and commercial environments. [26] **This clarifies DNV GL's recommendation that ventilation requirements are within established limits of the built environment as long as the system demonstrates it can limit propagation of cell failures with cascading protections**

- CO (Figure 18 and Table 13 on page 66) can be mitigated in all scenarios with only 0.25 ACH.
- HF (Figure 19 and Table 14 on page 66) can be mitigated with 0.25 ACH in the most probable failure scenarios and may require up to 14.5 ACH in the smallest room considered.
- HCN emissions rates can be mitigated for the most probable failure scenarios (a single or multiple cells) with only a 0.25 ACH. In the worst case scenario of 1.5 failing modules, the ACH is 7.5.

Note that **HCl and HF govern the ventilation requirements, which implies that the ventilation requirement is determined by toxicity, not flammability**. This is because toxic gas IDLH limits are between 30-50 ppm, while flammability limits for many gases are in the 1,000-10,000+ ppm range. The assumptions used in this calculation are shown below. The emissions rates assumed for the ACH calculations are the average of the emissions measured during cell testing. A 30-minute release rate is conservative, and accounts for an average of emissions rate that is higher than the low level emissions leading up to peak failure, and lower than the peak emissions.

9.3.3 GPM and CFM Requirement

It is shown in Figure 15 that the heat release rate has a weak positive correlation to mass lost because the linear fit has a positive slope but the R^2 is low due to scatter in the data. As discussed on page 4, the scatter is due to the nonlinear behavior of battery fires. As shown in Figure 20 the battery spends between 40-90% of the time in a smoldering state, meaning that the exothermic contribution to the fire is low during this period and much of the battery mass is lost during this time, which means there is less to contribute to the peak HRR event. It was also shown in Figure 12 that it was possible to reduce the water requirement as testing progressed on modules and systems. This data was directly measured from the masses of the cells and modules and the water used.

The theoretical minimum water requirement *for the battery mass* (not the system mass) is calculated in Table 7. It should be noted that the water calculation is determined in units of GPM/kg; dividing this number by the energy density (commonly given in Wh/kg) will convert the result to GPM/Wh, and multiplying by 1000 Wh/kWh will convert the result to GPM/kWh. A cross check for these conversions will be needed as energy density of batteries will inevitably increase over time.

For context and benchmarking, typical ventilation and water sprinkler requirements are shown in Table 8 on page 51. The range of possible values for the GPM/kg of battery are shown in Figure 31 on page 54. Table 15 on page 67 shows conversion factors between ACH, CFM, and CFM/ft^2.

The aggregate of such data is shown on page 67, which demonstrates the means to estimate water flow and ventilation flow requirements based on system size. In some cases it can be seen that the ventilation rates and GPM requirements are within the norm of building codes. This is translated in Table 10 on page 53. However, the factors that affect this most are the mass of batteries, their energy density, and the volume of the room where they are installed. The air volume in larger rooms will dilute emissions, resulting in lower requirements for air change.

DNV GL and Rescue Methods found that the water requirement per kg of battery material decreased as the quantity of modules became larger (Figure 31). It is acknowledged that initial testing began with an arbitrary water volume at the cell level, and it was found that this quantity was more than sufficient—and is therefore excessive—for a practical application. **DNV GL recommends that further study be considered to find the minimum water requirement for extinguishing and measure the physical parameters impacting water contact efficiency**

Because outdoor systems are likely containerized they are also likely to include on-board gas-based fixed suppression systems. As recommended by DNV GL in the extinguishing section (see page 45), a gas based suppression system may serve as a first line of extinguishing. Adequate sizing of nearby fire hydrants should be considered in the context of the maximum possible heat load during a system fire.

Table 7 **Example calculation to determine the minimum water requirement per kg of burning cell.**

Theoretical Minimum Water Requirement to Cool a Battery	
Battery burn time (min)	42.25
water density (kg/gal)	3.7
m battery (kg)	2.87
c water (kJ/kgC)	4.1
c battery (kJ/kgC)[6]	1.4
ΔT battery (deg C)	525
ΔT water (deg C)	75
Q battery (kJ)	2,107.0
m water (kg)	6.9
vol water (gal)	1.9
GPM	0.044
Theoretical Minimum GPM/kg	0.015

Table 8 **Benchmarks for airflow and water flow for typical structures.**

Benchmarks	CFM/ft^2	GPM/ft^2	Sources
Libraries	0.12	0.05-0.3	*ASHRAE Addendum n to ANSI/ASHRAE Standard 62-2001 "Ventilarion for Acceptable Indoor Air Quality" and NFPA 13 Area Density Curves*
Warehouses	0.06	0.05-0.3	
Pharmacy	0.18	0.05-0.3	
Laboratories	0.18	0.05-0.3	

Based on the known test data, DNV GL is able to recommend the following across the aggregate of battery chemistries. The values in Table 9 are derived from Table 16. These are converted to example CFM/ft^2 and GPM/ft^2 values in Table 10 on page 53.

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[6] Estimated by phenolic, given that the battery is a composite of multiple polymers, liquids, and some metals.

Table 9 **Values derived from probabilistic analysis of water flow rates (GPM) and air flow rates (CFM) per system energy (kWh) or mass (kg).**

Scalable Metrics for Systems based on Electrochemical Battery Mass and Energy Content

	25th Percentile	Mean	75th Percentile
Water Flow Rate GPM/kg	0.07	0.10	0.20
Water Flow Rate GPM/kWh	0.70	0.99	2.09
Air Flow Rate CFM/kg	0.01	0.02	0.03
Air Flow Rate CFM/kWh	0.11	0.18	0.31

A sensitivity analysis is demonstrated with calculated regression coefficients. The uncertainty in the calculation is captured by triangular probability distributions created in Table 16. In regression analysis, the coefficients calculated for each input variable measure the sensitivity of the output to that particular input distribution. The sensitivity of the calculation of the ventilation rate is shown in Figure 35.

The energy density, cell mass, and emissions rate from the cell are the greatest influencing factors in 90% of the calculated outcomes. **DNV GL recommends that when calculating the air flow and water extinguishing rate, one must account for battery energy density (only the battery cells, not the entire system) as well as the duration of the event.** The sensitivity of the calculation of the water flow rate is shown in Figure 36. The two main factors influencing the calculation are the range of flow rates found during testing and the range of possible energy densities of the battery system.
These uncertainties demonstrate the following:

- Energy density and the emissions duration should dictate the ventilation requirement
- Energy density and the duration of the event affect the extinguishing requirement

In Table 10 some example ventilation and water extinguisher ratings are calculated based on hypothetical systems. The values in Table 10 are calculated from Table 7 and demonstrate the mean of probability distributions generated from Table 16. The distributions of the water requirement is skewed to the left, as shown in Figure 31. The table demonstrates how these findings translate to codes development via examples. The table demonstrates that the ventilation and water requirements are within the scope of present requirements for the built environment when the system is placed within adequate room volumes (compare with Table 8). Considerations of whether the spaces are occupied or whether they are outdoors apply.

In practice, these results will depend on the actual system weight and room size on a per project basis. When considering a containerized system, the following additional considerations may occur:

- A containerized system may not be considered a livable or occupied space and therefore may have different code considerations.
- The water requirement in Table 10 is equivalent to about 4-5 garden hoses and is less than half the GPM rating of a typical 2.5” line (250 GPM). If the system is already equipped with a gas-based fixed suppression system, a parallel water

connection on the exterior would accomplish the goal for first responders to create a cost effective internal sprinkler system as a backup to the fixed suppression system.

The calculated airflow requirement can be oversized with a variable speed fan that meets the minimum air change requirement and may peak upon detection of smoke or particulates.

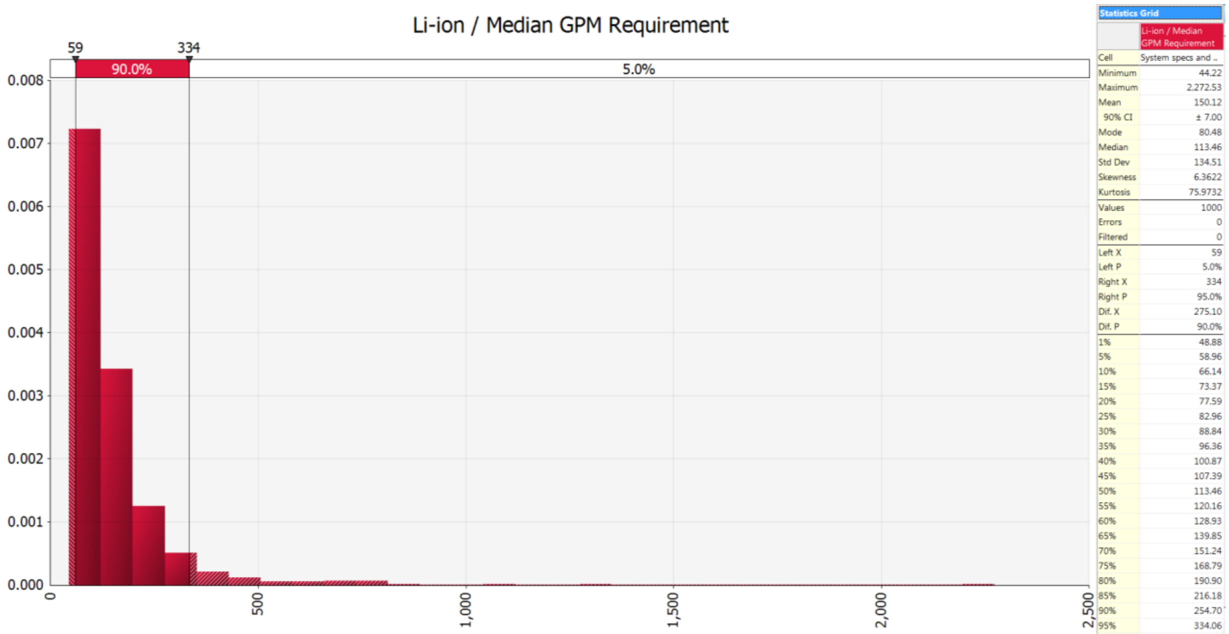
The leftward skewness of the distributions for both the GPM requirement and the ACH requirement is demonstrated in Figure 31 and Figure 32.

Table 10 **Example implications based on extrapolated findings from testing. It can be seen that the calculated water requirement is within the bounds of what was described for libraries, pharmacies, warehouses, and laboratories; similarly the air flow requirements can be at or below unless the room volume is too small.**

Example Code Requirements

System Size (kWh)	System Chemistry	Estimated Mass (kg)	Estimated Room Size (ft^2)	Ventilation Requirement (CFM)	Theoretical Minimum GPM Requirement	Median GPM Requirement	GPM Requirement at 0.1 GPM/kg	CFM/ft^2	Min GPM/ft^2	Median GPM/ft^2
20	Li-ion	133.3	100	2.3	2.0	2.2	13.3	0.02	0.02	0.02
100	Li-ion	666.7	146	11.7	9.8	11.2	66.7	0.08	0.07	0.08
100	Pb Acid	3,333.3	200	58.4	*UPS Requirement*			0.29		
1000	Li-ion	6,666.7	300	116.8	98.1	111.8	666.7	0.39	0.33	0.37
1000	Vanadium Redox	20,000.0	1500	350.4	*Standard Commercial*			0.23		

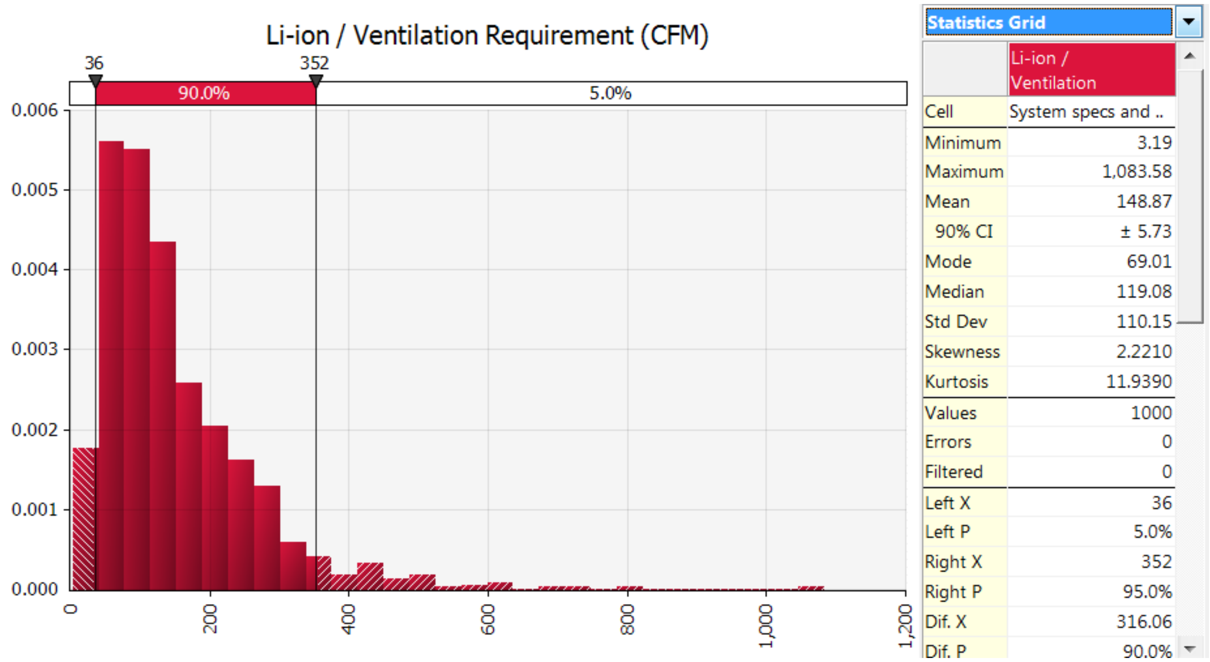
Note: Fire flows in excess of 3,000 GPM per buildings are considered impractical for many state fire codes. Consideration of battery flammability, cascading protections, and building water supply should be considered. For containerized systems, a parallel system may be fed externally by fire hose.



Statistics Grid

	Li-ion / Median GPM Requirement
Cell	System specs and ..
Minimum	44.22
Maximum	2,272.53
Mean	150.12
90% CI	± 7.00
Mode	80.48
Median	113.46
Std Dev	134.51
Skewness	6.3622
Kurtosis	75.9732
Values	1000
Errors	0
Filtered	0
Left X	59
Left P	5.0%
Right X	334
Right P	95.0%
Dif. X	275.10
Dif. P	90.0%
1%	48.88
5%	58.96
10%	66.14
15%	73.37
20%	77.59
25%	82.96
30%	88.84
35%	96.36
40%	100.87
45%	107.39
50%	113.46
55%	120.16
60%	128.93
65%	139.85
70%	151.24
75%	168.79
80%	190.90
85%	216.18
90%	254.70
95%	334.06

Figure 31 **Distribution of gallons per minute for a 1 MWh battery, calculated from cell testing and extrapolating with the latent heat value, which demonstrates that the 0.1 GPM/kg estimation is highly conservative.**



Statistics Grid

	Li-ion / Ventilation
Cell	System specs and ..
Minimum	3.19
Maximum	1,083.58
Mean	148.87
90% CI	± 5.73
Mode	69.01
Median	119.08
Std Dev	110.15
Skewness	2.2210
Kurtosis	11.9390
Values	1000
Errors	0
Filtered	0
Left X	36
Left P	5.0%
Right X	352
Right P	95.0%
Dif. X	316.06
Dif. P	90.0%

Figure 32 **Example of the air flow requirement for a 1 MWh Li-ion system, demonstrating that the distribution of values is strongly skewed leftward.**

9.4 Inspection and Monitoring

DNV GL's testing revealed that, besides lingering offgases such as CO, lingering (unseen) internal temperatures and residual voltages on unburned cells presented a hazard to first responders.

Similar to the code for uninterruptible power supplies, which recommends hydrogen monitoring and a system health status display (see Table 5), **DNV GL recommends at a minimum that an error status panel, emergency response contact, or other form of error notification be available to first responders, and that the energy storage supply chain engage with first responders to propose a viable solution.** Current codes for UPSs include a display panel for inspection and error notification purposes.

If a system has been in a fire which has been contained by internal fire suppression, such a display panel is enough to alert first responders that the system has sustained damage. They may be able to call in a specialist to handle the hazard and relieve FDNY of their responsibility for the site.

There are technical parameters that have direct impact on the volatility of the system, though it is debatable whether they should be the responsibility of the first responder. Recall that the ultimate objective of the first responder is to protect life, preserve property, and ultimately secure the scene. The intent of system health notifications or an emergency response network is to alleviate the concern of the first responder that he/she will somehow be obligated to own an unknown hazard. The project development community would serve its own interest to support first responders in creating a means to facilitate a hand-off from the first responder to a project owner with good certainty that the hazard is under control.

9.5 Clearances

As referenced in Table 4 and Table 5, the majority of codes identify a 3-5ft clearance on energy devices within enclosed spaces. [4]

In addition, from an economic and technical standpoint, limitation of footprint of energy storage systems directly undermines one of the key value propositions of energy storage, i.e., high density stored electrical energy in a small space where it is most needed. Therefore there is a need to weigh overly prescriptive recommendations against the actual hazard. Recall that in DNV GL's model (also supported by testing) a system could withstand 60 minutes of direct fire at 1000^{o}F with only a metal barrier and an air gap (see Figure 28 on page 42).

The current rule structures (NFPA 855, IBC, and IFC updates may allow for local AHJ exceptions for the spacing and quantity of energy storage systems provided they pass a risk analysis).

With these considerations, DNV GL recommends that all system installations undergo a risk analysis, with particular attention paid to:

- **Cascading protections between cells and modules**
- **Clearances to structures above the energy storage systems**
- **Fire rating of the enclosure**
- **Most probable expected failure mode**

This recommendation is consistent with the IEEE 1547 and ANSI recognition of UL 9540 because of its FMEA process. Because cascading protections have been overlooked in safety incidents (see Literature Review) it is highly important that this consideration be emphasized in the up-front risk analysis. Clearances to nearby structures are presently being recommended on a kWh basis, which may inadvertently limit the effectiveness of energy storage by artificially increasing its footprint and therefore its effective functional power and energy density. The risk analysis should provide a foundation for stakeholder agreement on when the risks are deemed acceptable to exceed these requirements. Similarly, the fire rating of the enclosure, if exceeding specification, may create opportunities to reduce spacing or clearances. And the most probable failure mode is the most important part of the risk analysis; it helps differentiate risks that seem significant but are actually low probability, versus risks that are probable and measurable, and then design with cost effectiveness and practicality.

9.6 Room Capacity Limitations

The holding capacity of an enclosed space is dependent on a number of factors:

- As shown Figure 20 the total quantity of emissions from burning batteries is dependent on the mass available and the nonlinearity of its emissions rate.
- As shown in Figure 20, the battery fire is largely a smoldering event until a 2-3 minute peak.
- It was also mentioned in “Extinguishing” on page 45 that cascading protections between cells have a direct impact on the propagation of the event to the entire system.
- It was also found in this work that peak room temperatures in a fire are directly correlated to the mass of the battery (see Figure 38 on page 76).

Present guidance is suggesting limitations on battery systems as a function of kWh capacity. It should be noted that energy density (kWh/kg) in battery cells is continually increasing as new generations are released. Prescribing a code based on mass (kg), would present the challenge of increasingly higher amounts of energy being deployed under the same mass constraint. The precedent is a limitation of 1000 lbs. (453 kg) of Li-ion batteries in a space without suppression, which at today’s typical Li-ion energy density of ~150 Wh/kg, corresponds to about 67.9 kWh. Proposed IFC language will reduce this to 20 kWh for single units with a total limit of 600 kWh in an enclosed space.

As previously stated, DNV GL recommends that a risk analysis be performed on any basis where battery systems larger than 20 kWh and assembled in aggregate shall be installed in an enclosed space, with the intent of answering these questions:

- **Is the system functionally limited by the code rating?**
- **Does the system have design features that prevent cascading failure between cells and modules? (See fire test, UL 1973 test, or IEC 62619 test data.)**
- **Is the baseline and peak ventilation capacity adequate for the potential off gas? (Example, Figure 16)**
- **Is the sprinkler system adequately designed for the potential heat load and battery chemistry? (Example, Figure 29)**

- **Does the protective casing provide adequate insulation and fire blocking? (Example, Figure 28)**

The output of this analysis should determine if the rules are too prescriptive for the case being considered, or alternatively, if the rules have not adequately captured a safety risk.

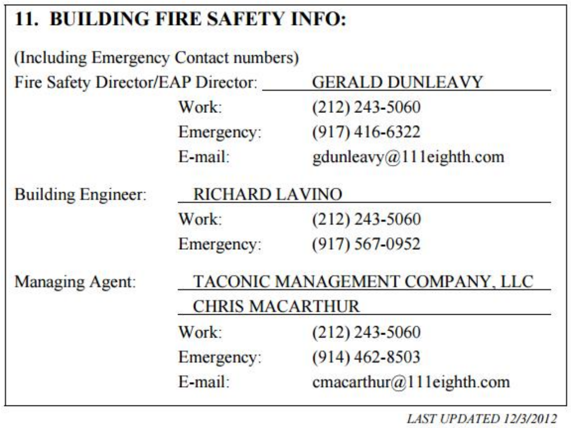
9.7 Project Development Considerations for Interaction with First Responders and AHJs

DNV GL surveyed several handbooks for fire departments in large cities across the country and found a universal theme in fire fighter training concerning extinguishing. Fire fighters are trained to achieve the following objectives when arriving at the scene:

- **Objective 1:** Remove endangered person(s) and treat the injured.
- **Objective 2:** Stabilize the incident and provide for life safety.
- **Objective 3:** Provide for the safety, accountability, and welfare of personnel (this priority is ongoing throughout the incident).
- **Objective 4:** Protect the environment.
- **Objective 5:** Property conservation.

Note that Objective 5 is often the primary concern of the property owner. It is on the priority list of the first responder, *but safety of life at the scene takes precedence.* The following recommendations for emergency response specific to batteries refer to these objectives. These are based on the UPS battery system precedent that already exists in New York City.

- Battery systems should be described in the Building Information Card (BIC) (see example, Figure 33). This greatly aids in first responders meeting **Objective 2**.
- A building should have an assigned liaison who works with FDNY to update emergency response plans. This liaison may be the same as the certificate of fitness (COF) holder for the battery system, or may be a different individual. This Liaison should be listed in the BIC. **This aids first responders in meeting Objectives 2 and 3, and also protects the property owner's interest relating to Objective 5.**
- Battery systems should have a COF similar to what is required for UPS systems. Again, this aids in **Objectives 2, 3 and 5.**
- The recommendations for monitoring and system health display are consistent for codes for uninterruptible power supplies. The method of system health display and monitoring should be proposed by the system integrator or project owner.



11. BUILDING FIRE SAFETY INFO:

(Including Emergency Contact numbers)
Fire Safety Director/EAP Director: GERALD DUNLEAVY
Work: (212) 243-5060
Emergency: (917) 416-6322
E-mail: gdunleavy@111eighth.com

Building Engineer: RICHARD LAVINO
Work: (212) 243-5060
Emergency: (917) 567-0952

Managing Agent: TACONIC MANAGEMENT COMPANY, LLC
CHRIS MACARTHUR
Work: (212) 243-5060
Emergency: (914) 462-8503
E-mail: cmacarthur@111eighth.com

LAST UPDATED 12/3/2012

Figure 33 **The FDNY Building Information Card (actual example) contains emergency contact information for fire safety and building engineers.**

9.8 Considerations for Battery Chemistries that are not Li-ion

Much of the data in this report pertains to Li-ion because the majority of battery cells tested are variants of that chemistry. However, the data contained in this report should concisely demonstrate the following:

- Vanadium redox and Pb acid electrolytes are not flammable.
- Vanadium redox and Pb acid electrolytes do represent a toxicity hazard when heated.
- Polymer cases for any battery are flammable and will contribute to a fire as fuel and a source of toxic emissions.

While not tested explicitly in this study, it is also worth mentioning that under rare circumstances lead acid batteries are also capable of so-called thermal runaway, i.e., an exothermic failure. Because the members of the battery industry have taken great care to differentiate themselves in the area of safety, with nearly all chemistries that are *not* Li-ion using marketing language such as “safe”, “nonflammable”, “thermally stable”, “environmentally benign” or “incapable of thermal runaway”, there is a need to clarify a universal finding in this program: in the case of external fire, all batteries emit toxic gases. It should also be noted that the average emissions rates of equivalent masses of plastics exceed those of batteries. Every battery tested either emitted a gas or left a residue that has a varying degree of hazard (Table 3 on page 29); however, this can be expected from most fires. The general findings of this work conclude that water and ventilation requirements are within the technical limitations of legacy building codes, i.e., there are precedents for managing these hazards.

All of the batteries tested carry with them a risk in their deployment; however, all of the risks identified are manageable within the realm of today’s engineering controls for safety. In addition, the toxicity and flammability risks identified are not insurmountable or highly unique when compared to the challenges of burning hydrocarbons or plastics, and the resulting requirements in codes, if implemented, are within the boundaries of the typical built environment.

DNV GL’s recommendations are the following:

- **If a battery is demonstrated to have a non-flammable electrolyte, there may be considerations for a reduced water extinguisher requirement, or at a**

minimum a water requirement equivalent to that required for the space without battery systems installed.

- **The ventilation requirements should be the same for all battery chemistries tested in this program because they all have varying degrees of HCl or similar toxic emission upon heating.**

Lastly, the emissions rates of equivalent amounts of plastics during a fire, including common every day materials that are found in office environments, commercial and industrial settings, and even residential homes, can exceed the quantity of emissions from a battery fire and will emit HCl as well.

10.0 SUMMARY OF MAIN FINDINGS AND RECOMMENDATIONS

The below directly summarizes key findings and recommendations from this study. These are placed in list form up front in the document for access and readability. The reader is strongly encouraged to use the cross references in the report to learn the reasoning behind the recommendations, or read the FAQ section for clarifications.

- The toxic emissions from fires in this study are not necessarily excessive in content or quantity, and can be managed by today's engineering controls.
- The code requirements for battery systems have the potential to fall within the boundaries of legacy codes, provided that technical and practical engineering considerations are made concerning room volume and battery size.
- DNV GL recommends a minimum 1-hour fire enclosure rating with a 2-hour rating in areas with critical population density.
- For the intent of delaying the escalation of the fire, all systems with individual cells as part of their assembly should either demonstrate that a single cell failure cannot propagate to neighboring cells in a module design or demonstrate that a module design contains adequate external fire protection to contain the heat and flames to that module, which may exceed the acceptance criteria for UL 1973 or the IEC 62619 internal propagation test.
- Because of the rapid evolution of a cell fire, DNV GL does not see an advantage to using a Class D extinguisher on a single cell fire, given the difficulties of access and timing. While technically appropriate, the deep seated nature and window for access present technical challenges; the need for cooling should be prioritized.
- Fixed suppression gas agents may reduce or mitigate flammability in an environment until ventilation and/or cooling strategies are implemented, though their actual cooling capability should be scrutinized in comparison to water.
- DNV GL recommends the following for extinguishing:
  - Stage 1: If a system can limit cell cascading, a gas based suppression system may be considered for the first stage of fire fighting to extinguish a single cell fire and prevent flashover in a contained environment.
  - Stage 2: If temperatures continue to rise or if an increasing level of smoke and gas is detected, water extinguishing accompanied by forced ventilation should be considered to cool the system and prevent further propagation of fire.

- For nearly all chemistries, the ventilation of HCl, CO, and HF govern the ACH requirements, i.e., toxicity considerations dominate the ventilation need rather than flammability.
- The gases emitted are also found in plastics fires in greater time-averaged quantities. This should be considered in the context of prescriptive codes because these hazards are likely to already exist in the built environment.
- DNV GL recommends that the lowest level ventilation rate - if prescribed - be continuous under normal systems operation. The study concludes this may be as low as 0.25 ACH, which is lower than what is required for most occupied spaces.
- Regardless of chemistry, DNV GL recommends sizing for ventilation and extinguisher systems as the following (these may be translated to GPM/ft^2 and CFM/ft^2 or ACH starting on page 50).
- DNV GL recommends that minimizing the water requirement be an area of further study as it has likely been overstated in these recommendations for conservativeness.
- DNV GL recommends at a minimum that an error status from an operating energy storage system be readily apparent to first responders for the following parameters, and recommends **that a dialog be opened with system integrators to determine the most effective and economic way to address this need**:
    - Internal atmosphere (normal or gas detected)
    - Temperature (above normal or normal)
    - Current (normal or threshold exceeded)
    - Voltage (normal or threshold exceeded)
- During and after fire extinguishing, it is recommended that if first responders choose to use water submersion to cool and isolate battery modules, that preparation to deal with alkaline or acidic water be considered.
- After extinguishing, continued ventilation and monitoring of the area is highly recommended to protect first responders from continued toxic and flammable gas emissions. The first responder team can monitor the area with handheld sensors to determine the appropriate time to stop ventilation.
- It is highly recommended that an emergency contact list and/or subject matter expert be available for all battery systems installed in buildings in order to introduce the opportunity for first responders to relinquish control of the scene to the system developer or a designate after the site has been secured and extinguishing has been completed. This is likely to require involvement from the project development and systems integration community.
- If a battery is demonstrated to have a non-flammable electrolyte, there may be considerations for a reduced water extinguisher requirement, or at a minimum, a water requirement equivalent to that required for the space without battery systems installed.
- The ventilation requirements—if prescribed—should be the same for all battery chemistries tested in this program because they all emit similar HCl levels.
- In order to meet or exceed UL 9540 requirements, DNV GL recommends that a risk analysis be performed on any basis where a battery system or portfolio of systems

shall be installed in an enclosed space near occupants. The analysis should look at the general safety picture of the project(s) —in aggregate if possible—with a focus on these risks:

  - Does the system have design features that prevent cascading failure between cells and modules? (See fire test, UL 1973 test, or IEC 62619 test data.)
  - Are ventilation systems at the intended site(s) adequately rated to handle the most probable failure mode? (Example: Table 7)
  - Are sprinkler systems at the intended site(s) adequately designed for the potential heat load and battery chemistry? (Example: Figure 29 and Table 7)
  - Does the protective casing provide adequate insulation and fire blocking? (Example: Figure 28)

10.1 Conclusions

- Many historic battery incidents are due to external damage factors which have created confusion and overreaction to the topic of battery safety.
- Existing building codes and engineering controls can be adequate in many cases to handle battery safety issues.
- The toxic emissions from fires in this study can be managed by today's engineering controls and are not anomalous or excessive when compared to a plastics fire. Plastics fires can generate similar gases in larger quantities over the average emissions duration on an equivalent mass basis.
- The water requirements from this study can be lessened for building fire extinguisher systems when combined system-level safety approaches are implemented.
- Legacy codes could provide insightful interim requirements for battery systems used in energy management, provided that technical and practical engineering considerations are made.
- Gas-based agents that can reduce flammability in an enclosed environment can put out single battery fires, but should not be considered an adequate cooling measure.
- Water demonstrated the highest cooling efficacy of all extinguishing agents tested. The use of water should only be considered if there is an acceptable risk of shorting additional cells or collateral damage to the remainder of the system.
- Water volumes for cooling can be minimized based on the expected duration of a failure event. Systems with adequate internal cascading protections will minimize the water volumes required for extinguishing.
- Staged extinguishing with fixed aerosol or gas suppression agents first, followed by water in the event of a cooling need, is recommended. It may be possible to use parallel water inputs on fixed suppression systems for containerized battery systems.
- Forced ventilation is recommended for first responders, even after the fire has been extinguished.
- The historical legacy of safety concerns has validity, though understanding of the root causes and failure modes is necessary in order to understand the true threats and failure modes.

Appropriate mitigation of risk shall include a pre-commissioning design review per accepted industry practices that are presently being used in California and other states. Overall DNV GL's findings are that these hazards are manageable for building code officials and first responders. No significant technology barrier exists that prevents code officials or first responders from doing their duty when encountering battery energy storage systems.

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12.0 APPENDIX 1: REFERENCED DATA

12.1 Assumptions for Air Changes per Hour (ACH) Calculations

Statistics for mass loss, duration of failure, and HCl, HCN, HF, and CO emissions are shown in Table 1. This data is taken directly from all of the cell tests. It can be seen from the data that the mass loss ranges from 0-57%, the duration of the event lasts from 13-83 minutes, and the emissions rate (in ppm per kg per min) in the 0.44 m^3 chamber ranges from zero to 0.719 for HCl, 0.032 for HF, 0.027 for HCN, and 2.341 for CO. This data demonstrates that CO is emitted in greatest quantity and HCl is emitted in the second greatest quantity, but because HCl has a lower IDLH this threshold is met first in most scenarios.

The following tables demonstrate the calculated ACH as a function of burning battery mass and room size. The tables below are the same data that is visually presented in Figure 16 and related figures. It is clear from the visual representation of the data that these relationships are nonlinear. The estimations limit the failure to 1.5 modules, with the presumption that the system should demonstrate adequate separations, cascading protections, and suppression systems to limit failure to a single cell or at least a single module. The probability of failure for multiple modules should be very low for systems with these active and passive barriers to catastrophic failure. Catastrophic failure scenarios can be examined by risk analysis to determine which barriers are in place to prevent it and the relative strength of those barriers. The risk analysis places practical boundaries on the probability of high consequence events, and should either 1) tame the deployment of extreme safety measures with a low probability of utilization or 2) identify likely failure scenarios that have been overlooked in the context of the site and system.

Table 11 **Air change rates based on HCl emissions as a function of room size and quantity of failing cells.**

		20 ft container	40 ft container	80 ft X 80 ft room
	HCl	**33.1**	**67.6**	**3624**
1 cell	**1.54**	0.25	0.25	0.25
5 cells	**7.70**	0.25	0.25	0.25
10 cells	**15.40**	0.25	0.25	0.25
15 cells	**23.10**	1.25	0.25	0.25
20 cells	**30.80**	3.25	0.25	0.25
24 cells	**36.96**	4.75	0.25	0.25
1 module	**44**	6.5	0.6	0.25
30 cells	**46.20**	7	1	0.25
35 cells	**53.90**	8.5	2	0.25
1.5 modules	**66**	11.5	3.5	0.25

Table 12 **Air change rates based on HCN emissions as a function of room size and quantity of failing cells.**

		20 ft container	40 ft container	80 ft X 80 ft room
	HCN	**33.1**	**67.6**	**3624**
1 cell	**1.54**	0.25	0.25	0.25
5 cells	**7.70**	0.25	0.25	0.25
10 cells	**15.40**	0.25	0.25	0.25
15 cells	**23.10**	0.25	0.25	0.25
20 cells	**30.80**	1	0.25	0.25
24 cells	**36.96**	2.25	0.25	0.25
1 module	**44**	4	0.25	0.25
30 cells	**46.20**	4	0.25	0.25
35 cells	**53.90**	5.5	0.25	0.25
1.5 modules	**66**	7.5	1.5	0.25

Table 13 **Air change rates based on CO emissions as a function of room size and quantity of failing cells.**

		20 ft container	40 ft container	80 ft X 80 ft room
	CO	**33.1**	**67.6**	**3624**
1 cell	**1.54**	0.25	0.25	0.25
5 cells	**7.70**	0.25	0.25	0.25
10 cells	**15.40**	0.25	0.25	0.25
15 cells	**23.10**	0.25	0.25	0.25
20 cells	**30.80**	0.25	0.25	0.25
24 cells	**36.96**	0.25	0.25	0.25
1 module	**46.20**	0.25	0.25	0.25
30 cells	**53.90**	0.25	0.25	0.25
35 cells	**44**	0.25	0.25	0.25
1.5 modules	**66**	0.25	0.25	0.25

Table 14 **Air change rates based on HF emissions as a function of room size and quantity of failing cells.**

		20 ft container	40 ft container	80 ft X 80 ft room
	HF	**33.1**	**67.6**	**3624**
1 cell	**1.54**	0.25	0.25	0.25
5 cells	**7.70**	0.25	0.25	0.25
10 cells	**15.40**	0.25	0.25	0.25
15 cells	**23.10**	2.5	0.25	0.25
20 cells	**30.80**	5	0.25	0.25
24 cells	**36.96**	7	1	0.25
1 module	**44**	9	2	0.25
30 cells	**46.20**	9.5	2.5	0.25
35 cells	**53.90**	11.5	4	0.25
1.5 modules	**66**	14.5	5.5	0.25

Table 15 shows conversion factors from air changes per hour to CFM and CFM/ft^2 for the modeled energy storage rooms and enclosures.

Table 15 **Conversions from ACH to CFM based on the example room volumes for energy storage systems.**

				ACH (row) to CFM (column)					CFM/ft^2 @ ACH				
	m^3	ft^3	ft^2	**0.25**	**1**	**5**	**10**	**30**	**0.25**	**1**	**5**	**10**	**30**
Shipping Container, 20 ft	33	1,168	146	*5*	*19*	*97*	*195*	*584*	*0.03*	*0.13*	*0.67*	*1.33*	*4.00*
Shipping Container, 40 ft	68	2,407	301	*195*	*781*	*3,906*	*7,811*	*23,434*	*0.65*	*2.60*	*12.98*	*25.96*	*77.88*
Room, 80x80 ft	3,624	128,290	16,036	*417,549*	*1,670,195*	*8,350,973*	*16,701,946*	*50,105,838*	*26.04*	*104.15*	*520.76*	*1041.52*	*3124.55*
Notes: Occupied laboratories = 4-12 ACH, emergency ventilation ~30 ACH.													

In Table 16, useful metrics derived directly from testing are provided. As mentioned previously these values are input into a probabilistic model[7] to generate the sensitivity analysis demonstrated in Figure 35 and related figures. The min, average, and max values are used to generate triangular probability distributions. The GPM/kg measurement is a direct measure of the water used to extinguish fires across the entire spectrum of cell to module testing. The cell masses, mass loss, emissions range, HRR, and duration are the ranges of values observed from cell testing. The energy density is calculated directly from the cells. The estimated peak cell temperature is directly sourced from the cell data. The fraction of cells simultaneously burning is a factor used to estimate the impact of total emissions rate and account for the observed fact during module testing that cell failures were rarely simultaneous and occurred as discrete events. It should be noted in the table that the water contact efficiency averages 1-2%. This highly conservative number greatly drives the water requirement estimation. Any method by which a battery manufacturer or system integrator can demonstrate that the water contact efficiency is higher will reduce the water requirement overall.

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[7] Palisade @Risk

Table 16 **Aggregation of data regarding battery fires, extinguishing, emissions rates, and extinguishing. Distributions in the column labeled "Dist" are triangular; the mean is shown.**

Probabilistic Inputs

Parameter	**min**	**avg**	**max**	**Dist**	**Notes**
Cell Mass kg	0.5	1.6	6.5	2.867	From cell test data
Peak Cell Temperature (˚C)	350	525	700	525	From cell test data
Duration (min)	2	47	83	43.882	From cell test data
Water Contact Efficiency	0.001	0.01	0.04	0.017	Estimated
Energy Density (Wh/kg)	30	120	150	100	Pb Acid to Li-ion
Probabilistic Outputs					
Delta T to Cool Battery to 25 C	325	500	675	500	Calculated from Above
Energy to cool battery (kJ)	227.50	1120.00	6142.50	2006.67	mcdT
Required Water Mass including heat of vaporization (kg)	0.09	0.44	2.39	0.78	Q battery = Q water, m_water = Q battery / (energy to heat water to 100 C + dHv)
Required Water Volume (gal)	0.02	0.12	0.65	0.21	divide by 3.7 kg/gal
GPM	0.012	0.003	0.008	0.005	divide gal by duration
GPM/kg	0.024	0.002	0.001	0.002	divide GPM by battery mass
GPM/kg with water contact efficiency	23.916	0.158	0.030	0.099	Divide by water contact efficiency
Additional Probabilistic Parameters					
Testing GPM/kg	0.105	0.881447	1.65789474	0.881	From cell, module, and system test data
Emissions range kg/min per cell	0.0002	0.0077	0.0152	0.0077	From cell test data
HRR kW/kg (of mass lost)	17	31	45	31	From cell test data
Fraction of cells simultaneously burning	0.12	0.16	0.2	0.16	From module testing, 1-3 out of 8-15

12.2 Water Mass Requirement Calculation

There are two ways to calculate the water mass requirement. One method is to calculate the rate of energy released, which assumes that the extinguishing event is perfectly timed with the peak energy release of the cell. The other method is to size the water requirement to the battery mass, acknowledging that the cell failure event is not a single peak event, but is instead characterized by long periods of smoldering (40-90% of the total event duration) and a 2-3 minute peak event (accounting for 1-15% of the event duration).

The latter method was observed to be effective during testing as the water use in DNV GL and Rescue Methods' testing became progressively smaller (on a GPM/kg basis) as the timing of the extinguishing event became decoupled with the peak HRR. In other words, extinguishing the module or large pack was an exercise of removing distributed heat and preventing perpetuating failure modes.

12.2.1 Sizing the Water Requirement to Peak HRR

Sizing the water requirement to the peak HRR involves the calculation of the amount of energy required to raise the temperature of 1 kg of battery[8] by 500 degrees Celsius. Using the average HRR in Table 16, 1 kg of battery emits 31 KJ/second. This would be the heat release rate $\dot{Q}$ and the formula used to calculate the mass flow rate of water is $\dot{Q} = \dot{m}c_p\Delta T$. This results in a flow rate of **1.7 GPM per kg of battery. This is an oversized water requirement, as shown below.**

12.2.2 Alternative Strategy for Sizing the Water Requirement: Preventing the Peak HRR Altogether

There are minutes of opportunity to simply cool the cell and avoid the peak event altogether. Recall from Figure 20 that a Li-ion battery smolders for minutes before eventually failing. Also recall from Figure 28 that the metal enclosure around a battery system can provide a window as long as 60 minutes to respond to a fire. Thermal runaway risk builds, but can be arrested by cooling and preventing the battery from reaching temperatures near 120°C. A strategy in the marine sector is exactly this: cool the battery and prevent thermal runaway temperatures from ever being reached, resulting in very benign cell failure even during aggressive overcharge. [33]

Therefore the extinguishing strategy should be arrest the climbing temperatures before they reach the transition temperature at 120°C. This more practical approach takes into account that automatic fixed suppression systems typically lack the intelligence to sense and trigger according to specific gas species or gas emission rates; i.e., they are discharged upon detection of smoke via a sensor that is generally sensitive to multiple particulate and hydrocarbon species. As a result, fixed suppression will trigger very early in the cell failure process. *This would be the case for all battery types tested*, as smoldering and gaseous emissions from the plastics used for containment began as early as 60°C. Just the fumes from the plastics may be enough to trigger a smoke alarm.

If the module has adequate cascading protections and a 1-hour fire rating, there is an opportunity to contain the cell failure and avoid the issue of oversizing the water requirement to the peak and instead size the water requirement to the battery mass.

As a result the water calculation is simplified by sizing the water flow to the battery mass rather than the HRR at thermal runaway. This strategy is only valid if the cascading protections are demonstrated to contain single cell failures and prevent cascading from cell to cell and module to module, and the fire rating of the system provides adequate time to address an external fire.

Following this method, the energy to be removed from the system is:

$$Q = mc\Delta T$$

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[8] Simulated as phenolic due to its specific heat which is near the average of the battery composition by material

And thus the thermal equilibrium requirement is:

$$Q_{water} = Q_{cell}$$

For a 1 kg battery cell with an estimated composite specific heat similar to phenolic (1.4 kJ/kg˚C), and a temperature change of 525ºC – 25ºC = 500ºC, the energy of heat transferred is 700 kJ. This calculation neglects the additional removal of heat by water from the heat of vaporization, which is addressed below.

The specific heat of water is 4.1 kJ/kg˚C. The objective is to use the minimum amount of water before water flashes into steam. If we target a volume of room temperature water necessary to prevent the water from flashing off into steam, we assume ΔT = 70ºC (70+25 = 95ºC, or just under the boiling point). This translates to

$$m_{water} = 700\ kJ / (4.1\ kJ/kg^oC * 70^oC) = 2.43\ kg$$

This states that 2.43 kg of water is required to cool a 1 kg battery from 500ºC to 25ºC, and the water will have risen in temperature to 95ºC. This calculation should be very conservative, as it neglects the vaporization of water into steam and assumes the entire mass of the battery is contributing to the heat.

The density of water is 3.7 kg/gal, and therefore the theoretical conservative minimum volume of water required is **0.65 gal**. However recall that this reaction occurs over 1-3 minutes during the peak, and up to 40 minutes over a slow duration, and therefore the **gallons per minute required is 0.02-0.6 GPM/kg with the latter being conservatively sized to still address the peak.** The major factors driving the GPM/kg requirement are the battery mass and the duration of the event.

The water requirements need not be excessive if the battery system employs simple, industry proven safety measures such as an external fire rating and cascading protections between cells and modules. Most of the batteries tested had masses from 0.5-1.5 kg, with one battery being particularly large at 6 kg, which skews the average to 2.8 kg and therefore makes this calculation more conservative. The values in the table are probabilistic and the resulting distribution of water flows is shown in Figure 31. The skewness of the distribution demonstrates that **the theoretical minimum water requirement mean is actually 0.019 GPM/kg**, or very near the minimum.

12.2.3 Additional Consideration: Heat of Vaporization

When the heat of vaporization of water is included, the water volume requirement is further reduced. The latent heat of vaporization is the energy required to accomplish the phase change from liquid to gas. This property is given in kJ/kg and there is no change of temperature to make the transition at 100º C at atmospheric pressure. This factor is important is because the latent heat of vaporization is larger than the energy required to heat water from 25 to 100º C.

The required energy to heat water from 25º C and then vaporize to steam at 100ºC is:

$$E = mC\Delta T + m\Delta H_v$$

The specific heat of water C is 4.187 kJ/kgC and the latent heat of vaporization ΔH_v is 2257kJ/kg. Using these numbers, the energy required to heat and boil one kilogram of water from 25° C is:

$$E = 1kg * 4.187 * (100 - 25) + 1 * 2257$$

$$314kJ + 2{,}257kJ = 2{,}571kJ$$

It can be seen from the calculation that the latent heat of vaporization is 7x greater than the energy required to heat from 25-100° C. This is important for cooling considerations because the heat energy of the fire is transferred from the fire to the heating and boiling of water; water withdraws energy from the fire, reducing its destructive power and energy. Every kilogram of room temperature water that that is heated and flashed into steam draws 2,571 kJ from the fire.

Energy is most efficiently drawn from the fire when water contact is as complete as possible. The method of delivery for the water will affect this contact efficiency such as mist, spray, and jet. Access to the deepest seated batteries will govern the water contact efficiency as well. When more water is in contact with the hot surfaces of the battery, the rate of the water-to-steam conversion process increases, which saps energy from the fire and reduces overall temperature as a result.

Expanding on the prior section, if the following assumptions are reconsidered with the inclusion of latent heat of vaporization, the calculation follows:

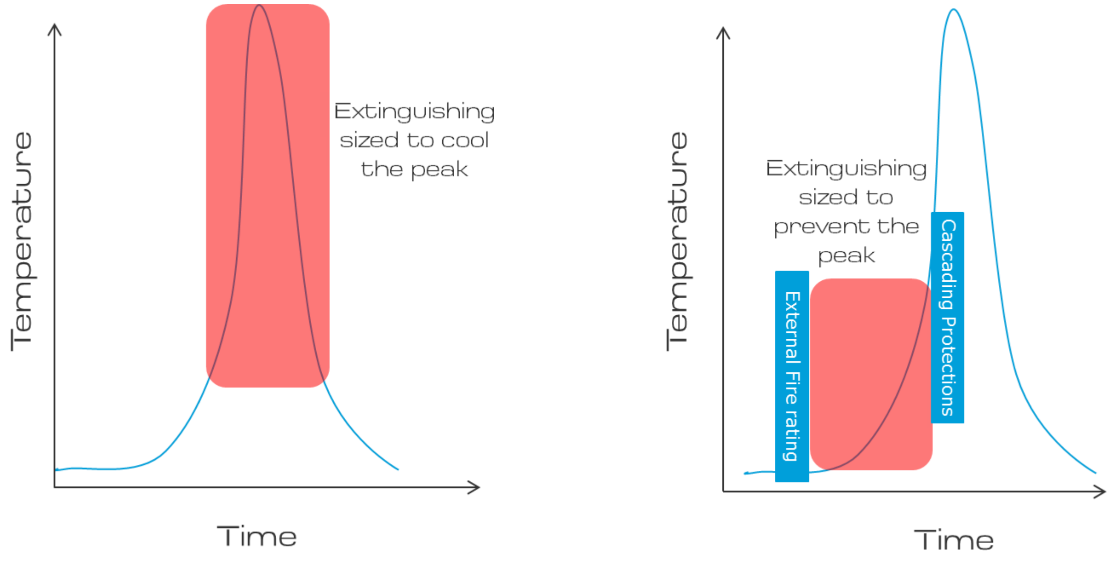
$$mc\Delta T + m\Delta H_v = Q_{cell}$$

Where Q_{cell} = 700 kJ. Therefore for 1 kg of battery cell:

$$m_{H2O} = Q_{cell} / (c\Delta T + \Delta H_v) = 700\ kJ / (4.1\ kJ/kg\ {}^oC * 75\ {}^oC + 2257\ kJ/kg)$$

$$= 700\ kJ / (307.5\ kJ/kg + 2257\ kJ/kg) = \mathbf{0.27\ kg}$$

Using the conversion factor 3.7 kg/gal, the resulting water volume is 0.07 gal. Again assuming 1-3 minutes of battery burn duration, and up to 40 minutes for a slow duration failure, the water requirement is 0.07 gal over 1-40 minutes or **0.001-0.07 GPM per kilogram of battery. Note that this requirement is nearly 10x less than the thermal mass balance calculation in the previous section.** The latent heat of vaporization is therefore a significant contributor to the cooling of the battery fire.



Reactive Approach

Proactive Approach

Figure 34 **A reactive cooling approach requires an oversized water flow requirement; whereas a system-level proactive approach enables a reduced water requirement.**

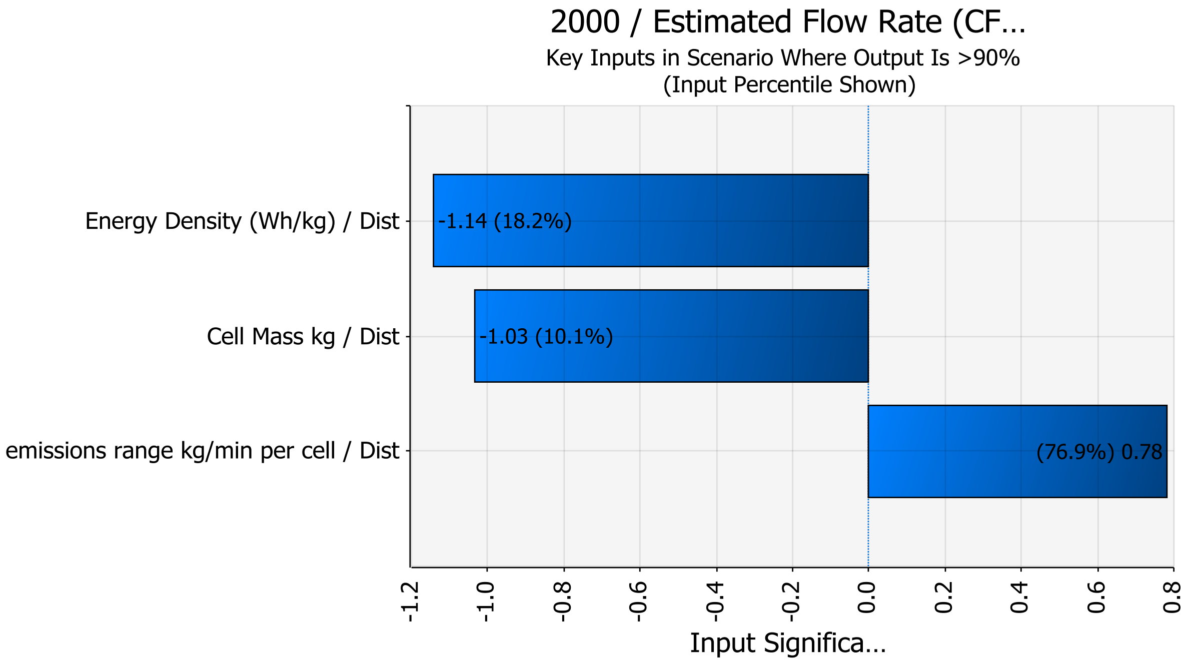


Figure 35 **Regression coefficients of the ventilation requirement.**

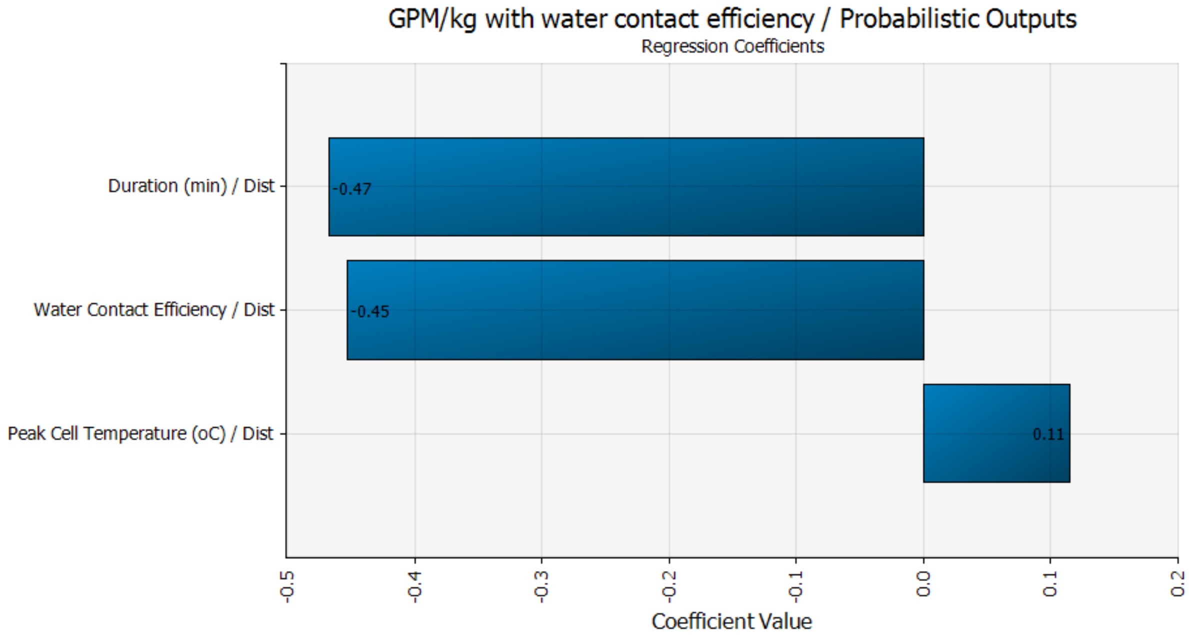


Figure 36 **Regression coefficients for the water flow rate in GPM/kg demonstrate that the duration of the event and the water contact efficiency are the strongest drivers in reducing the water requirement.**

12.2.4 Summary of Water Extinguishing Calculations

It can be seen in Table 17 that sizing the water requirement to the peak HRR leads to a 4-170x oversizing of the water extinguishing system, when proactive and integrated safety approaches are more efficient and reduce the water requirement.

The water contact efficiency of the extinguishing method is highly relevant to the overall cooling effectiveness. The calculations demonstrate physically possible water flow rates, however the testing is the most telling. As testing progressed, DNV GL was able to reduce the water requirement from 1.7 GPM/kg at the module level to 0.1 GPM/kg. Conservative factors accounting for water contact efficiency have resulted in DNV GL's recommendations in Table 9.

Table 17 **Summary of methodologies and results of the water requirement calculation.**

Method	Water Requirement (GPM/kg)	Cross Reference
Module Testing	0.1 – 1.7	Figure 12 on page 17
Calculated by Peak HRR	1.7	Page 69
Calculated Minimum Static Thermal Mass Balance	0.015	Page 51, Table 7
Calculated Time-Dependent Thermal Mass Balance	0.02 - 0.6	Page 69
Calculated by Thermal Mass Balance and the Latent Heat of Vaporization of Water	0.001 – 0.07	Page 70

Based on the testing results and the calculations, 0.07 GPM/kg (including latent heat of vaporization) and 0.1 GPM/kg (observed in testing a multi-module configuration) brackets a significant range in heating and cell failure rate scenarios. A value of 0.1 GPM/kg appears to be a highly conservative extinguishing rate as it does not account for the added benefit of latent heat of vaporization and it provides a substantial compensation for water contact efficiency.

12.3 Why Bowtie Models?

Cell level safety and system level safety are two different things. Assessing the risk of external abuse factors can be accomplished with a risk analysis at the site. This technique permits the visualization of all possible threats that may cause a top event, such as battery failure, to occur. Putting barriers in place to prevent such events may increase safety of the system overall. The diagram illustrates a generic battery failure model, illustrating that a number of threats (left side of the diagram) can be prevented from leading to the top event – which is loss of battery control – with barriers in place such as active monitoring and proactive controls.

An example shown is mechanical damage by the red arrows progressing from the left of the diagram to the right. In this example, there may be monitoring methods in place that did not react quickly enough to identify and prevent consequences of mechanical damage, and other barriers (such as physical barriers) may have failed. If these barriers are breached and the top event occurs, then a possible consequence is thermal runaway. There may also be reactive controls such as fire alarms, automatic module disconnects, or emergency cooling systems to draw heat from the battery before the thermal runaway threshold is reached. Either side of the Bowtie model may be expanded into multiple threat or consequence layers, depending on the detail of the model.

The Bowtie model is the highest level analysis that can be done and may be performed in tandem with or in lieu of a failure mode effects and criticality analysis (FMECA). The FMECA process involves a listing of all possible failure modes and a relative ranking of the probability of their occurrence. The Bowtie model adds a visual representation of the incident paths, the consequence of their occurrence, the barriers that are in place to prevent the occurrence, and the escalation factors that can either defeat barriers or increase the probability of the event occurring. Escalation factors are typically included on the left hand side of a Bowtie model and demonstrate how outside factors increase the likelihood of a barrier failure. Barrier defeating mechanisms can occur on either side of the top event in the figure, but are more commonly included in the right hand side. The list of possible failure modes in the FMECA analysis is a rank order list of all possible incident pathways diagramed in the Bowtie model. Thus the Bowtie model is descriptive and qualitative in nature, while the FMECA analysis is more quantitative. The Bowtie output can easily be converted to a FMEA output and vice versa. Together, the Bowtie and the FMECA listing can be used to address risks and outline recommendations for improvement in safety systems.

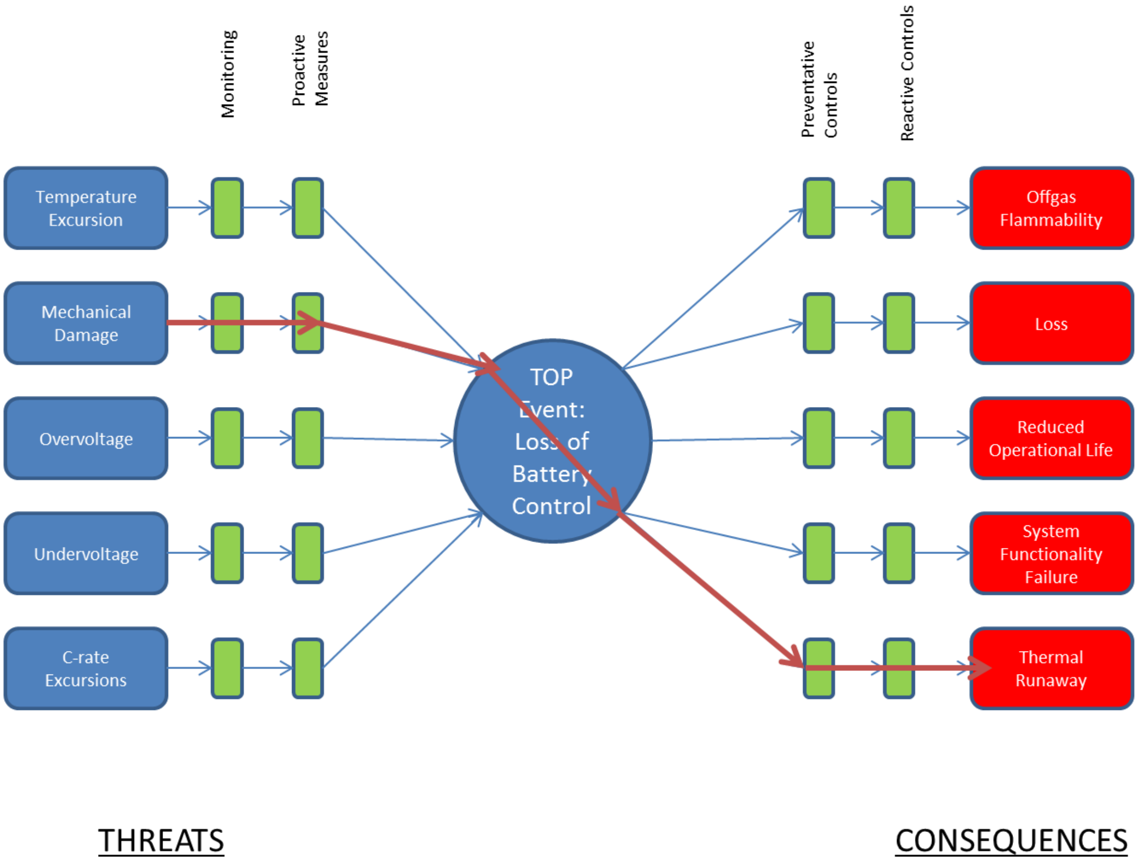


Figure 37 **BowTie analysis permits the visualization of threats to a top event, such as loss of battery control, and ties these threats to consequences.**

12.4 Heat Load from Li-ion Battery Failures

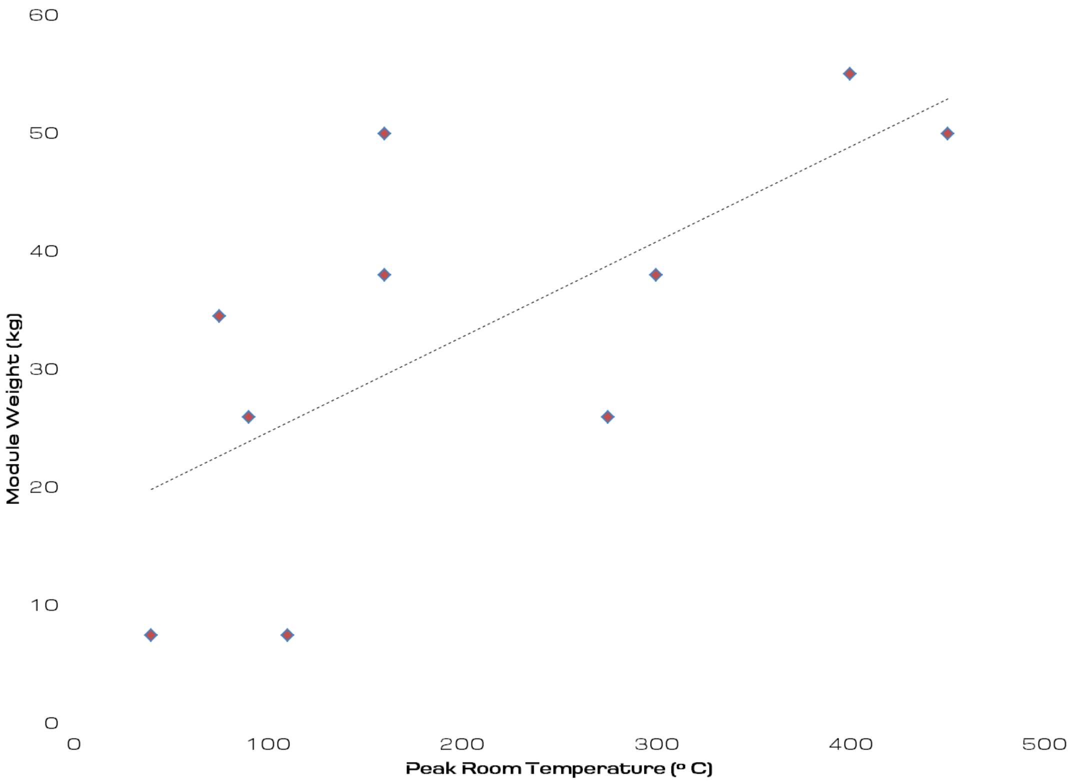


Figure 38 **Battery weight and the peak room temperature are positively correlated.**

13.0 APPENDIX 3: TESTING PLAN AND APPROACH

The total project scope for the Consolidated Edison-New York State Energy Research and Development Authority (NYSERDA) BESS program is shown below. It includes four project tasks with a final report, which also includes the development of guidelines and training materials.

Literature Review

A literature review concisely summarizing the findings from previous safety testing conducted on the specific battery chemistry families tested in this scope of work. Additionally, a review of sodium sulfur and nickel sodium chloride batteries, not being tested in this scope of work, was completed.

Chemistries Participating in the Program

1. **NCM (4 vendors)**
2. **$LiFePO_4$ (2 vendors)**
3. **LTO**
4. **Lead Acid**
5. **Vanadium Redox**
6. **An additional Li-ion chemistry described as BM-LMP**

Small Scale Testing Parameters Measured

1. Heat release rate
2. Species and rate of release of gasses liberated during a burn and as a result of application of suppression agents
3. Species and volume of liquids or solids released during a burn and as a result of application of suppression agents
4. Perform limited suppression agent testing of a small number of suppressants: Water, F-500, FireIce®, and PyroCool®. Testing of suppression release rates for water, or if water is deemed ineffective or unsafe the next best candidate suppressant identified, will also be performed.
5. Observe for presence of electrical arcing or mini-explosions and post burn re-ignition

Computer Modeling

Computer modeling was used to extrapolate small scale burn test results to larger scale fire scenarios involving battery racks. A model at the system scale (rack level) was constructed for each of the chemistries tested. Model predictions were validated through comparison with burn testing of small units.

Final Report

The final report (this document) includes the following for each family of chemistries: findings from the literature review, results from the small scale cell level tests, results of the system size modeling, an assessment of risk at the system scale, effectiveness of extinguishers and techniques, and any other code relevant findings that emerge. First responder training materials and guidelines are also a deliverable from this report.
The testing program is designed to address two hazards: 1) toxic or flammable off gases as well as solids and liquids released during the burn and during fire suppression, and 2) heat load and release rate. The testing program is designed to determine what toxic and flammable gases are present as a function of chemistry and when they are released during the fire. The heat release data provides scalable data as a function of chemistry to determine passive fire protection requirements (as part of container or room design), as well as the quantity and duration of release for fire extinguishers.

13.1 Design of Experiments

Extinguisher tests were performed on cells that demonstrated the best burn properties for testing. All module tests were also subject to extinguishing. Vanadium redox and lead acid electrolyte tests were performed in an autoclave (without direct fire) to examine the volatility of the electrolyte in high heat conditions. There were seven donated battery chemistries to the program as well as two volunteer participants.

13.2 Combustion Gas and Particulate Matter Analysis

Of chief concern to the fire services and first responders are CO, O_2, H_2S and LEL/combustible values. There are additional risks of fluoridated compounds (F_2 and HF), SO_2, VOCs and H_2. DNV GL monitored these during the tests using an *FTIR* gas analyzer from Gasmet (Figure 39) as well as gas chromatography bags for post-test analysis. Additionally, coupon sampling was performed to measure ash, soot and particulate matter emitted and deposited during the fire, in addition to analysis of the battery debris. These coupons and debris measurements will inform hazmat risks during overhaul and after fire ground operations.

13.3 Heat Release Rate

ASTM[9] tests were modified and combined to measure the heat release rate of the batteries. Heat release rates as a function of time and fire stage were calculated using a thermopile built around the battery as well as thermocouples around the chamber including at inlet and outlet. DNV GL was able to quantify *heat release rate* (kJ/s or kW or BTU/min) and *fire load per mass of battery (BTU/lb. or kWh/kg)*. As standardized sizes and footprints do not yet exist, these parameters provide better insight into the fire hazard than the typical ASTM approach per unit area (per ft^2 or per m^2).
The power and energy of the fire per unit mass of battery provided data to estimate the required extinguisher flow rates or mass. The heat removal potential of the extinguisher was estimated by calculation prior to the extinguisher test by matching the battery mass to the required extinguisher mass ($mc\Delta T$) with an added safety margin.

13.4 Procedure

The setup for all tests is depicted in the figure below. Additionally, all batteries underwent multiple tests and state of charge (SOC) was varied to account for differences in energy levels[10]. Battery voltages were measured during and after each test to determine their potential for re-ignition, if any.

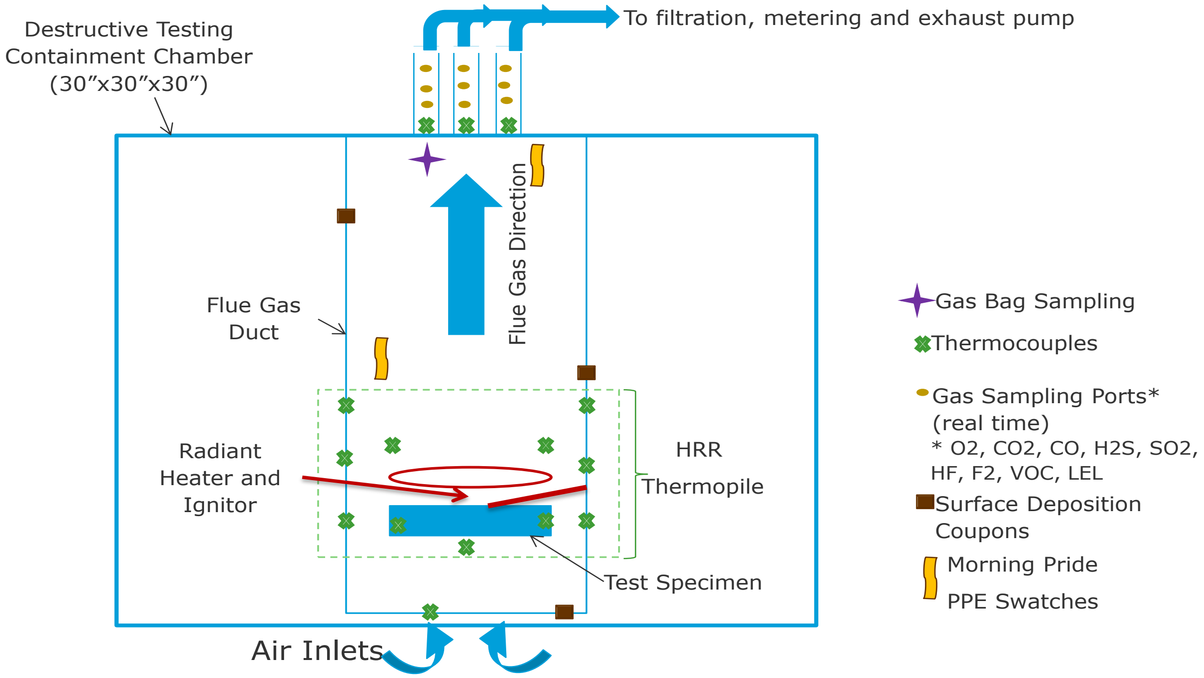


Figure 39 **Large abuse test chamber design for battery fire and extinguishing testing.**

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[9] ASTM 906: Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using a Thermopile Method, ASTM 1354: Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter, and ASTM E1623: Standard Test Method for Determination of Fire and Thermal Parameters of Materials, Products, and Systems Using an Intermediate Scale Calorimeter (ICAL)

[10] Current plan is for testing at 50% and 100% SOC

13.4.1 Testing Procedure: Lithium Battery Gas Sampling, No Extinguishing[11]

Heating was accomplished with a radiative electrical heating element and hot point ignitor to heat the lithium batteries to the point of sublimation or off gassing and ignite any flammable gases produced or released. Testing was recorded with regular image and thermal video.

- Step 1: Put battery in chamber, verify function of all sensors. Begin filming.
- Step 2: Compile gas sensor baselines, capture ambient **gas bag** for baseline
- Step 3: Initiate radiative heating element. Monitor temperature battery.
- Step 4: **Gas bag** sample. Monitor temperature and gas sensors. Heat rise may last 10 minutes to one or more hours. Monitor for flammables such as hydrogen and VOCs.
- Step 5: Record increasing heat with thermocouple measurements. **Gas bag sample** as appropriate
- Step 6: Monitor for peaking heat. **Gas bag sample** as appropriate. Monitor gas sensor and thermocouples. This may occur in durations < 5 minutes.
- Step 7: Monitor decaying heat. **Gas bag sample** as appropriate. Monitor and record gas sensor and thermocouple data.
- Step 8: Monitor decaying heat until temperatures reach safe levels. May take hours or overnight.
- Step 9: Once battery remains are deemed safe, collect surface swabs, coupons, PPE swabs, and secure battery in flame resistant enclosure for posttest observation.
- Step 10: Battery remains will be secured and monitored (video and temperature) for 24 hours. If re-ignition does not occur, batteries will be observed and intentionally re-ignited the following day to observe remaining fire load.[12]

13.4.2 Testing Procedure: Lithium Battery Gas Sampling With Extinguishing[13]

With basic off gas testing complete, a range of extinguishing agents as well as water were tested for effectiveness and reaction. Heat release rates were used to estimate required extinguisher flow rates and volumes. Battery remains were stored in flame resistant enclosures for 24 hours and monitored with video and thermocouples for re-ignition. Testing was video recorded with regular image and thermal video.

- Step 1: Put battery in chamber, verify function of all sensors. Begin filming.
- Step 2: Compile gas sensor baselines, capture ambient **gas bag** for baseline
- Step 3: Initiate radiative heating element. Monitor temperature battery.
- Step 4: **Gas bag** sample. Monitor temperature and gas sensors. Heat rise may last 10 minutes to one or more hours. Monitor for flammables such as hydrogen and VOCs.
- Step 5: Record increasing heat with thermocouple measurements. **Gas bag sample** as appropriate

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[11] Items in bold are actions to be determined as a function of testing progress – requires attentive monitoring by technician.

[12] No such events were observed.

[13] Items in bold are actions to be determined as a function of testing progress – requires attentive monitoring by technician.

- Step 6: *Execute extinguisher based on recommended extinguisher use*[14]*. Monitor and record temperature and gas sensors.* **Gas bag sample** *immediately after.*
- Step 7: Monitor decaying heat. **Gas bag sample** as appropriate. Monitor and record gas sensor and thermocouple data.
- Step 8: Monitor decaying heat until temperatures reach safe levels. May take hours or overnight.
- Step 9: Once battery remains are deemed safe, collect surface swabs, coupons, PPE swabs, and secure battery in flame proof enclosure.
- Step 10: Battery remains will be secured and monitored (video and temperature) for 24 hours. If re-ignition does not occur, batteries will be observed and intentionally re-ignited the following day to observe remaining fire load. Battery will be allowed to burn out on its own to ensure complete destruction and remove change of re-ignition.

13.4.3 Testing Procedure: Flow and Lead Acid Battery Electrolyte (liquid)

A sealed autoclave with heater was used to contain the test. A sample of either liquid (vanadium redox) or acid soaked glass mat (Pb AGM) was placed in a smaller container within the autoclave. The autoclave was heated and off gases measured.

- Step 1: Put electrolyte (liquid or wet glass mat) in autoclave, verify function of all sensors. Electrolyte for each test will be taken from batteries charged to different SOCs to maintain SOC variance in testing.
- Step 2: Compile gas sensor baselines, capture ambient **gas bag** for baseline before heating
- Step 3: Initiate radiative heating element. Monitor liquid and ambient temperature.
- Step 4: **Collect gas bag sample**. Monitor temperature and gas sensors. If electrolyte is not expected to heat exothermically, monitor that heat rise is consistent with controller setting. Monitor for flammables such as hydrogen, VOCs, and sulfuric gases (SO_2 and H_2S).
- Step 5: Record increasing heat with thermocouple measurements. **Gas bag sample** as appropriate
- Step 6: Continue heating to predetermined temperature[15]. **Collect gas bag sample** as appropriate. Monitor gas sensor and thermocouples. This may occur in durations < 5 minutes.
- **Option Step 7A:** *Attempt spark ignition. If fluid vapor is known to be inert, this step shall be skipped.*
- **Option Step 7B:** *Execute extinguisher. Monitor and record temperature and gas sensors***. Gas bag sample** *immediately after.*
- Step 8: Monitor decaying heat. Gas bag sample as appropriate. Monitor and record gas sensor and thermocouple data.

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[14] Different extinguishers, including automated extinguishers, have different guidelines for use and deployment. Execution of extinguisher will be based on FDNY recommendations and use cases.

[15] Peak temperature for flow batteries may vary. Temperature may be based on common class A/B/C/D fire temperatures to determine fluid behavior during boiling or combustion. Max testing temperature may specified by NYSERDA or Con Ed.

- Step 9: Monitor decaying heat until temperatures reach safe levels. May take hours or overnight.

13.4.4 Testing Procedure: Lead Acid Battery Lead (solid)[16]

As multiple risks exist with burning lead and lead oxides, a different approach was taken to test the lead acid batteries. This test involved burning a small amount of lead in a simple, class "A" fire[17] to determine the amount of lead vaporized and deposited on the surrounding surfaces. This testing took place in a tightly contained enclosure to minimize lead contamination. As class "A" fires are not uncommon to the fire service, the focus was to quantify the risk posed by lead and lead oxides.

- Step 1: Place small, known quantity of lead plate and lead oxide in class A material. Material will be taken from batteries charged to different SOCs to maintain SOC variance in testing.
- Step 2: Place coupons and ensure swab areas are clean, ensure container sealed except for air inlets
- Step 3: Ignite class "A" materials
- Step 4: **Collect gas bag sample**, monitor temperature. Allow fire to burn out on its own.
- Step 5: Let container sit, allowing lead vapor to settle
- Step 6: Open container with appropriate PPE, collect sample coupons, all solid waste, and surface swabs.
- Step 7: Reseal container for disposal or re-use.

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[16] No HRR will be performed on the lead acid or flow components as the energy storage portions of these technologies are non flammable, only the balance of system will add to the fire load.

[17] Likely PTFE or PET plastic or basic construction materials (wood).

Table 18 **Battery burn tests without extinguishing, combustible batteries only**[18]

Stage of Fire	**Gases Analyzed**	**Information Gained From Gas Analysis**	**Information from Coupons and PPE samples**	**Information from Heat Release Rate**	**Testing Standards used**
Before fire	(Background)	Background gases, baseline measurement. Coupon and turnout gear prior to damage.	Turnout gear "as is" condition. Bare coupons before contamination		
Incipient/ Ignition	Sensors: CO, CO_2, O_2, H_2S, HF, F_2, SO_2, VOCs, H_2, LEL Gas Chromatography Bags, post test analysis: VOCs, fluoride compounds, CO, CO2, heavy metals[19]	Toxic or flammable gases during fire incipient stage.		Early stage heat release rate, potential combustibility of radiantly heated batteries	Modified ASTM 906 (thermopile); modified ASTM 1354 (O2 consumption calorimetry) ; modified ASTM 1623 (intermediate scale calorimetry)
Rising heat	Same	Evolution of gases as fire climaxes		Accelerating heat release rate, O2 consumption, CO production[20], thermopile temperatures	Same
Heat Climax	Same	Gas composition during fire climax		Peak heat loads, O_2 consumption	Same
Decaying fire	Same	Gas composition as fire evolves and decays		Heat decay rate	Same
Fully decayed fire	Same	Background gases after fire has decayed completely		Determination of potential for re-ignition	Same
Debris	(Background)	Residues and HAZMAT conditions.	Residues and HAZMAT considerations, degradation to PPE	Turnout gear after exposure. Coupons for SEM/EDAX/XRD. Ion chromatography may be performed with swabs from turnout gear.	

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[18] See below test procedures for flow battery electrolytes
[19] If contained within battery, based on MSDS
[20] Compliments gas analysis

Table 19 **Battery burn or heat[21] tests with extinguishing**

Stage of Fire	**Gases Analyzed**	**Information Gained From Gas Analysis**	**Coupons and PPE samples**	**Heat Release Rate**	**Testing Standards Used**
Before fire	(Background)	Background gases, baseline measurement. Coupon and turnout gear prior to damage.	Turnout gear "as is" condition. Bare coupons before contamination		
Incipient	Sensors: CO, CO_2, O_2, H_2S, HF, F_2, SO_2, VOCs, H_2, LEL Gas Chromatography Bags, post test analysis: VOCs, fluoride compounds, CO, CO2	Toxic or flammable gases during fire incipient stage.		Early stage heat release rate, potential combustibility of radiantly heated batteries	Modified ASTM 906 (thermopile); modified ASTM 1354 (O2 consumption calorimetry) ; modified ASTM 1623 (intermediate scale calorimetry)
Rising heat	Same	Evolution of gases as fire climaxes		Accelerating heat release rate, O2 consumption, CO production[22]	Same
Heat Climax	Same	Gas composition during fire climax		Peak heat loads, O_2 consumption	Same
Extinguisher Deployment	**Same[23]**	**Changes in gas composition as a result of extinguishing**	**Changes in residues as a result of extinguishing, HAZMAT impact**	**Heat removal rate[24] achieved with extinguisher**	Same
Decaying fire	Same	Gas composition as fire evolves and decays. **Changes in gas composition as a result of extinguishing**		Heat decay rate, **ability to sustain cooling with extinguisher**	Same
Fully decayed fire	Same	Background gases after fire has decayed completely. **Changes in gas composition as a result of extinguishing.**		**Accelerated cool down rate with extinguisher**	
Debris	(Background)	Residual fumes. **Changes in gas composition as a result of extinguishing.**	Residues and HAZMAT considerations. **Changes in residues as a result of**	Turnout gear after exposure. Coupons for SEM/EDAX/XRD.	

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[21] Flow battery electrolytes may be heated to achieve the simulation of external heating due to a fire. Some flow battery electrolytes are not expected to be exothermic.

[22] Complements gas analysis

[23] To be compared against benchmark "without extinguishing"

[24] Evaluation of heat management as a result of extinguishing will inform firefighter extinguisher guidelines

			extinguishing, HAZMAT impact, degradation to PPE	Ion chromatography may be performed with swabs from turnout gear. **Change in residues as a result of extinguishing. Liquid samples for IC will determine if extinguisher liquid residues are toxic.**	

13.5 Large Scale Burns

Upon completion and evaluation of the small scale burn tests, and following or in parallel to the modeling of the data from those tests, large scale tests, at the module or pack level or bigger, were conducted to verify modeling results and determine unforeseen risks posed by larger systems. This phase of testing was performed in conjunction with Rescue Methods (RM) and involved the complete ignition of a full system or subsystem of an energy storage unit comprised of cells of the previously tested chemistries. These tests took place in a designated burn trailer used for the development of guidelines and training material for first responders as well as testing the effectiveness of extinguishing agents on a larger scale. Test units were secured overnight for observation of re-ignition and then intentionally re-ignited 24 hours later to determine remaining fire load as well as to ensure complete destruction for safe disposal. Samples of the remaining battery, as well as residual run-off from the extinguisher and coupon samples from within the burn area were collected after each test. Thermal and regular video was taken.

ABOUT DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas and energy industries. We also provide certification services to customers across a wide range of industries. Combining leading technical and operational expertise, risk methodology and in-depth industry knowledge, we empower our customers' decisions and actions with trust and confidence. We continuously invest in research and collaborative innovation to provide customers and society with operational and technological foresight. Operating in more than 100 countries, our professionals are dedicated to helping customers make the world safer, smarter and greener.

Lithium-ion batteries removed from Warwick storage site following 2 fires

Jul 03, 2023, 6:03am *Updated on Jul 03, 2023*

By: **News 12 Staff**

Lithium-ion batteries that emitted fumes and worried Warwick residents are being moved out of town.

News 12 reported on two recent incidents – a days-long fire at a storage site on County Route 1 and fumes being emitted from a storage site on Church Street Extension.

The batteries from the Church Street site were packaged and then removed on Monday, to be properly disposed of.

Officials say the batteries burning at the CR-1 location haven't been removed but have cooled down, which will help with the investigation.

Hazmat crews did 20 hours of air metering over three days. They told News 12 that they did not find elevated levels of any chemicals related to the batteries. The school district also tested surfaces in buses and classrooms and found no residue of harmful chemicals.

Warwick Town Supervisor Michael Sweeton says lithium-ion battery incidents should give state officials pause.

"I think it behooves all of us, led by the state of New York, to step back and evaluate safety precautions with these things," he said.

Both the operator of the storage sites and the manufacturer of the batteries told News 12 that they have workers on the ground at both sites and are investigating the cause alongside local fire officials.

https://www.montereycountyweekly.com/blogs/news_blog/air-quality-testing-showed-no-hazards-to-human-health-amid-battery-fire-in-moss-landing/article_5a0ee07a-4125-11ed-a797-c31048cab7a5.html

Air quality testing showed no hazards to human health amid battery fire in Moss Landing.

Sara Rubin

Sep 30, 2022

PG&E's Elkhorn Battery plant in Moss Landing, built in partnership with Tesla.

Daniel Dreifuss

When a lithium-ion battery caught fire at PG&E's Moss Landing Elkhorn battery storage facility on Tuesday, Sept. 20, it was 1:30am. Few people were out and about, and there was little disruption beyond the footprint of the plant itself and the firefighters who responded to the scene.

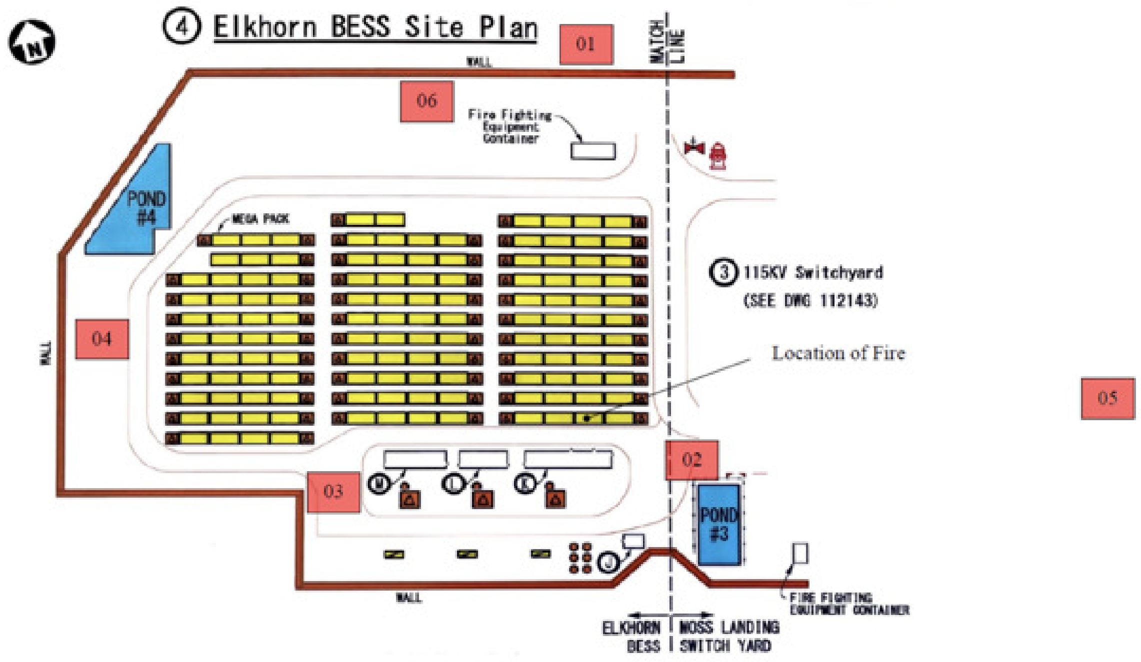
A few hours later, Highway 1 was closed and rush hour traffic backed up for miles. Amid shifting wind and concerns about potential hazards from inhaling the combustion products of a battery fire, officials advised the public to shelter in place and close their windows.

It was a closure that lasted all day, with the road reopening and shelter-in-place advisory lifted by 6:50pm. That decision was based on air quality sampling data collected around the site. And on Sept. 30, a week-and-a-half after the fire, authorities have released their findings: There was not a hazard to human health.

The component of concern is hydrogen fluoride. "The analytical results indicate that particulate fluoride and hydrogen fluoride airborne concentrations around the perimeter of the site were below the detection limit for the method, and well below the applicable permissible exposure limit for both chemicals," according to the statement released by Monterey County.

County health officials coordinated air monitoring with the U.S. Environmental Protection Agency. The EPA and contractor NES Consulting conducted testing at locations around the battery fire, according to the county's Environmental Health Bureau.

(The incident command team decided it was safe to lift advisories at 6:50pm, but authorities indicate the air monitoring went on for longer; it was not immediately clear on Friday for how much longer.)



The red boxes show the locations of air monitors around the Elkhorn Battery plant in Moss Landing.

Courtesy of County of Monterey

The Elkhorn battery plant was built by Tesla and PG&E, and features 256 Tesla battery units on 33 concrete slabs. It's one of the largest utility-owned, lithium-ion battery energy storage systems in the world and it first came online in April of this year.

The county Environmental Health Bureau will continue monitoring the site and plans to coordinate with PG&E and Tesla on mitigations to cleanup. Specifically, that means a water sampling plan in advance of disposal of discharge of fire water, and a soil sampling plan near the fire.

Sara Rubin

Cat® 3616

Diesel Generator Sets

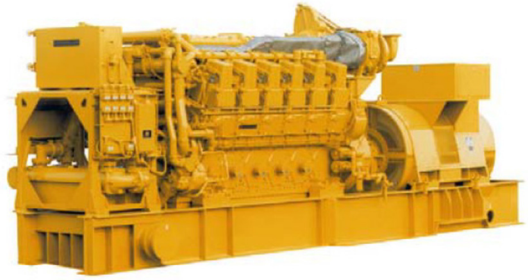


Image shown may not reflect actual configuration.

Bore – mm (in)	280 (11.0)
Stroke – mm (in)	300 (11.8)
Displacement per cylinder – L (in^3)	18.5 (1127)
Total Displacement – L (in^3)	296 (8,032)
Compression Ratio	13:1
Aspiration	TA
Fuel System	Direct Unit Injection

Features

Cat® Diesel Engine

- Designed and optimized for low fuel consumption
- Reliable, rugged, durable design

Alternators

- Superior motor starting capability minimizes need for oversizing generator
- Designed to match performance and output characteristics of Cat diesel engines

Generator Set Package

- Fully prototype tested with certified torsional vibration analysis available

Worldwide Product Support

- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- Your local Cat dealer provides extensive post-sale support, including maintenance and repair agreements

Cat Generator Set Monitoring System (GSM)

- Simple user friendly interface and navigation
- Provides protection, monitoring, and control of the diesel generator set
- Redundant shutdown protection
- 10 inch (254 mm) color monitor to display all engine parameters and alarm annunciation
- Annunciation of all engine shutdowns, alarms, and status points
- Start/prelube control switch, fuel control switch and emergency stop buttons
- Speed control switch with automatic changing to ball head control when a governor failure occurs, if ball head control is available
- Contacts are available for customer use
- Selection of local/remote control of engine
- Selection of idle/rated control of engine
- Equipped for remote communication
- Four 4-20mA outputs (programmable)
- Relay contact signals to the remote monitoring system (summary shutdown, summary alarm, local operation/remote, engine running, PLC failure, fuel control and idle/rated)

Standard and Optional Equipment

Air Inlet

☐ Aftercooler, fresh water, corrosion resistant coated (air side)
☐ Air inlet shutoff
☐ Air cleaner
☐ Breather, crankcase, top-mounted
☐ Turbocharger, engine oil lubricated
☐ Soot filter
☐ Air cleaner louver assembly
☐ Vertical support bracket
☐ Heavy duty air cleaner
☐ Air inlet adapter
☐ Boost control valve

Cooling

☐ Engine coolant water drains
☐ Front mounted turbos
☐ Three-bundle oil cooler
☐ Water temperature regulator
☐ Jacket water thermostats
☐ Heat exchanger for single circuit
☐ Heating aids
☐ Cooling system aids
☐ Auxiliary water pump
☐ Expansion tank

Exhaust

☐ 457 mm (18 in) Cat bolt pattern
☐ Dry, gas tight, exhaust manifold
☐ Includes adapter, flexible exhaust fitting
☐ Flexible exhaust fittings
☐ Weld flange and related hardware

Fuel

☐ Simplex or Duplex
☐ Fuel Priming Pump
☐ Duplex Primary Fuel Strainer
☐ Fuel System Connections

Generator

☐ Custom generator
☐ 3 Phase, six leads, WYE
☐ Class F insulation
☐ Busbar connections
☐ Winding temperature detectors
☐ Anti-condensation space heaters

Governor

☐ UG Actuator
☐ Electronic / actuators
☐ Digital programmers
☐ Battery backup / power supply
☐ 230 UA
☐ 723 Plus
☐ EGB Actuator

Lube

☐ Centrifugal oil filters with single shutoff
☐ Service side engine mounted on cylinder block inspection covers
☐ Wet oil sump. Includes engine-driven main lubrication pump, installed oil lines, engine-driven oil pump and oil pan
☐ Oil filler and dipstick
☐ Valve, oil pressure regulating
☐ Valves, crankcase explosion relief
☐ Oil pan drain valve
☐ Lube ANSI adapter (emergency connection)

Mounting

☐ Damper, torsional vibration
☐ Engine and generator mounting
☐ Isolator
☐ Spring type vibration isolator
☐ Vertically restrained
☐ Non-vertically restrained

Starting / Charging

☐ Vane type air starter
☐ Two motors, engine mounted at rear, on left side
☐ Includes air silencer
☐ Line group for single point custom connection
☐ Pressure reducing valve
☐ Compressed air flex hose
☐ Turbine type air starters
☐ Redundant air starters

General

☐ Paint, Caterpillar yellow
☐ Pumps, gear driven: fuel, oil, jacket water, aftercooler / oil cooler water
☐ Custom paint colors

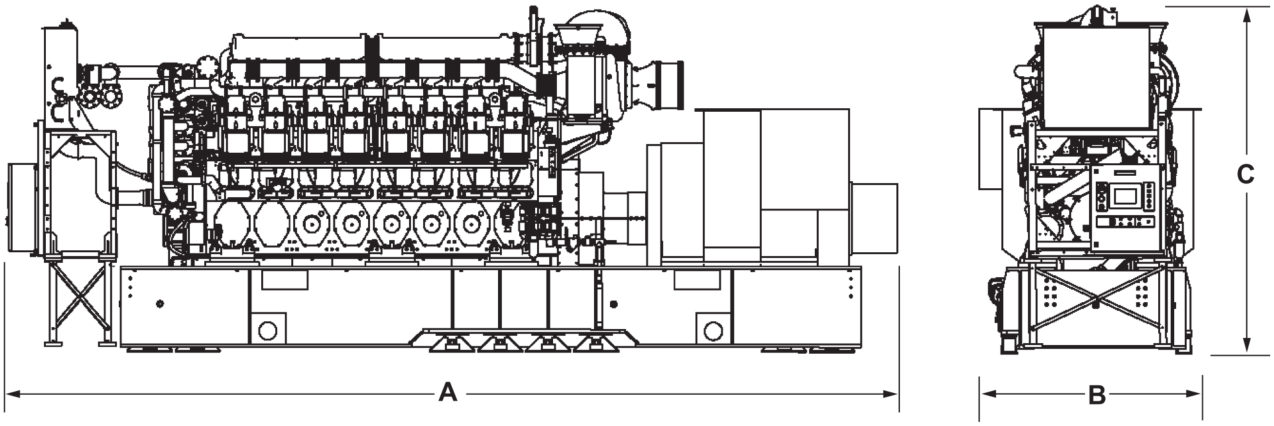
Package Performance

Performance – 1000 rpm	Notes	Standby	Prime	Continuous
Frequency		50 Hz	50 Hz	50 Hz
Engine power – bkW	(2)	5960	5420	4920
Generator power – ekW	(2)	5720	5200	4700
Performance number		DM5538-01	DM5540-01	DM5413-06
Engine Data				
Fuel consumption (ISO 3046/1) – g/bkW-hr	(1)	192.9	192.7	193.7
Fuel consumption (nominal) – g/bkW-hr	(1)	196.7	196.5	197.5
Fuel Consumption (90% confidence) – g/bkW-hr	(1)	198.9	198.7	199.8
Air flow (@ 25°C, 101.3 kPa) – m^3/min		580.9	522.5	467.6
Air mass flow – kg/hr		38882	34971	31298
Compressor outlet pressure – kPa (abs)		307.3	266.3	227.5
Compressor outlet temperature – °C		203.0	186.5	170.2
Inlet manifold pressure – kPa (abs)		305.0	264.1	225.4
Inlet Manifold temperature – °C		60.3	59.4	58.5
Timing – °BTDC	(10)	16.5	16.5	16.5
Exhaust stack temperature – °C		395.1	404.5	420.5
Exhaust gas flow (@ stack temperature, 101.3 kPa) m^3/min		1263.2	1152.5	1056.4
Exhaust gas mass flow – kg/hr		40063	36043	32277
Energy Balance Data (nominal)				
Fuel input energy (LHV) – kW	(1)	10401	12747	11634
Heat rejection to jacket water – kW	(4)	1166	1080	1005
Heat rejection to atmosphere – kW	(5)	281	255	233
Heat rejection to oil cooler – kW	(6)	523	569	545
Heat rejection to exhaust (LHV to 25°C) – kW	(4)	4431	4089	3820
Heat rejection to exhaust (LHV to 177°C) – kW	(4)	3087	2732	2384
Heat rejection to aftercooler – kW	(7), (8)	1537	1231	970
Emissions				
NOx – g/bkW-hr	(9)	12.94	13.69	14.09
CO – g/bkW-hr	(3)	0.81	0.70	0.64
HC – g/bkW-hr	(3)	0.90	0.91	0.90
PM – g/bkW-hr	(9)	0.13	0.13	0.13

Notes

1) Fuel consumption tolerance. ISO 3046/1 is 0, + 5% of full load data. Nominal is ± 3% of full load data.
2) Engine power tolerance is ± 3% of full load data.
3) Emission data shown are not to exceed values.
4) Heat rejection to jacket water and exhaust tolerance is ± 10% of full load data. (Heat rate based on treated water.)
5) Heat rejection to atmosphere tolerance is ± 50% of full load data. (Heat rate based on treated water.)
6) Heat rejection to lube oil tolerance is ± 20% of full load data. (Heat rate based on treated water.)
7) Heat rejection to aftercooler tolerance is ± 5% of full load data. (Heat rate based on treated water.)
8) Total aftercooler heat = aftercooler heat x ACHRF. (Heat rate based on treated water.)
9) Emission data shown are dry and nominal values.
10) Timing based on AFM injectors.

Weights and Dimensions



Dim "A" mm (in)	Dim "B" mm (in)	Dim "C" mm (in)	Weight kg (lb)
10261.7 (404.0)	2530.3 (99.6)	3977.7 (156.6)	51 230 (112,690)

Note: *For reference only. Do not use for installation design. Contact your local Cat dealer for precise weights and dimensions.*

Ratings and Definitions

Standby
Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby rated ekW. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Prime
Output available with varying load for an unlimited time. Average power output is 70% of the prime rated ekW. Typical peak demand is 100% of prime rated ekW with 10% overload capability for emergency use for a maximum of 1 hour in 12. Overload operation cannot exceed 25 hours per year.

Continuous
Output available with non-varying load for an unlimited time. Average power output is 70-100% of the continuous rated ekW. Typical peak demand is 100% of continuous rated ekW for 100% of the operating hours.

Applicable Codes and Standards
AS 1359, CSA, IEC 60034-1, ISO 3046, ISO 8528, NEMA MG 1-22, NEMA MG 1-33, UL508A, 2014/35/EU, 2006/42/EC, 2014/30/EU.

Note: Codes may not be available in all model configurations. Please consult your local Cat dealer for availability.

Engine Rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JAN90 standard reference conditions of 25°C, 100 kPa, 30% relative humidity and 150m altitude at the stated aftercooler water temperature. Consult altitude curves for applications above maximum rated altitude and/or temperatures.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO 3046 standard conditions.

Fuel Rates are based on fuel oil of 35º API [16ºC (60ºF)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 15ºC (59ºF) and weighing 850 g/liter (7.0936 lbs/U.S. gal). Additional ratings may be available for specific customer requirements, also, for information regarding low sulfur fuel and biodiesel capability, please consult your Cat dealer.

www.cat.com/electricpower

EAST POINT
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AN EQUINOR COMPANY

DECOMMISSIONING PLAN

Updated December 1, 2023. See highlighted sections.

PROJECT BACKGROUND

The proposed battery energy storage system (BESS) Facility is an open configuration consisting of: an array of multiple individual, fully equipped, containers that contain racks of lithium-ion batteries; thermal management systems; control instrumentation; electric grid interconnection switchgear; and on-board fire protection system; AC/DC inverters; transformers; and an on-site substation that facilitates connection to NYSEG'S electric grid. Separate from the Facility, but necessary for purposes of connecting it to the electric grid, NYSEG will construct, own, and operate a substation adjacent to the Facility.

The proposed BESS facility would be located on a Commercial/Business Park (C/BP) zoned parcel totaling 94.5+/- acres on 24 Miller Road, Mahopac.

INTRODUCTION

This Section provides a general description of the decommissioning activities anticipated in support of restoration of the Project Site when the Facility reaches the end of its useful life. Decommissioning would result in the removal of Facility equipment from the Site, thereby rendering the cleared Site available for redevelopment for another future use.

A determination when decommissioning might occur depends on the BESS Facility's anticipated useful commercial life. With routine maintenance, including periodic battery augmentation, replacements or upgrades, Union Energy Center, LLC anticipates that the proposed BESS Facility's useful life will be a minimum of 20 years.

When the Facility reaches the end of its useful life, an updated Decommissioning Plan based on this document will be implemented to ensure that all above-ground Facility components will be removed such that the Property can be repurposed. Decommissioning will be accomplished with the objective of maximizing the recycling/reuse of the installed BESS Facility's equipment and materials and minimizing the amount of waste to be disposed.

PRE-PLANNING

The following protocols/procedures would be implemented with as much advance planning as the still operating system operation allows. This Plan anticipates these actions would be completed at least six (6) months prior to the start of planned equipment deactivation and removal activities.

- Review and update Decommissioning Plan (review/revise as required).
- Establish Decommissioning Schedule with key Milestone Dates.
- Notify all Authority(ies) having Jurisdiction (AHJ).
- Establish Division of Responsibilities (DOR) Matrix.
- Gather all of the BESS systems' technical information including, but not limited to:
    - Instruction manuals
    - As-built drawings
    - Equipment weights
    - MSDS sheets
- Establish Safety Response Plan for decommissioning activities.
- Review system arc flash report to determine personal protection equipment (PPE) arc flash levels required for decommissioning tasks and obtain required PPE as prescribed in NFPA 70E Standard for Electrical Safety in the Workplace.
- Review all systems adjacent to and supporting the BESS that may be impacted by decommissioning and determine means of protecting said systems. These systems include but are not limited to: structural elements; building penetrations; means of egress; fire detection and suppression systems and interface points; communication equipment and interface points; and electrical interconnecting equipment including the Facility's on-site substation and NYSEG's substation.
- Determine salvage value of components and disposal fees. Establish a list of components to be disposed of in one of the following categories:
    - Salvage/recycle
    - Special disposal required
    - General disposal
    - Resell/repurpose
- Contact receiving entities to establish quantities, schedule, financial, and logistical information.
- Prepare shipping Chain-of-Custody paperwork and labeling per governing requirements.
- Obtain any special tools and equipment necessary for disassembly as required.

GENERAL CONSIDERATIONS

The following general considerations should be adhered to prior to and during the decommissioning process.

- An identification of all energy sources (batteries, connected batteries in other enclosures or structures), inverters [also known as power conversion systems (PCS)], DC bus pre-charge power supplies, UPS, support equipment with batteries, and AC or DC auxiliary power equipment and distribution systems.
- Information about PPE and requirements for use as needed (site dependent), noting that each electrical equipment cabinet should already have shock and arc flash warning labels applied as per NFPA 70E.
- A notification that the ESS should be discharged to its safe state of charge for transport.
- Assurance that during the decommissioning process, critical support equipment such as, but not limited to, fire detection and suppression equipment, electrical circuits to facilitate decommissioning, and so forth, remain operational to the extent possible.
- A warning not to disconnect any ESS grounding until all energy sources are isolated and locked out.
- A notification to disconnect and shut down all batteries and support or auxiliary equipment associated with the system or its component parts.
- Isolation of all energy sources, starting with those with highest fault current, by isolating the AC POI, then isolating each inverter/MV transformer, then the battery strings and/or racks, then isolating the individual battery modules in each string/rack/blade.
- The need to mechanically uninstall battery trays and place them into original or equivalent packing materials or protect terminals.
- Information on disposal material associated with the BESS.

Decommissioning procedures vary, and therefore BESS manufacturer's instructions will also be followed.

DISASSEMBLY OF EQUIPMENT AND MATERIALS

The following steps will govern the removal of equipment and materials after the BESS preparation (described above) has been completed.

1. Review DC arc flash reports and labels and utilize PPE appropriate for the designated arc flash hazard level.
2. The Facility will be disconnected from NYSEG's grid at the Facility's POI; inverter/transformers from the AC collection system; containers/enclosures/blocks from the inverter; MV transformer, then individual racks and/or strings from DC bus system.
3. If state of charge has been taken down to 0% as part of system preparation, safety grounds will be applied to the DC bus of each rack. If modules are being removed at a non-zero state of charge, safety grounds won't be applied, and all work will be performed with appropriate shock protection, treating components as potentially energized.

4. Disconnect and/or segment individual groups of modules into segments.
5. Remove battery modules.
6. Remove cooling media (as applicable); store and dispose of per MSDS instructions.
7. Remove any fire suppression media and equipment after all modules have been removed.
8. Remove remaining project-owned fixed equipment and project-owned interconnecting equipment at the original equipment location.
9. Perform final Site waste removal, including removal of rental equipment, tools, and demolition materials at the original equipment location.

The substation owned and operated by NYSEG will remain in place in perpetuity and is not subject to this decommissioning plan.

DECOMMISSIONING PHASES

Actual decommissioning shall proceed in four major phases:

1. Removal of Specialized Equipment: For removal of specialized installations, electrical equipment shall be de-energized, and all hazardous materials associated with or housed in that equipment shall be removed for recycling/disposal, including batteries. Equipment racks can be a source of scrap metal.
2. Removal of Basic Structures: For removal of basic structures, dismantling should first occur. Much of this material would be sold as scrap metal.
3. Removal of Foundations: For removal of foundations, to the extent required, piping, and utilities, excavation would be necessary. The first part of this phase would be removal of aboveground piping, followed by excavation and removal of foundations (with appropriate disposal of the concrete and steel girders), and excavation and piecemeal removal of underground piping.
4. Backfill, reseeding, and general landscaping of excavated areas as required.

SALVAGE VALUE

It is expected that the aboveground portion of the Facility's components would be offered for sale or for salvage or scrap value. For example, there will be a number of high-value, rare metals in the project, such as graphite, copper, and lithium that are expected to retain value. Even if there were no market for the purchasing of the Facility's components for salvage purposes, the aggregate scrap value of the equipment and structures are anticipated to be more than sufficient to offset the costs for complete dismantling, demolition, and removal of the BESS Facility.

DECOMMISSIONING SECURITY

The proposed BESS must provide a financial assurance to ensure decommissioning and removal of the BESS Facility and its ancillary supporting equipment and infrastructure with a parent company guarantee, a letter of credit, bond or other suitable guarantee to the Town. The overall goals and objectives of the security for a BESS facility are to ensure adequate funds are available to decommission and remove the project, such that the property can be functionally similar to its state pre-construction. The decommissioning security amount will be determined by the anticipated facility removal costs net of facility components salvage and/or resale value.

Estimated decommissioning costs are listed in the table below and predicted to be roughly $5.5M. The source of the estimate is from East Point Energy's experience with other projects and from engineering staff. It is recommended that the financial security (in one of the forms listed above) be posted in year 20. At or prior to year 20, East Point would hire a mutually agreed upon subject matter expert to establish the decommissioning costs net of salvage/resale value. East Point is willing to discuss the structure and timing further to address any of the Town's concerns.

Ultimately, project abandonment is a low risk for BESS projects for several reasons. First, BESS are very capital intensive but have fairly low operating expenses, meaning that there is a strong incentive to keep the project performing at a high level for the duration of the project lifetime. Furthermore, BESS projects can have a salvage value that is greater than the decommissioning costs, giving a strong incentive to take care of the project at the end of the life cycle.

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Estimate of Decommissioning Costs for Union Energy Center

Description	Cost ($)
1. Disassembly and Disposal	
Overhead and Management Removal Activities	$ 52,500.00
Transformer(s) with foundations	$ 59,325.00
Battery Storage Container(s) with foundations	$ 259,875.00
Fence	$ 14,175.00
Gravel & Road	$ 42,000.00
Batteries	$ 2,782,500.00
Subtotal	$ 3,210,375.00
2. Site Restoration	
Re-Seeding (fenced area only)	$ 4,725.00
Re-Grading (Gravel area & road	$ 9,450.00
Subtotal	$ 14,175.00
3. Salvage	
Transformers	$ (28,350.00)
Battery Storage Containers	$ (323,400.00)
Fence	$ (5,040.00)
Batteries, Inverters	$ (10,000,000.00)
Subtotal	$ (10,356,790.00)
4. Net Decommissioning Costs	
Disassembly, Disposal & Site Restoration	$ 3,224,550.00
Disassembly, Disposal & Site Restoration (20 years @ 2% inflation)	$ 4,791,511.68
Salvage Value (20 years)	$ (10,356,790.00)
Net Decommissioning Costs	$ (5,565,278.32)

EAST POINT ENERGY
AN EQUINOR COMPANY

Union Energy Center PILOT Proposal

Highlights include modifications as of December 1, 2023.

Union Energy Center, LLC is a proposed 116-megawatt (MW) battery energy storage system located at 24 Miller Road, Mahopac, NY. The Carmel Planning Board requested that East Point Energy, the owner of the project, provide a proposed Payment-in-Lieu-of-Taxes ("PILOT") to the Town, County, and schools.

East Point Energy has had in-depth discussions with multiple stakeholders in Putnam County as it pertains to a PILOT, including the Carmel Assessor, Putnam County Economic Development, and the Putnam County Industrial Development Agency ("IDA"). First, it is worth stating that there is no state guidance on assessing battery energy storage projects. However, many AHJ's in NY recognize that some components of the project are considered "real property" which is taxable—like the containers and affixed structures, while other components like the batteries themselves constitute movable machinery or equipment under Real Property Tax Law Section 102(12)(f) and therefore are not subject to property tax. The batteries represent a significant portion of the capital expenditure of the project.

East Point has proposed to the IDA three different scenarios for real property taxes. The following approach would allow for flexibility if the project electrical capacity were to be modified.

1. 15-year PILOT: $2,000/MW/year ($232K/year)
2. 20-year PILOT: $2,500/MW/year ($290K/year)
3. 25-year PILOT: $2,750/MW/year ($319K/year)

Importantly, any taxes owed to the Fire Department would not be abated. Therefore, the project would pay an additional ~$58,000 in year 1. Further detail can be seen in the attached spreadsheet.

The IDA has also suggested waiving some county and state sales tax payments, such that the project would pay 0.375% for a limited period of time. The Project does not intend to include the mortgage exemption in its PILOT application. The PILOT would provide Union Energy Center a predictable and manageable tax rate that would allow the project to be built. Without a PILOT, the project would be unfeasible. The Town/Schools/County benefit for all the reasons described in the project narrative, including a dramatic increase of the baseline taxes (according to our landowner, the property paid $11,758 in 2022 to Town, County, and Schools), construction jobs, critical electrical infrastructure and reliability, all while having minimal impacts.

East Point's proposal is not without precedent. While every project has unique characteristics and should be treated individually, there are several projects in upstate NY that demonstrate East Point's offer is above and beyond what similar projects have paid:

1. Orange County: A set of three projects agreed to pay ~$1500-$2000/MW/year over 15 years (payment rose gradually over time). Agreed to in 2022.
2. Town of Hamburg: Project agreed to pay ~$1000-$1200/MW/year over 20 years (payment rose gradually over time). Agreed to in 2022.
3. Wyoming County: Project agreed to pay ~$1500-$2400/MW/year over 20 years (payment rose gradually over time). Agreed to in 2022.
4. City of Mechanicsville, Town of Stillwater: Project agreed to pay ~$750-800/MW/year over 15 years (payment rose gradually over time). Agreed to in 2019.

The PILOT negotiation is a work in progress that will not be completed for at least several months. However, we believe that this offer should provide the Planning Board with a meaningful sense of the positive tax impacts as they consider our site plan.

Assessment & PILOT Comparison

The Planning Board requested the Project provide an estimated assessed value of the project over its lifetime, so that the size of the PILOT can be put in context. As mentioned above, this exercise assumes that the batteries themselves are not taxable, though this will need to be confirmed by the NY State Department of Taxation and Finance as well as the Carmel Assessor. These entities will also need to provide context on the assessment methodology. For the purposes of this exercise, we are assuming that a "cost-based" methodology is used.

The attached spreadsheet walks through our estimate of the payments due to the Town/County/Schools/Fire before and after a PILOT. There are a number of columns, but the main takeaway can be found in the highlighted columns. The purple shows the annual estimated tax payments without a PILOT (excluding sales tax), and the green columns show the annual PILOT payment (excluding sales tax) in the proposals outlined above. These show the project paying between $14.2-19.1 million dollars to the Town/County/Schools/Fire over a 30-year period. Since the Project has not yet negotiated a PILOT, the exact breakdown of payments to the Town, County, and Schools cannot be determined is unknown.

year	Org. Cost	% good	Dep Value	Current mill rate	Mill Rate Covered By PILOT, 2% increase per year	Mill Rate Not Covered By PILOT (i.e. Fire), 2% increase per year	Est.tax per yr NO PILOT, excluding sales tax	PILOT Estimated Taxes ($2,000/MW/year) plus special district taxes. 15 y abatement. Excludes sales tax	PILOT Estimated Taxes ($2,500/MW/year) plus special district taxes. 20 y abatement. Excludes sales tax	PILOT Estimated Taxes ($2,750/MW/year) plus special district taxes. 25 y abatement. Excludes sales tax
1	$ 75,000,000.00	0.95	$ 71,250,000.00	0.028795	0.027985	0.00081	$ 2,051,643.75	$ 289,712.50	$ 347,712.50	$ 376,712.50
2	$ 75,000,000.00	0.9	$ 67,500,000.00	0.028795	0.0285447	0.0008262	$ 1,982,535.75	$ 287,768.50	$ 345,768.50	$ 374,768.50
3	$ 75,000,000.00	0.8	$ 60,000,000.00	0.028795	0.029115594	0.000842724	$ 1,797,499.08	$ 282,563.44	$ 340,563.44	$ 369,563.44
4	$ 75,000,000.00	0.7	$ 52,500,000.00	0.028795	0.029697906	0.000859578	$ 1,604,267.93	$ 277,127.87	$ 335,127.87	$ 364,127.87
5	$ 75,000,000.00	0.6	$ 45,000,000.00	0.028795	0.030291864	0.00087677	$ 1,402,588.53	$ 271,454.65	$ 329,454.65	$ 358,454.65
6	$ 75,000,000.00	0.5	$ 37,500,000.00	0.028795	0.030897701	0.000894305	$ 1,192,200.25	$ 265,536.45	$ 323,536.45	$ 352,536.45
7	$ 75,000,000.00	0.4	$ 30,000,000.00	0.028795	0.031515655	0.000912192	$ 972,835.41	$ 259,365.75	$ 317,365.75	$ 346,365.75
8	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.032145968	0.000930435	$ 744,219.09	$ 252,934.80	$ 310,934.80	$ 339,934.80
9	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.032788888	0.000949044	$ 759,103.47	$ 253,353.49	$ 311,353.49	$ 340,353.49
10	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.033444666	0.000968025	$ 774,285.54	$ 253,780.56	$ 311,780.56	$ 340,780.56
11	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.034113559	0.000987385	$ 789,771.25	$ 254,216.17	$ 312,216.17	$ 341,216.17
12	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.03479583	0.001007133	$ 805,566.67	$ 254,660.50	$ 312,660.50	$ 341,660.50
13	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.035491747	0.001027276	$ 821,678.01	$ 255,113.71	$ 313,113.71	$ 342,113.71
14	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.036201582	0.001047821	$ 838,111.57	$ 255,575.98	$ 313,575.98	$ 342,575.98
15	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.036925613	0.001068778	$ 854,873.80	$ 256,047.50	$ 314,047.50	$ 343,047.50
16	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.037664125	0.001090153	$ 871,971.27	$ 871,971.27	$ 314,528.45	$ 343,528.45
17	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.038417408	0.001111956	$ 889,410.70	$ 889,410.70	$ 315,019.02	$ 344,019.02
18	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.039185756	0.001134196	$ 907,198.91	$ 907,198.91	$ 315,519.40	$ 344,519.40
19	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.039969471	0.001156879	$ 925,342.89	$ 925,342.89	$ 316,029.79	$ 345,029.79
20	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.040768861	0.001180017	$ 943,849.75	$ 943,849.75	$ 316,550.38	$ 345,550.38
21	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.041584238	0.001203617	$ 962,726.74	$ 962,726.74	$ 962,726.74	$ 346,081.39
22	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.042415923	0.00122769	$ 981,981.28	$ 981,981.28	$ 981,981.28	$ 346,623.02
23	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.043264241	0.001252244	$ 1,001,620.90	$ 1,001,620.90	$ 1,001,620.90	$ 347,175.48
24	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.044129526	0.001277288	$ 1,021,653.32	$ 1,021,653.32	$ 1,021,653.32	$ 347,738.99
25	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.045012116	0.001302834	$ 1,042,086.39	$ 1,042,086.39	$ 1,042,086.39	$ 348,313.77
26	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.045912359	0.001328891	$ 1,062,928.12	$ 1,062,928.12	$ 1,062,928.12	$ 1,062,928.12
27	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.046830606	0.001355469	$ 1,084,186.68	$ 1,084,186.68	$ 1,084,186.68	$ 1,084,186.68
28	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.047767218	0.001382578	$ 1,105,870.41	$ 1,105,870.41	$ 1,105,870.41	$ 1,105,870.41
29	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.048722562	0.00141023	$ 1,127,987.82	$ 1,127,987.82	$ 1,127,987.82	$ 1,127,987.82
30	$ 75,000,000.00	0.3	$ 22,500,000.00	0.028795	0.049697014	0.001438434	$ 1,150,547.58	$ 1,150,547.58	$ 1,150,547.58	$ 1,150,547.58
						Total paid	**32,470,542.84**	**19,048,574.64**	**16,958,448.15**	**14,264,312.17**

LEGEND

━━━	EXISTING PROPERTY LINE
— — —	EXISTING EASEMENT
○○○○	EXISTING STONE WALL
— - - —	EXISTING UTILITY POLE w/ guy & overhead wires
—···—	EXISTING WATERCOURSE
⩊	EXISTING WETLAND
—△— — —△—	EXISTING WETLAND FLAG
━━ ━ ━━	EXISTING WETLAND ADJACENT AREA

1. NYS Elec & Gas Corp
2. NYS Elec & Gas Corp
3. Mari Hawkins
4. Rafael Vargas
5. Mahopac Terminals, LLC
6. Gabriel Lamanna
7. Roger Horvath
8. Phyllis Mantovi
9. JAS Palushaj, LLC
10. Iris Gorodess Irrev Trust
11. Rooney Properties LLC
12. The Teal Door Center, LLC
13. Nicole Jimenez
14. John Phillip Gkanios
15. Peter Cirino
16. Christopher Horan
17. Lake Mahopac Motel Inc
18. Anthony Michael Realty, Inc
19. David Nicholas
20. Sigurbjorn Sigurjonsson
21. Sigurbjorn Sigurjonsson
22. Sigurbjorn Sigurjonsson
23. S Sigurjonsson
24. Carbonara Family Irrev Trst #1
25. Videl Realty Corp.
26. VIdel Realty Corp.
27. Park Ford Of Mahopac Inc
28. RCTA Realty LLC
29. 287 Route 6, LLC
30. John Henning
31. John Glynn Trust
32. Lawrence Reo
33. George Johnson
34. Lormat Construction Corp
35. Kerril Hynes
36. 12th Street Realty, LLC
37. Marco Chuchuca
38. Francesco Pulice
39. Cherian Family Trust
40. James Brady
41. Gennaro Ferdico
42. Dea Wolfert
43. James Hennessey
44. Ferone Automotive, LLC
45. Irene Cassetta
46. Michael Nicotina
47. Michael Montgomery
48. James Crowley
49. Kathleen D'Ottavio
50. Florence Janet Faulkner
51. Benedetto Salerno
52. Chris Scheedel
53. Thomas Longhitano
54. Mahopac Improvement Owner LLC
55. Mahopac Improvement Owner LLC
56. Amerino D'onofrio
57. Matthew Rosolen
58. Christopher Vennard
59. Samantha Dodge
60. Wind River, LLC
61. Ralph D'alisa
62. Miller Road LLC
63. Michael Barile
64. Nicole Barile Stern
65. Emerson Cargain
66. Union Valley Plaza Inc
67. AAK Realty LLC
68. P P Co Limited Liability
69. Mahopac Volunteer Fire Dept
70. 46 Tomahawk LLC
71. Empire State Assoc Holding Co
72. ALOU Corporation

LOCATION MAP SCALE: 1" = 1000'±

OWNER:

MILLER RD LLC
888 ROUTE 6
MAHOPAC NY 10541

NYS ELEC & GAS CORP.
39 UNION VALLEY ROAD
MAHOPAC NY 10541

THE TEAL DOOR CENTER, LLC
18 MILLER ROAD
MAHOPAC NY 10541

SITE DATA:

Zone: C/BP
Total Acreage 95.5 AC.±
Tax Map Nos.:
1. 86.11-1-14 (93.5 AC.±)
2. 86.8-2-85 (1.6 AC.±)
3. 86.14-1-8 (0.4 AC.±)

APPLICANT:

EAST POINT ENERGY, LLC
310 4th STREET NE, 3rd FLOOR
CHARLOTTESVILLE, VA 22902

GENERAL NOTES:

1. The boundaries, topography, and wetland flags shown hereon are taken from a survey by Insite Engineering, Surveying & Landscape Architecture, P.C., entitled "Survey of Property Prepared for East Point Energy", last revised on March 29, 2023.
2. There will be no full time employees on site. The site will be occasionally visited by 1–2 employees.
3. There are no proposed clubhouses, pools, designated open space, parks or recreation areas.
4. No refuse is to be generated on site. Anything to be removed from the site during operations will be removed by truck. Therefore no refuse enclosure is proposed.
5. Site conditions on Now or Formerly The Teal Door Center, LLC area approximated from aerial orthoimagery.
6. All driveways are to be constructed in accordance with the Town of Carmel Code.

C/BP ZONE REQUIREMENTS:

	Required/Permitted:	Lot 1 Provided:	Lot 2 Provided:	Lot 3 Provided:
Minimum Lot Area:	3 Acres (130,680 SF)	78.9 AC.±	12.3 AC.±	4.3 AC.±
Minimum Lot Width:	200'	853'±	248'±	521'±
Minimum Lot Depth:	200'	3,100'±	1,557'±	430'±
Minimum Road Frontage:	100'	640.27'	267.14'	462'±
Minimum Yard Setbacks:				
Front:	50'	626.1'	N/A	16'± *
Side:	40'	175.1'	N/A	88'±
Rear:	40'	2,053.9'	N/A	356'±
Maximum Building Height:	40'	N/A	N/A	<40'
Minimum Building Floor Area	5,000 SF	0 SF	N/A	<5,000SF *
Maximum Building Coverage:	40%	1.54%	N/A	0.6%

* Pre-existing non-conforming condition.

NO.	DATE	REVISION	BY
2	12-4-23	REVISED PER PLANNING BOARD COMMENTS	KJK
1	10-30-23	RESUBMISSION TO PLANNING BOARD	MEU

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3 Garrett Place
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(845) 225-9690
(845) 225-9717 fax
www.insite-eng.com

PROJECT:
UNION ENERGY CENTER
MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:
OVERALL PLAN

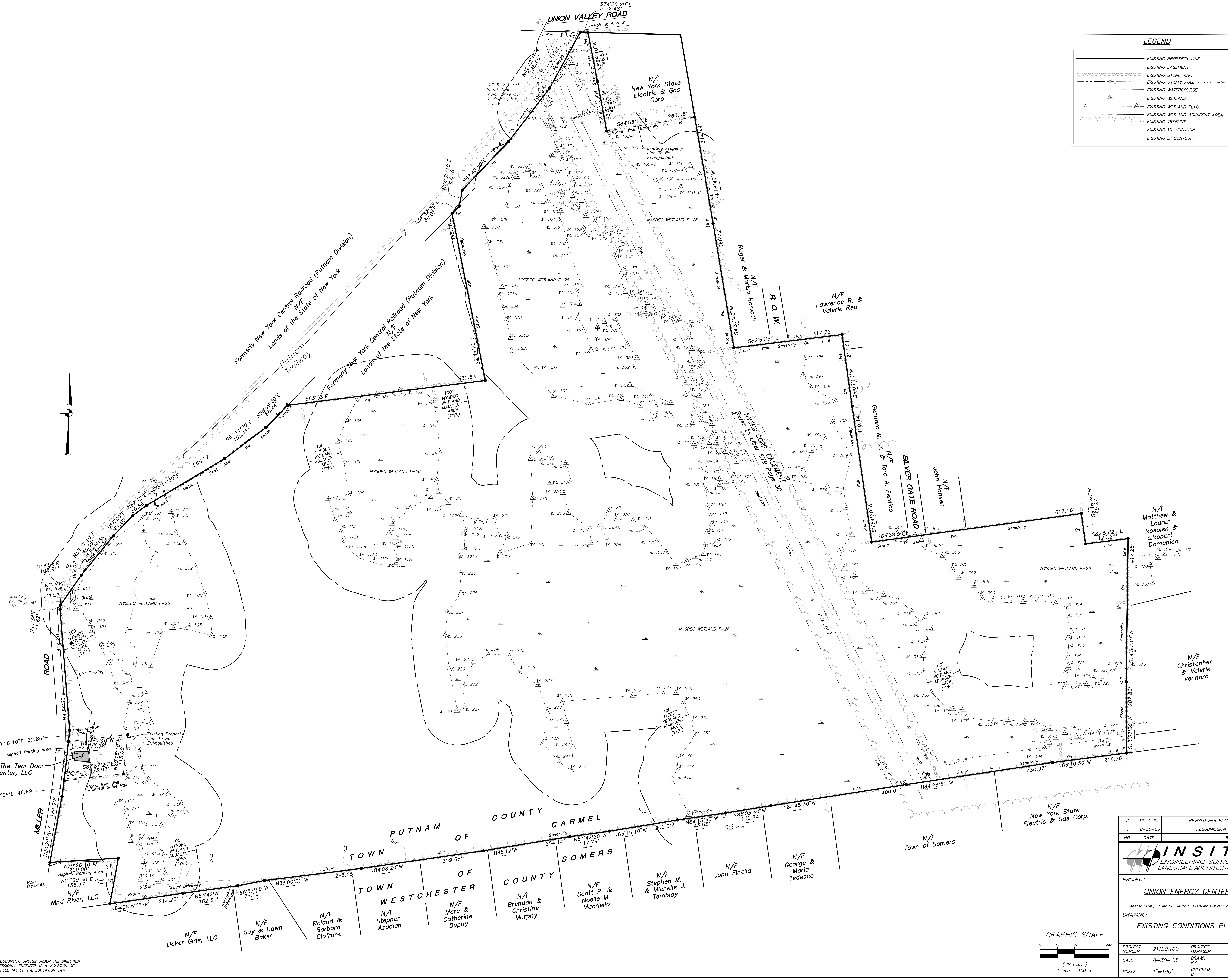
JEFFREY J. CONTELMO 61931

GRAPHIC SCALE
0 50 100 200
(IN FEET)
1 inch = 100 ft.

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8-30-23	DRAWN BY	I.B.
SCALE	1"=100'	CHECKED BY	A.D.T.

DRAWING NO. OP-1
SHEET 1/12

ALTERATION OF THIS DOCUMENT, UNLESS UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, IS A VIOLATION OF SECTION 7209 OF ARTICLE 145 OF THE EDUCATION LAW.



LEGEND

- EXISTING PROPERTY LINE
- EXISTING EASEMENT
- EXISTING STONE WALL
- EXISTING UTILITY POLE w/ guy & overhead wires
- EXISTING WATERCOURSE
- EXISTING WETLAND
- EXISTING WETLAND FLAG
- EXISTING WETLAND ADJACENT AREA
- EXISTING TREELINE
- EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR

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1	10-30-23	RESUBMISSION TO PLANNING BOARD	MEU

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PROJECT:

UNION ENERGY CENTER

MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:

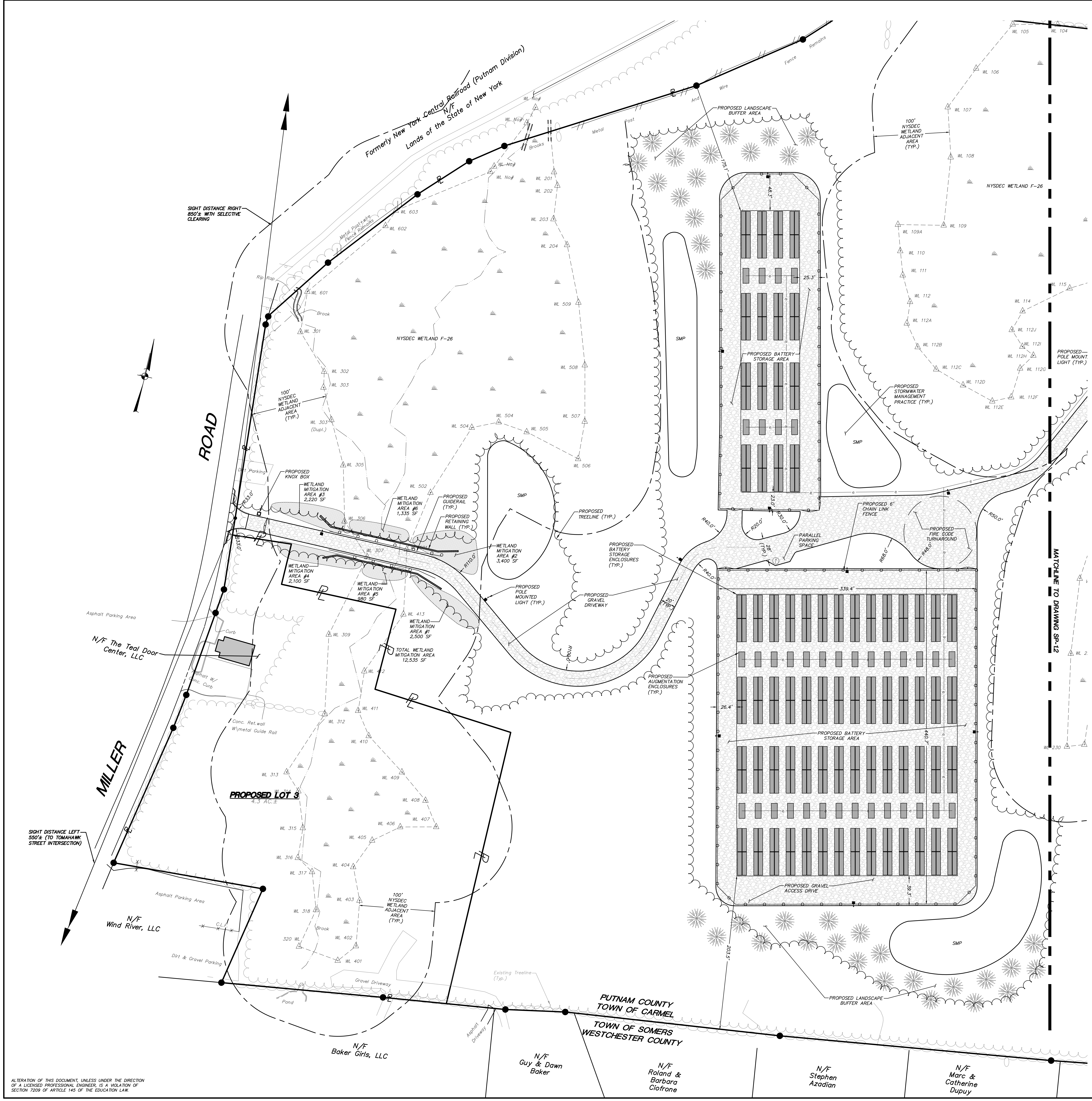
EXISTING CONDITIONS PLAN

JEFFREY J. CONTELMO
61931

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8-30-23	DRAWN BY	I.B.
SCALE	1"=100'	CHECKED BY	A.D.T.

DRAWING NO. EX-1

SHEET 2/12



GRAPHIC SCALE

0 25 50 100

(IN FEET)
1 inch = 50 ft.

LEGEND

- EXISTING PROPERTY LINE
- EXISTING EASEMENT
- EXISTING STONE WALL
- EXISTING UTILITY POLE w/ guy & overhead wires
- EXISTING WATERCOURSE
- EXISTING WETLAND
- EXISTING WETLAND FLAG
- EXISTING 100 YR. FLOODPLAIN BOUNDARY
- EXISTING WETLAND BUFFER
- EXISTING TREELINE
- PROPOSED OVERHEAD WIRES
- PROPOSED SINGLE POLE SIGN
- PROPOSED DOUBLE POLE SIGN
- PROPOSED DOUBLE SIDED SIGN
- PROPOSED BOLLARD
- PROPOSED GUIDE RAIL
- PROPOSED POLE MOUNTED LIGHT
- PROPOSED POST MOUNTED LIGHT
- PROPOSED LOADING SPACE
- PROPOSED LANDSCAPING

SCHEMATIC PLANT LIST

KEY	BOTANICAL/COMMON NAME	SIZE	ROOT
	EVERGREEN TREES		
JV	Juniperus virginia / Eastern Redcedar	8'–10' HT.	B&B
PG	Picea glauca / White Spruce	8'–10' HT.	B&B
TO	Relocated Thuja occidentalis / Arborvitae	6'–8' HT.	B&B
	SHRUBS		
JC	Juniperus chinensis "Sea Green" / Sea Green Juniper		#3 CONT./6' O.C.
VD	Viburnum dentatum / Leatherleaf Viburnum		#3 CONT./6' O.C.
	PERENNIALS/GROUND COVERS		
AC	Aquilegia canadensis / Columbine		#1 CONT./18" O.C.
EP	Echinacea purpurea / Purple Coneflower		#1 CONT./18" O.C.
MV	Mertensia virginica / Virginia Bluebells		#1 CONT./18" O.C.

WETLAND MITIGATION PLANT LIST

QTY	BOTANICAL/COMMON NAME	SIZE	SPACING
35	Amelanchier canadensis / Shadblow	2'–3'	10' O.C.
36	Cornus foemina / Gray Dogwood	2'–3'	10' O.C.
37	Lindera benzoin / Spicebush	2'–3'	10' O.C.
35	Sambucus canadensis / Elderberry	2'–3'	10' O.C.
36	Viburnum dentatum / Arrowood viburnum	2'–3'	10' O.C.
35	Viburnum lentago / Nannyberry	2'–3'	10' O.C.

NOTES:

1. All plantings to be verified by the Town of Carmel Wetland Inspector.
2. All plantings shall be installed per size of the Town of Carmel Town Code.
3. Wetland mitigation areas and plant lists provided by VHB, Inc.

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NO.	DATE	REVISION	BY
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1	10-30-23	RESUBMISSION TO PLANNING BOARD	MEU

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PROJECT:

UNION ENERGY CENTER

MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:

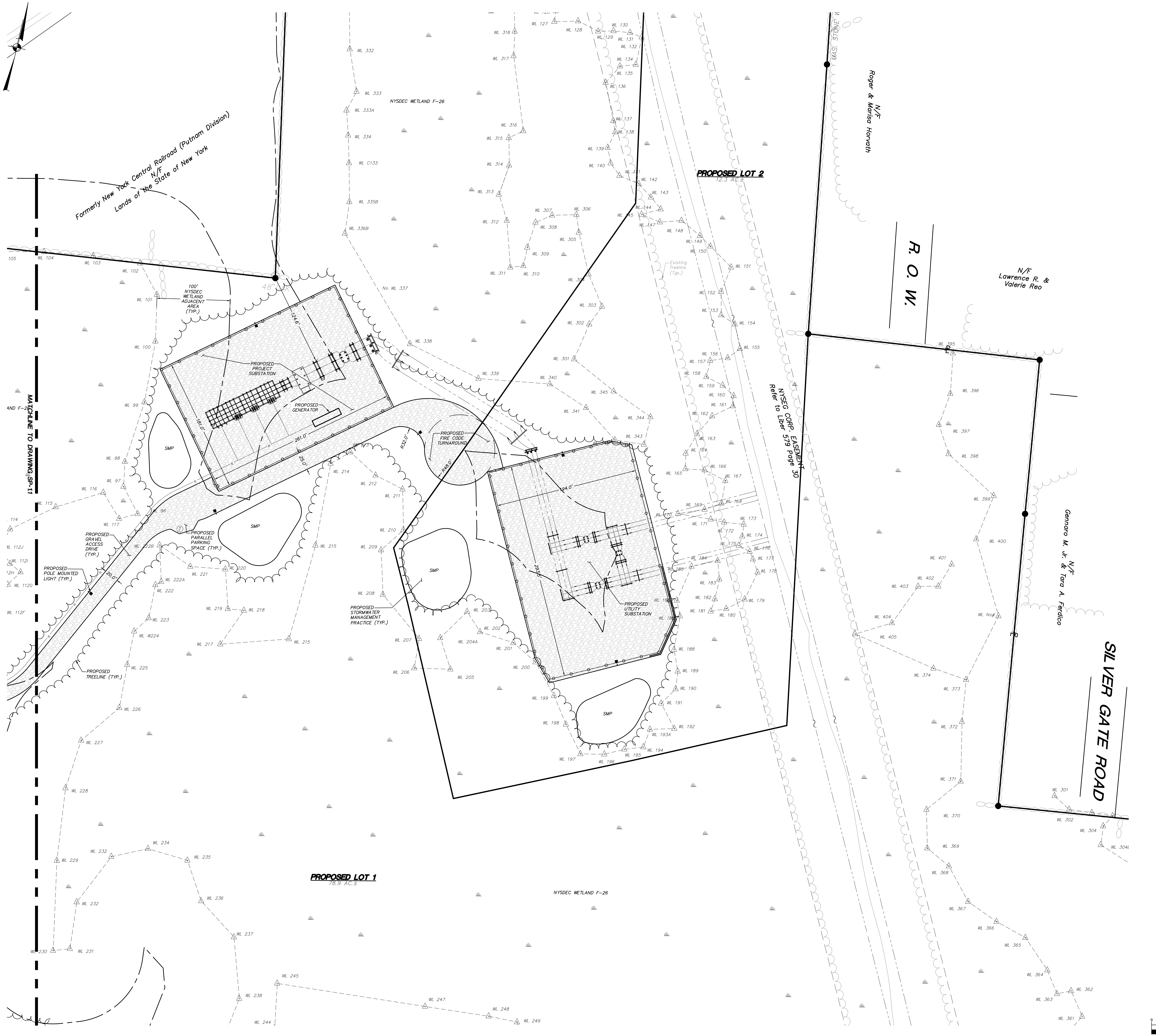
LAYOUT & LANDSCAPE PLAN

JEFFREY J. CONTELMO
61931

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8-30-23	DRAWN BY	I.B.
SCALE	1"=50'	CHECKED BY	A.D.T.

DRAWING NO. SP-1.1

SHEET 3 / 12



GRAPHIC SCALE

0 25 50 100

(IN FEET)
1 inch = 50 ft.

LEGEND

EXISTING PROPERTY LINE
EXISTING EASEMENT
EXISTING STONE WALL
EXISTING UTILITY POLE w/ guy & overhead wires
EXISTING WATERCOURSE
EXISTING WETLAND
EXISTING WETLAND FLAG
EXISTING 100 YR. FLOODPLAIN BOUNDARY
EXISTING WETLAND BUFFER
EXISTING TREELINE
PROPOSED OVERHEAD WIRES
PROPOSED SINGLE POLE SIGN
PROPOSED DOUBLE POLE SIGN
PROPOSED DOUBLE SIDED SIGN
PROPOSED BOLLARD
PROPOSED GUIDE RAIL
PROPOSED POLE MOUNTED LIGHT
PROPOSED POST MOUNTED LIGHT
PROPOSED LOADING SPACE
PROPOSED LANDSCAPING

SCHEMATIC PLANT LIST

KEY	BOTANICAL/COMMON NAME	SIZE	ROOT
	EVERGREEN TREES		
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PG	Picea glauca / White Spruce	8'–10' HT.	B&B
TO	Relocated Thuja occidentalis / Arborvitae	6'–8' HT.	B&B
	SHRUBS		
JC	Juniperus chinensis "Sea Green" / Sea Green Juniper		#3 CONT./6' O.C.
VD	Viburnum dentatum / Leatherleaf Viburnum		#3 CONT./6' O.C.
	PERENNIALS/GROUND COVERS		
AC	Aquilegia canadensis / Columbine		#1 CONT./18" O.C.
EP	Echinacea purpurea / Purple Coneflower		#1 CONT./18" O.C.
MV	Mertensia virginica / Virginia Bluebells		#1 CONT./18" O.C.

NO.	DATE	REVISION	BY
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1	10-30-23	RESUBMISSION TO PLANNING BOARD	MEU

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PROJECT:

UNION ENERGY CENTER

MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:

LAYOUT & LANDSCAPE PLAN

JEFFREY J. CONTELMO
61931

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8-30-23	DRAWN BY	I.B.
SCALE	1"=50'	CHECKED BY	A.D.T.

DRAWING NO. SP-1.2

SHEET 4/12

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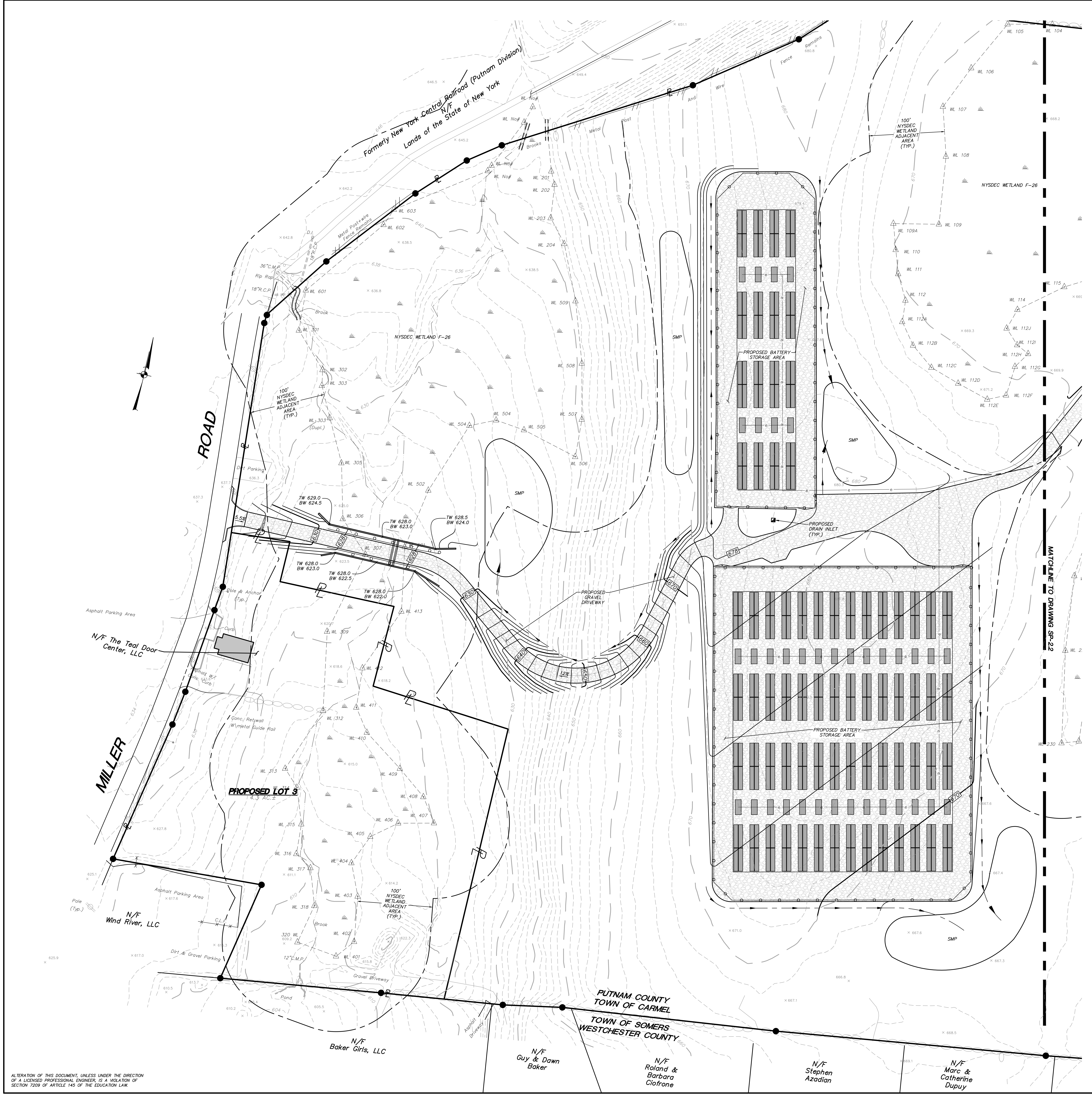

LEGEND

━━━━━	EXISTING PROPERTY LINE
— — —	EXISTING EASEMENT
○○○○○○○	EXISTING STONE WALL
— — ⊘ — —	EXISTING UTILITY POLE w/ guy & overhead wires
—···—	EXISTING WATERCOURSE
ᐦ	EXISTING WETLAND
—△— — — —△—	EXISTING WETLAND FLAG
━━ ━ ━━	EXISTING WETLAND BUFFER
—100—	EXISTING 10' CONTOUR
- - - - -	EXISTING 2' CONTOUR
—[100]—	PROPOSED 10' CONTOUR
———	PROPOSED 2' CONTOUR
×100.5 ×100.5	PROPOSED SPOT ELEVATION
—— — — ——	PROPOSED OVERHEAD WIRES
◐	PROPOSED DRAINAGE MANHOLE
◪	PROPOSED CATCH BASIN
⊠	PROPOSED OUTLET STRUCTURE
◁	PROPOSED END SECTION
⚲	PROPOSED FIRE HYDRANT
▲	PROPOSED WELL
SO	PROPOSED WATER SHUT OFF VALVE
WV ⋈	PROPOSED WATER VALVE
═>═	PROPOSED DRAINAGE PIPE
—fs—	PROPOSED FIRE SERVICE LINE
—ws—	PROPOSED DOMESTIC WATER SERVICE LINE
—W—	PROPOSED WATER MAIN
—►— — —►—	PROPOSED GRASS SWALE
PTD	PITCH TO DRAIN
●CO	PROPOSED CLEAN OUT

UTILITIES NOTES:

1. All utilities except for overhead wires associated with the substations and Battery Energy Storage Systems (BESS) will be buried.

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GRAPHIC SCALE

0 25 50 100

(IN FEET)
1 inch = 50 ft..

NO.	DATE	REVISION	BY
2	12-4-23	REVISED PER PLANNING BOARD COMMENTS	KJK
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PROJECT:

UNION ENERGY CENTER

MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:

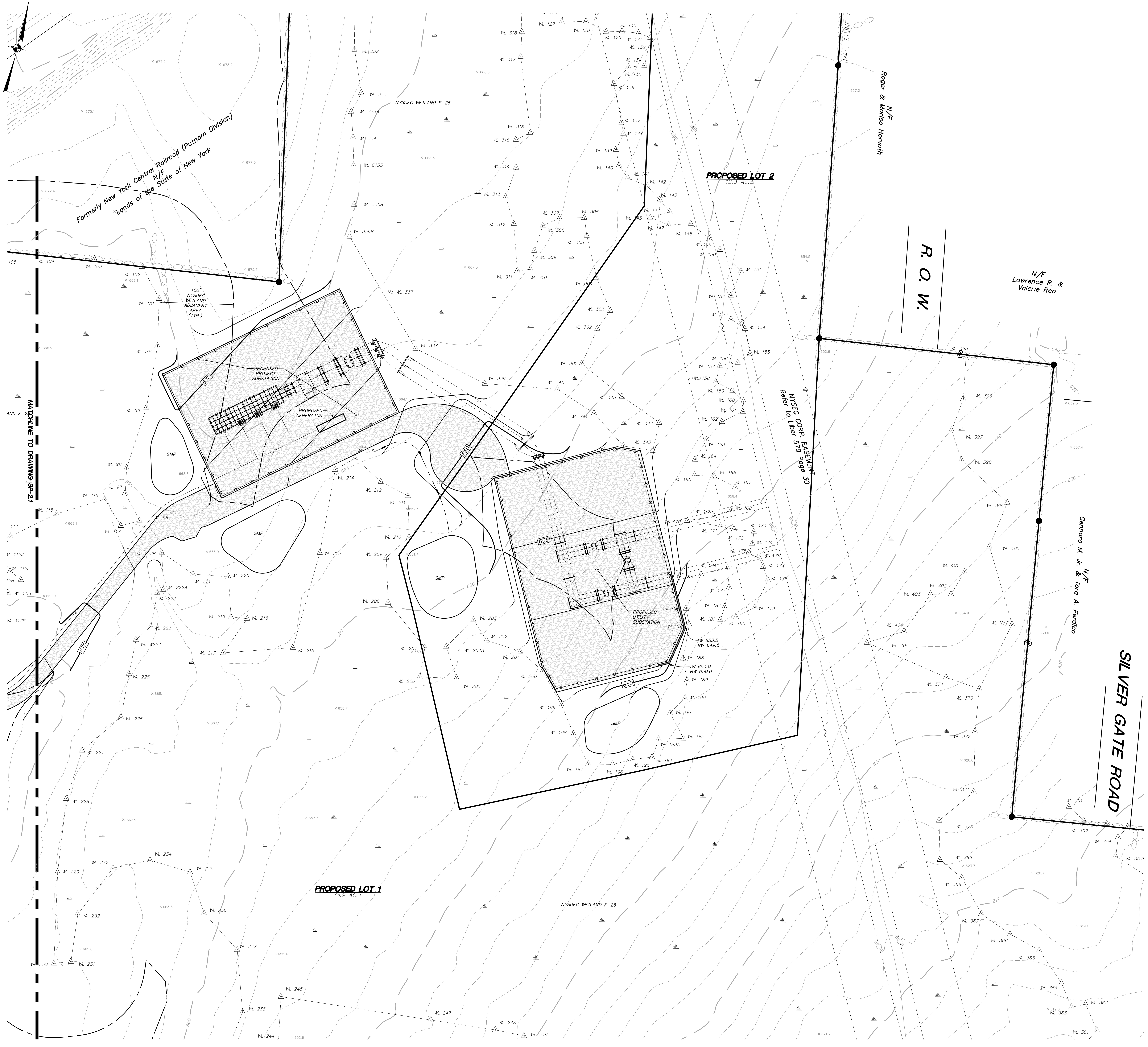
GRADING & UTILITIES PLAN

JEFFREY J. CONTELMO 61931

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8-30-23	DRAWN BY	I.B.
SCALE	1"=50'	CHECKED BY	A.D.T.

DRAWING NO. SP-2.1

SHEET 5/12



GRAPHIC SCALE

0 25 50 100

(IN FEET)
1 inch = 50 ft.

LEGEND

▬	EXISTING PROPERTY LINE
— — —	EXISTING EASEMENT
⬭⬭⬭	EXISTING STONE WALL
	EXISTING UTILITY POLE w/ guy & overhead wires
	EXISTING WATERCOURSE
	EXISTING WETLAND
	EXISTING WETLAND FLAG
	EXISTING WETLAND BUFFER
100	EXISTING 10' CONTOUR
	EXISTING 2' CONTOUR
100	PROPOSED 10' CONTOUR
	PROPOSED 2' CONTOUR
×100.5 ×100.5	PROPOSED SPOT ELEVATION
	PROPOSED OVERHEAD WIRES
◐	PROPOSED DRAINAGE MANHOLE
◩	PROPOSED CATCH BASIN
⧗	PROPOSED OUTLET STRUCTURE
◁	PROPOSED END SECTION
	PROPOSED FIRE HYDRANT
▲	PROPOSED WELL
WSO	PROPOSED WATER SHUT OFF VALVE
WV	PROPOSED WATER VALVE
>	PROPOSED DRAINAGE PIPE
fs	PROPOSED FIRE SERVICE LINE
ws	PROPOSED DOMESTIC WATER SERVICE LINE
W	PROPOSED WATER MAIN
	PROPOSED GRASS SWALE
PTD	PITCH TO DRAIN
●CO	PROPOSED CLEAN OUT

NO.	DATE	REVISION	BY
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PROJECT:

UNION ENERGY CENTER

MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:

GRADING & UTILITIES PLAN

STATE OF NEW YORK
JEFFREY J. CONTELMO
61931
LICENSED PROFESSIONAL ENGINEER

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.	DRAWING NO.	SHEET
DATE	8-30-23	DRAWN BY	I.B.	SP-2.2	6/12
SCALE	1"=50'	CHECKED BY	A.D.T.		

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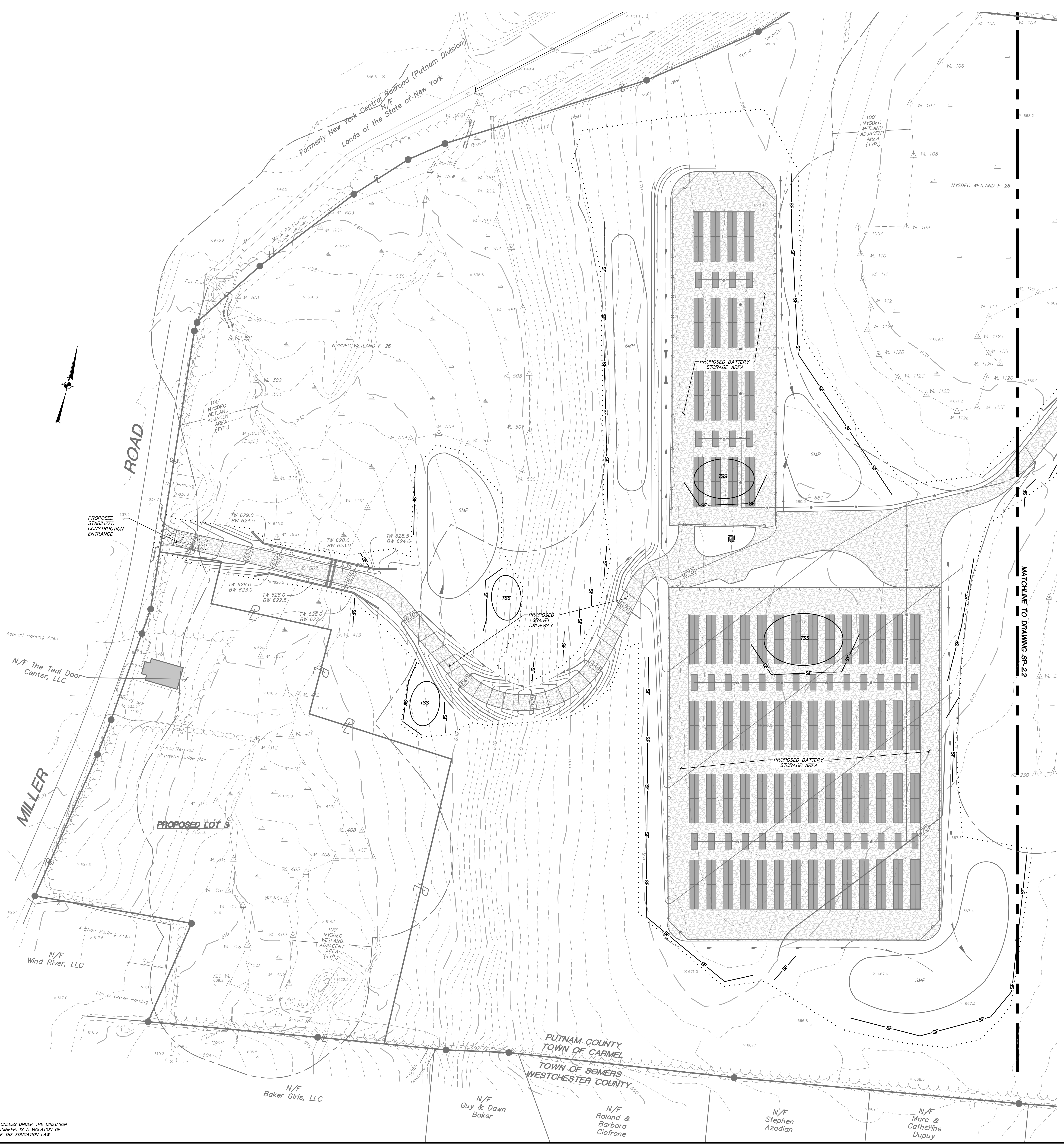

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LEGEND

EXISTING PROPERTY LINE
EXISTING EASEMENT
EXISTING STONE WALL
EXISTING UTILITY POLE w/ guy & overhead wires
EXISTING WATERCOURSE
EXISTING WETLAND
EXISTING WETLAND FLAG
EXISTING WETLAND BUFFER
100 EXISTING 10' CONTOUR
EXISTING 2' CONTOUR
SF PROPOSED SILT FENCE
CF PROPOSED CONSTRUCTION FENCE
TB PROPOSED TURBIDITY CURTAIN
PROPOSED LIMITS OF DISTURBANCE
PROPOSED STONE CHECK DAM
⇒ ⇒ ⇒ PROPOSED TEMPORARY DIVERSION SWALE
TSS SF PROPOSED TEMPORARY SOIL STOCKPILE
▨ PROPOSED STABILIZED CONSTRUCTION ENTRANCE
PROPOSED EROSION CONTROL BLANKET
PROPOSED DRAINAGE STRUCTURE W/ INLET PROTECTION
PROPOSED PHASING LINE

GRAPHIC SCALE
0 25 50 100
(IN FEET)
1 inch = 50 ft.

NO.	DATE	REVISION	BY
2	12-4-23	REVISED PER PLANNING BOARD COMMENTS	KJK
1	10-30-23	RESUBMISSION TO PLANNING BOARD	MEU

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(845) 225-9717 fax
www.insite-eng.com

PROJECT:
UNION ENERGY CENTER
MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:
EROSION & SEDIMENT CONTROL PLAN

JEFFREY J. CONTELMO 61931

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8-30-23	DRAWN BY	I.B.
SCALE	1"=50'	CHECKED BY	A.D.T.

DRAWING NO. SP-3.1
SHEET 7/12

LEGEND

━━━ EXISTING PROPERTY LINE
— — — EXISTING EASEMENT
⬭⬭⬭ EXISTING STONE WALL
EXISTING UTILITY POLE w/ guy & overhead wires
EXISTING WATERCOURSE
EXISTING WETLAND
△ EXISTING WETLAND FLAG
EXISTING WETLAND BUFFER
—100— EXISTING 10' CONTOUR
EXISTING 2' CONTOUR
—SF— PROPOSED SILT FENCE
—CF— PROPOSED CONSTRUCTION FENCE
—TB— PROPOSED TURBIDITY CURTAIN
· · · · · PROPOSED LIMITS OF DISTURBANCE
PROPOSED STONE CHECK DAM
⇒ ⇒ ⇒ PROPOSED TEMPORARY DIVERSION SWALE
TSS / SF PROPOSED TEMPORARY SOIL STOCKPILE
▨ PROPOSED STABILIZED CONSTRUCTION ENTRANCE
PROPOSED EROSION CONTROL BLANKET
PROPOSED DRAINAGE STRUCTURE W/ INLET PROTECTION
▬ ▬ ▬ PROPOSED PHASING LINE

GRAPHIC SCALE
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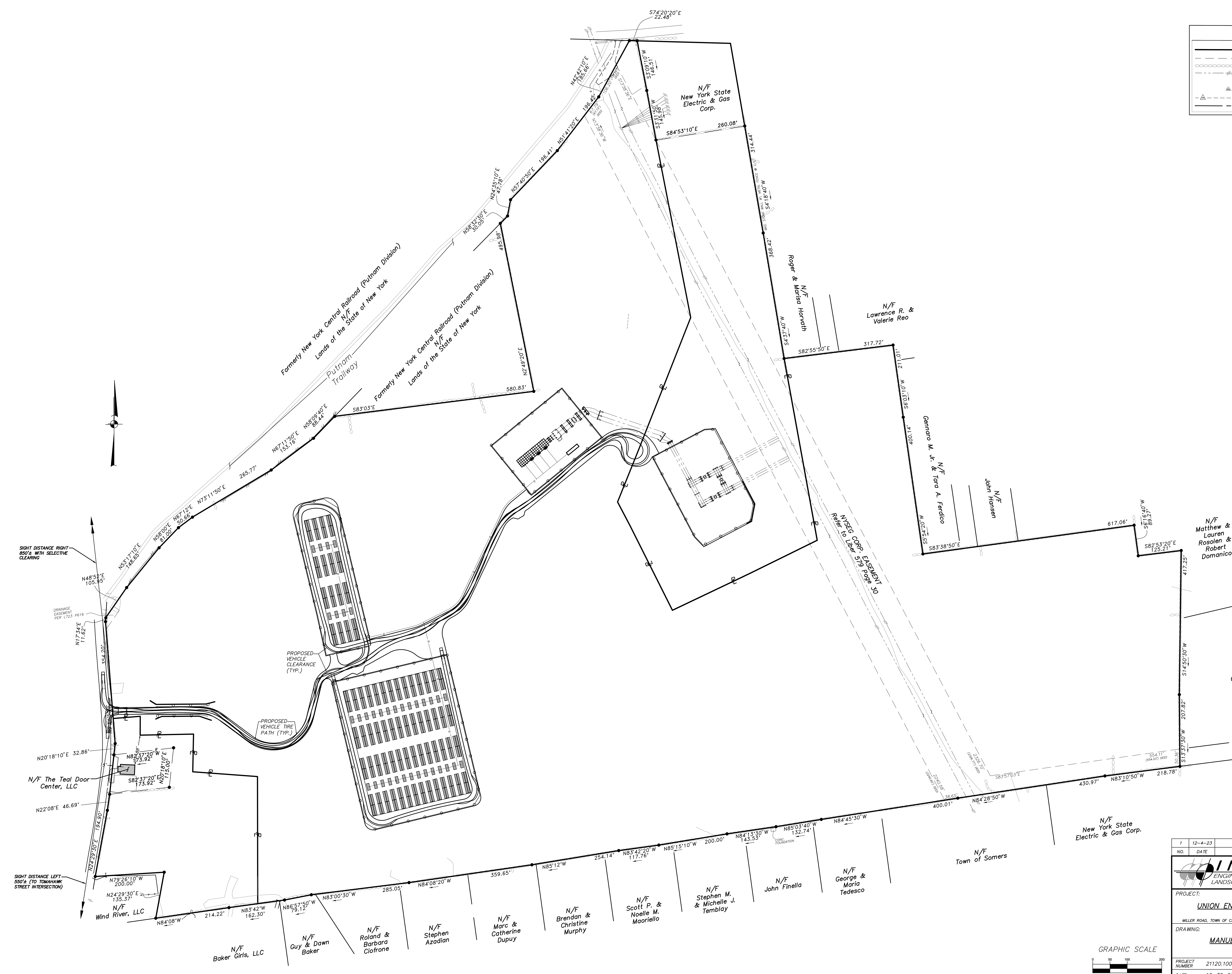
PROJECT:
UNION ENERGY CENTER
MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:
EROSION & SEDIMENT CONTROL PLAN

JEFFREY J. CONTELMO
61931

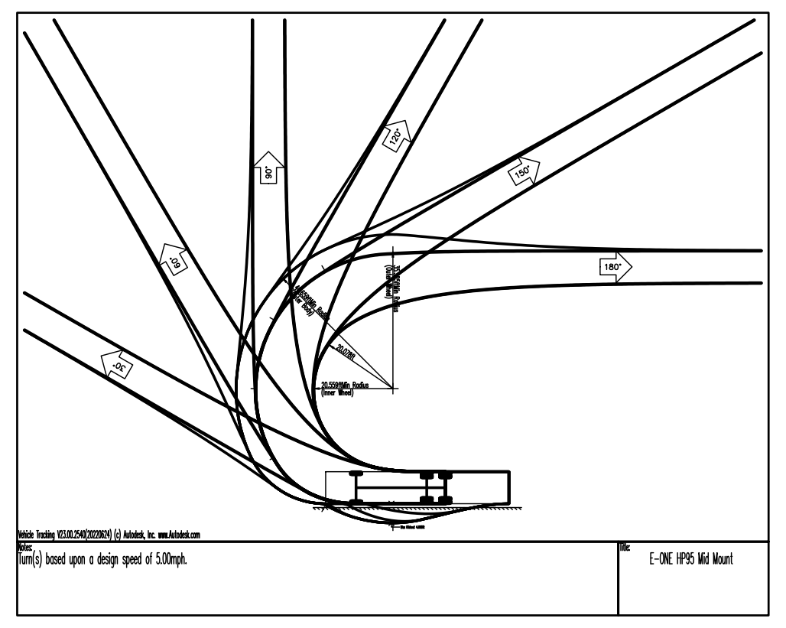
PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8-30-23	DRAWN BY	I.B.
SCALE	1"=50'	CHECKED BY	A.D.T.

DRAWING NO. SP-3.2
SHEET 8 / 12



LEGEND

- EXISTING PROPERTY LINE
- EXISTING EASEMENT
- EXISTING STONE WALL
- EXISTING UTILITY POLE w/ guy & overhead wires
- EXISTING WATERCOURSE
- EXISTING WETLAND
- EXISTING WETLAND FLAG
- EXISTING WETLAND ADJACENT AREA



E-ONE HP95 MID MOUNT TURNING TEMLATE

SCALE: 1" = 50'

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PROJECT:

UNION ENERGY CENTER

MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:

MANUEVER PLAN

JEFFREY J. CONTELMO
61931

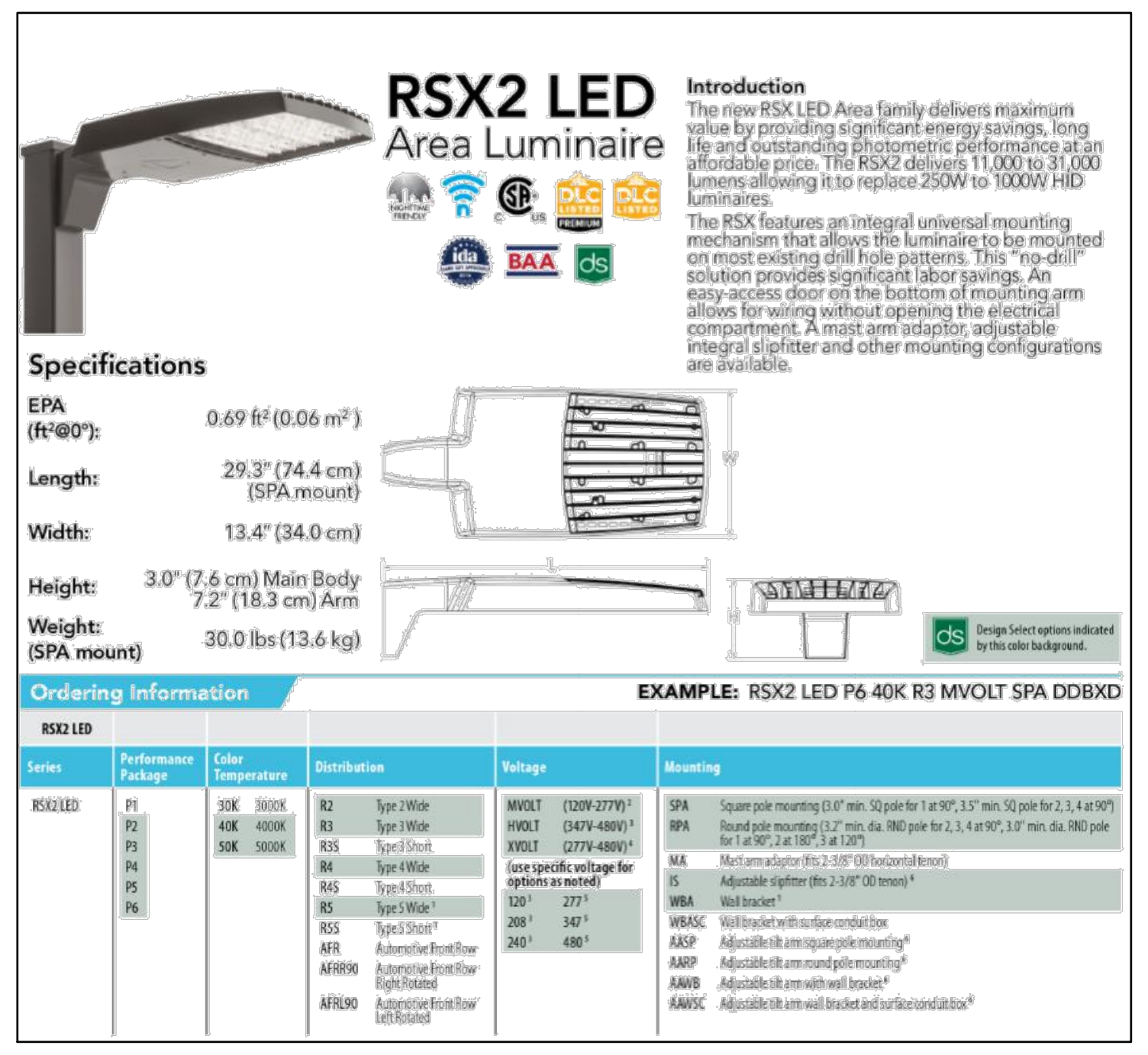
PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	10-30-23	DRAWN BY	K.J.K.
SCALE	1"=100'	CHECKED BY	A.D.T.

DRAWING NO. SP-4.1

SHEET 9 / 12

LUMINAIRE SCHEDULE

Sym	Qty	Catalog Number	Description	Lamp	Mounting Height	Watts
■	34	RSX2 LED P1 30K R3 EGFV	LITHONIA LIGHTING LED POLE MOUNTED LIGHT TYPE 3M DISTRIBUTION	LED	20'–0"	72.1



RSX2 LED
Area Luminaire

Introduction

The new RSX LED Area family delivers maximum value by providing significant energy savings, long life and outstanding photometric performance at an affordable price. The RSX2 delivers 11,000 to 31,000 lumens allowing it to replace 250W to 1000W HID luminaires.

The RSX features an integral universal mounting mechanism that allows the luminaire to be mounted on most existing drill hole patterns. This "no-drill" solution provides significant labor savings. An easy-access door on the bottom of mounting arm allows for wiring without opening the electrical compartment. A mast arm adaptor, adjustable integral slipfitter and other mounting configurations are available.

Specifications

EPA (ft^2@0°):	0.69 ft^2 (0.06 m^2)
Length:	29.3" (74.4 cm) (SPA mount)
Width:	13.4" (34.0 cm)
Height:	3.0" (7.6 cm) Main Body 7.2" (18.3 cm) Arm
Weight: (SPA mount)	30.0 lbs (13.6 kg)

Design Select options indicated by this color background.

Ordering Information EXAMPLE: RSX2 LED P6 40K R3 MVOLT SPA DDBXD

RSX2 LED

Series	Performance Package	Color Temperature	Distribution	Voltage	Mounting
RSX2 LED	P1 P2 P3 P4 P5 P6	30K 3000K 40K 4000K 50K 5000K	R2 Type 2 Wide R3 Type 3 Wide R3S Type 3 Short R4 Type 4 Wide R4S Type 4 Short R5 Type 5 Wide[1] R5S Type 5 Short[1] AFR Automotive Front Row AFRR90 Automotive Front Row Right Rotated AFRL90 Automotive Front Row Left Rotated	MVOLT (120V-277V)[2] HVOLT (347V-480V)[3] XVOLT (277V-480V)[4] (use specific voltage for options as noted) 120[3] 277[5] 208[3] 347[5] 240[3] 480[5]	SPA Square pole mounting (3.0" min. SQ pole for 1 at 90°, 3.5" min. SQ pole for 2, 3, 4 at 90°) RPA Round pole mounting (3.2" min. dia. RND pole for 2, 3, 4 at 90°, 3.0" min. dia. RND pole for 1 at 90°, 2 at 180°, 3 at 120°) MA Mast arm adaptor (fits 2-3/8" OD horizontal tenon) IS Adjustable slipfitter (fits 2-3/8" OD tenon)[6] WBA Wall bracket[1] WBASC Wall bracket with surface conduit box AASP Adjustable tilt arm square pole mounting[6] AARP Adjustable tilt arm round pole mounting[6] AAWB Adjustable tilt arm with wall bracket[6] AAWSC Adjustable tilt arm wall bracket and surface conduit box[6]

LIGHTING NOTES:

1. All lighting shall be as noted on the plan or approved equal.
2. Style and finish of all luminaires to be selected by owner.
3. Proposed lights will run on motion sensors after hours for security only.
4. Type, location, and shading of all proposed lighting shall prevent the spillover of light onto all adjacent residential properties.
5. All light fixtures to be full cutoff to comply with dark sky guidelines.

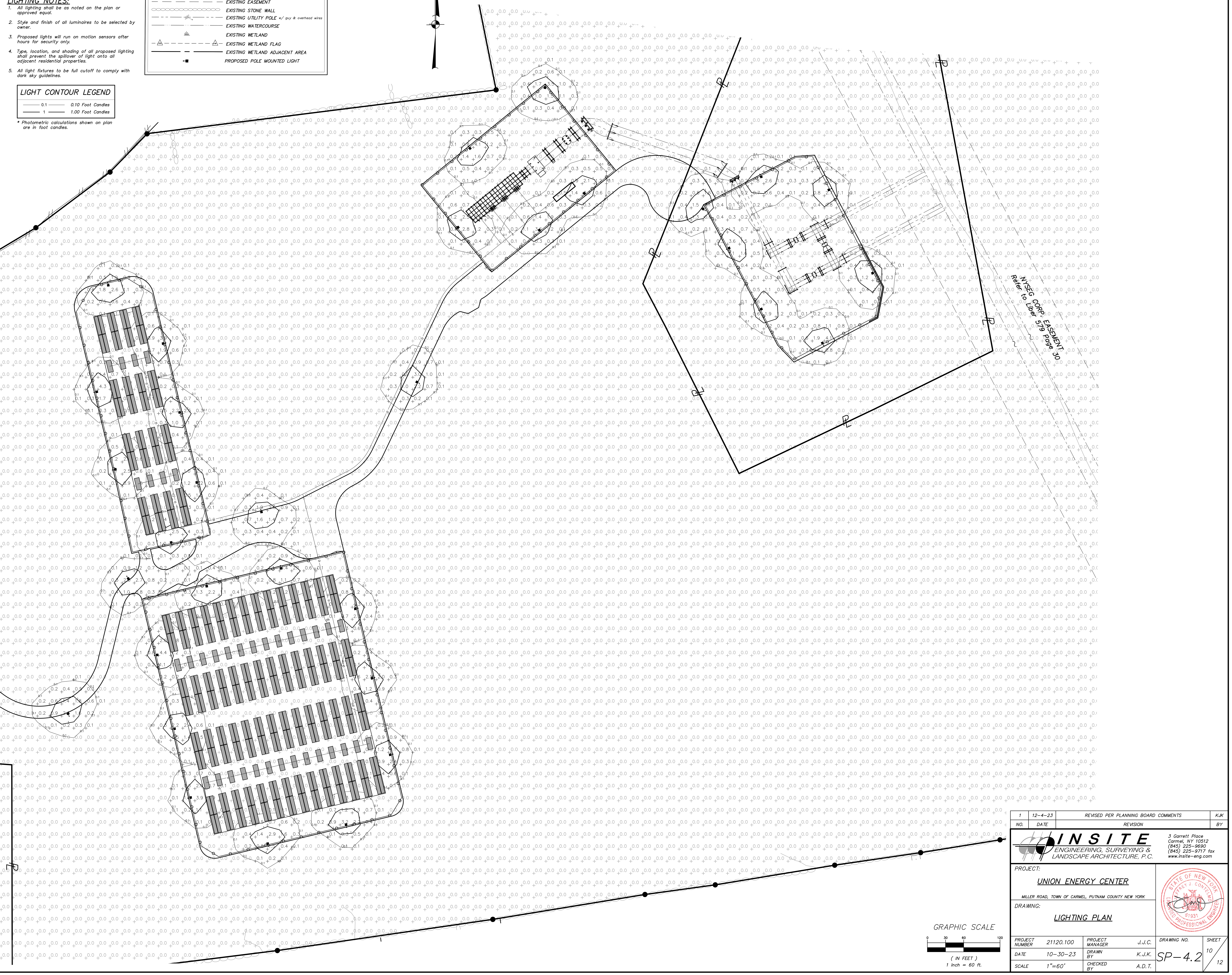
LIGHT CONTOUR LEGEND

—— 0.1 ——	0.10 Foot Candles
—— 1 ——	1.00 Foot Candles

* Photometric calculations shown on plan are in foot candles.

LEGEND

━━━━	EXISTING PROPERTY LINE
— — — —	EXISTING EASEMENT
○○○○○○	EXISTING STONE WALL
— - - — ⊘ — - - —	EXISTING UTILITY POLE w/ guy & overhead wires
—— ··· ——	EXISTING WATERCOURSE
⩛	EXISTING WETLAND
— △ — — — △ —	EXISTING WETLAND FLAG
——— ▬ ———	EXISTING WETLAND ADJACENT AREA
∘■	PROPOSED POLE MOUNTED LIGHT



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PROJECT:

UNION ENERGY CENTER

MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:

LIGHTING PLAN

JEFFREY J. CONTELMO
61931

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	10–30–23	DRAWN BY	K.J.K.
SCALE	1"=60'	CHECKED BY	A.D.T.

DRAWING NO. SP–4.2

SHEET 10 / 12

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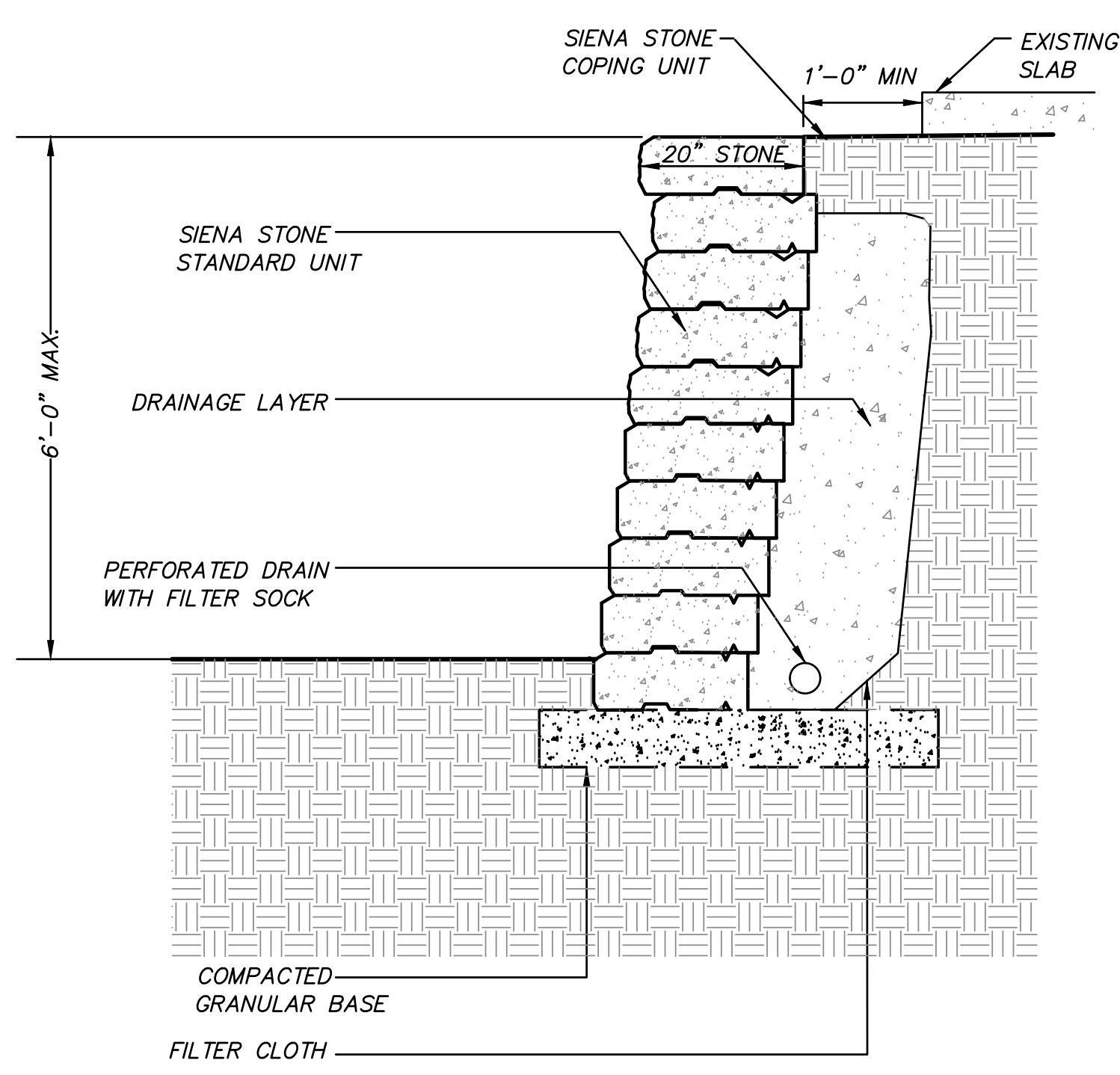
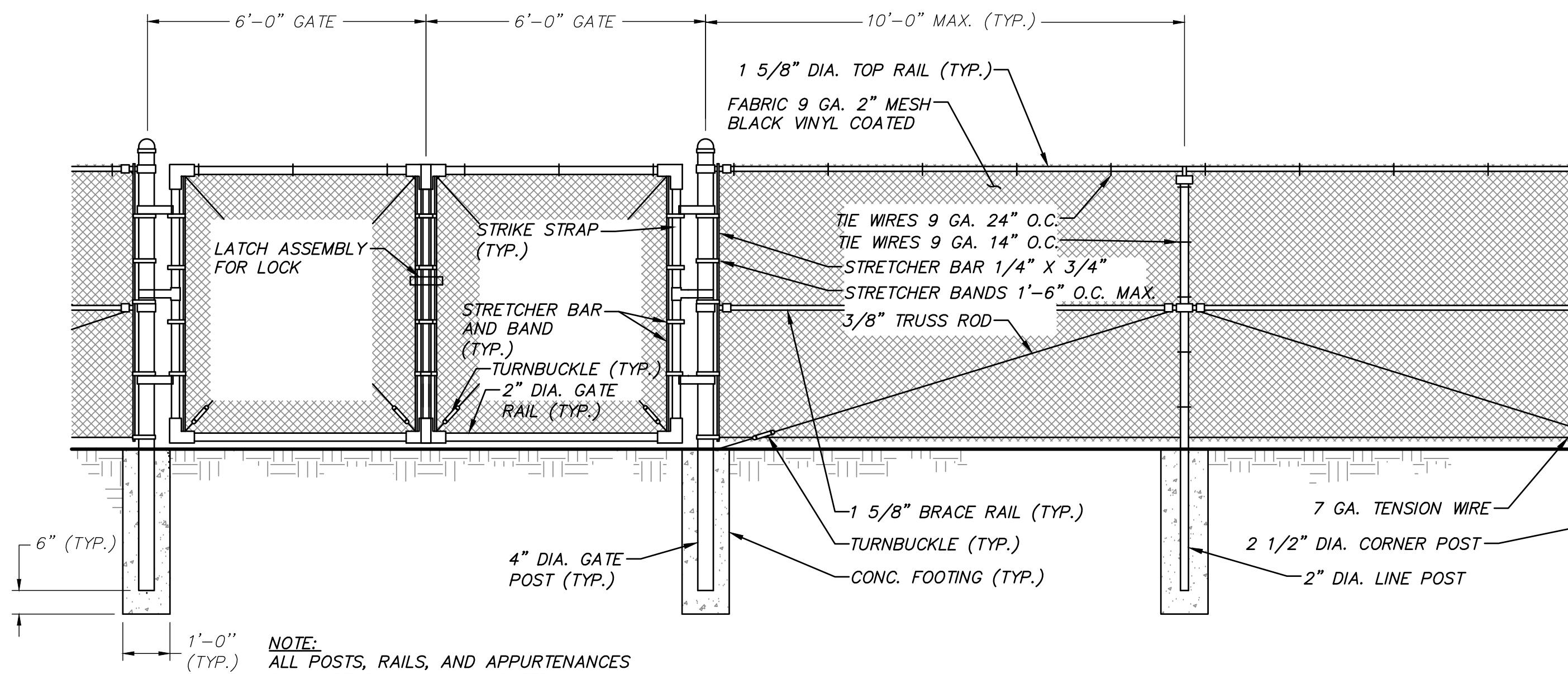


NOTES:

1. STRIP VEGETATION AND ORGANIC SOIL FROM WALL AREA.
2. BENCH CUT ALL EXCAVATED SLOPES.
3. DO NOT OVER EXCAVATE UNLESS DIRECTED BY SITE ENGINEER TO REMOVE UNSUITABLE SOIL.
4. SITE ENGINEER SHALL VERIFY FOUNDATION SOILS AS BEING COMPETENT PER THE DESIGN STANDARDS AND PARAMETERS.
5. LEVELING PAD SHALL CONSIST OF COMPACTED COARSE SAND OR CRUSHED GRAVEL, 6" THICK MIN.
6. CONTRACTOR MAY OPT FOR A LEAN CONCRETE PAD. CONCRETE PAD SHALL BE UNREINFORCED, 3" THICK MAXIMUM.
7. MINIMUM EMBEDMENT OF WALL BELOW FINISH GRADE SHALL BE 6".
8. FOR UNITS TO BE EMBEDDED, COMPACT FILL IN FRONT OF UNITS AT THE SAME TIME FILL BEHIND UNITS IS COMPACTED.
9. DRAINAGE AGGREGATE SHALL BE INSTALLED DIRECTLY BEHIND THE WALL WITHIN 12" OF THE TOP OF THE WALL. DRAINAGE AGGREGATE SHALL NOT EXTEND BELOW FINAL GRADE IN FRONT OF WALL.
10. COMPACTION SHALL BE TO 95% OF MAXIMUM STANDARD PROCTOR DENSITY.(ASTM D-698)
11. COMPACTION TESTS SHALL BE TAKEN AS THE WALL IS INSTALLED. THE MINIMUM NUMBER OF TESTS SHALL BE DETERMINED BY THE SITE SOILS ENGINEER.
12. COMPACTION WITHIN 3 FT. OF WALL SHALL BE LIMITED TO HAND OPERATED EQUIPMENT.
13. CONTRACTOR SHALL DIRECT SURFACE RUNOFF TO AVOID DAMAGING WALL WHILE UNDER CONSTRUCTION.
14. ANY SURFACE DRAINAGE FEATURES, FINISH GRADING, PAVEMENT, OR TURF SHALL BE INSTALLED IMMEDIATELY AFTER WALL IS COMPLETED.
15. FOLLOW APPLICABLE PROVISIONS OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND WRITTEN SPECIFICATIONS.

RETAINING WALL DETAIL

(N.T.S.)



NOTE:
ALL POSTS, RAILS, AND APPURTENANCES SHALL BE BLACK VINYL COATED.

CHAIN LINK FENCE DETAIL

(N.T.S.)

GENERAL PLANTING NOTES:

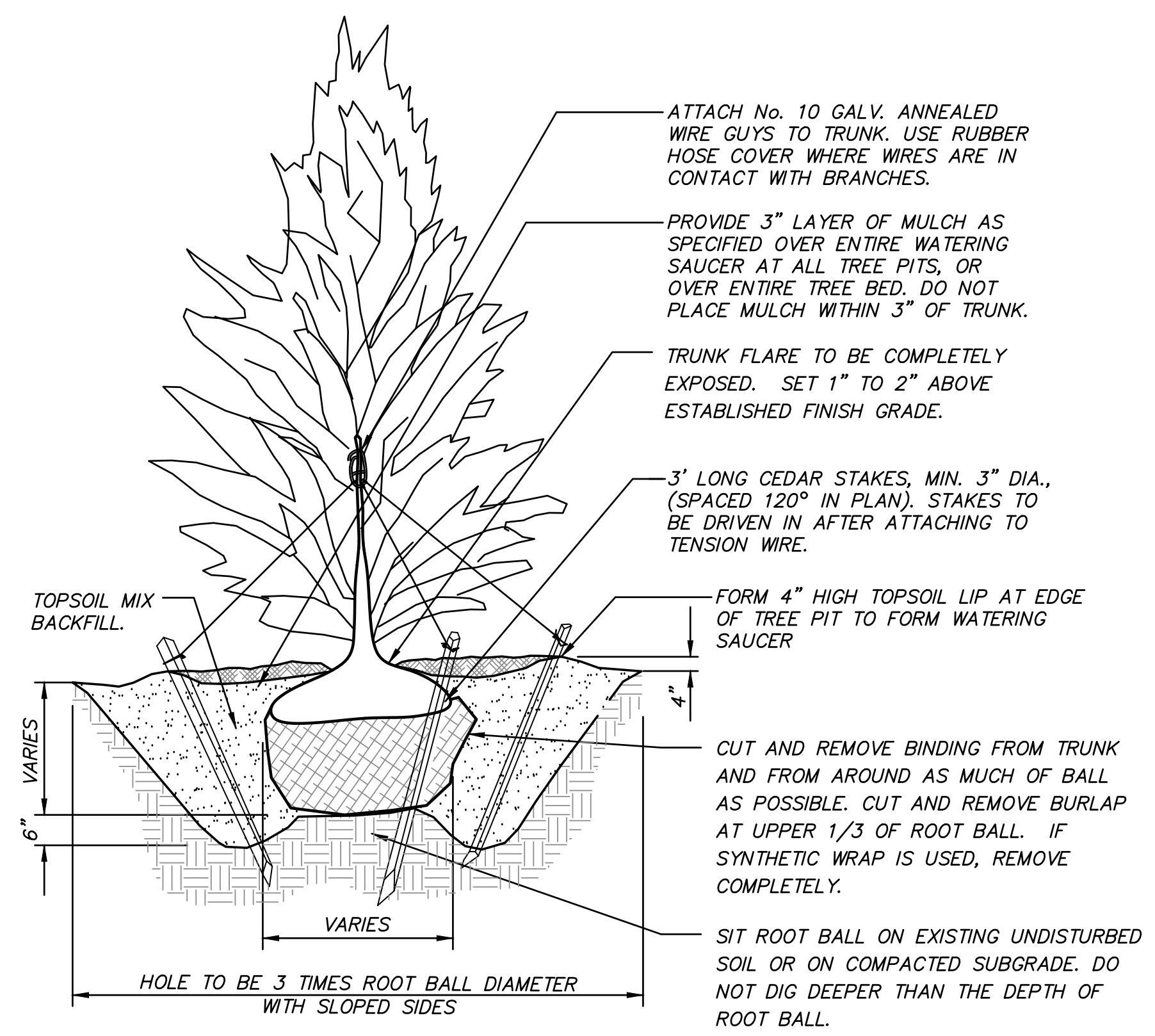
1. All proposed planting beds to receive a 12" min. depth of topsoil. Soil amendments and fertilizer application rates shall be determined based on specific testing of topsoil material.
2. Any new soils added will be amended as required by results of soil testing and placed using a method that will not cause compaction.
3. No fertilizer shall be added in stormwater basin plantings. Nutrient requirements to be met by incorporation of acceptable organic matter.
4. All plant material to be nursery grown.
5. Plants shall conform with ANSI Z60.1 American Standard for Nursery Stock in all ways including dimensions.
6. Plant material shall be taken from healthy nursery stock.
7. All plants shall be grown under climate conditions similar to those in the locality of the project.
8. Plants shall be planted in all locations designed on the plan or as staked in the field by the Landscape Architect.
9. The location and layout of landscape plants shown on the site plan shall take precedence in any discrepancies between the quantities of plants shown on the plans and the quantity of plants in the Plant List.
10. Provide a 3" layer of shredded pine bark mulch (or as specified) over entire watering saucer at all tree pits or over entire planting bed. Do not place mulch within 3" of tree or shrub trunks.
11. All landscape plantings shall be maintained in a healthy condition at all times. Any dead or diseased plants shall immediately be replaced "in kind" by the contractor (during warranty period) or project owner.

GENERAL SITE SEEDING NOTES:

1. All proposed seeded areas to receive 4" min. depth of topsoil. Soil amendments and fertilizer application rates shall be determined based on specific testing of topsoil material.
2. For temporary stabilization, apply annual ryegrass (Lolium perenne ssp.) at 30 lbs/ acre.
3. Upon final grading and placement of topsoil and any required soil amendments, areas to receive permanent vegetation cover in combination with suitable mulch as follows:
   - select seed mixture per drawings and seeding notes.
   - fertilizer applied at the manufacturer's recommended rate using Lesco 10-0-18 (no phosphorous) fertilizer or equivalent.
   - mulch: salt hay or small grain straw applied at a rate of 90 lbs./1000s.f. or 2 tons/acre, to be applied and anchored according to New York State Standards and Specifications for Erosion and Sediment Control, August 2005.
   - if the season prevents the establishment of a permanent vegetation cover, the disturbed areas will be mulched with straw or equivalent.
4. Seed Mix #1 for areas as shown on the drawings, including tops of berms, backslopes of embankments of stormwater basins, & any area to be seeded within the NYSDEC Wetland Adjacent Area, at a rate of 30 lbs. per acre: 30% annual ryegrass (Lolium perenne ssp.), and 70% New England Conservation/Wildlife Mix from New England Wetland Plants, Inc. of Amherst, MA.
5. Seed Mix #2 for areas as shown on the drawings in stormwater basins with no standing water at a rate of 18 lbs per acre: Erosion Control/ Restoration Mix for Detention Basins and Moist Sites from New England Wetland Plants, Inc. of Amherst MA.
6. Seed Mix #3 for all other disturbed areas not specified as seed mix #1 or #2. Primarily for lawn areas and mow strip along roads at a rate of 100 lbs. per acre:

Kentucky Bluegrass	20%
Creeping Red Fescue	40%
Perennial Ryegrass	20%
Annual Ryegrass	20%

7. Seed mixes to be planted between March 21 and May 20, or between August 15 and October 15 or as directed by project representative.
8. Mulch: Salt hay or small grain straw applied at a rate of 90 lbs./1000 S.F. or 2 tons/acre, to be applied and anchored according to "New York Standards and Specification For Erosion and Sediment Control," latest edition.
9. Grass seed mix may be applied by either mechanical or hydroseeding methods. Seeding shall be performed in accordance with the current edition of the "NYSDOT Standard Specification, Construction and Materials, Section 610-3.02, Method No. 1". Hydroseeding shall be performed using materials and methods as approved by the site engineer.



ATTACH No. 10 GALV. ANNEALED WIRE GUYS TO TRUNK. USE RUBBER HOSE COVER WHERE WIRES ARE IN CONTACT WITH BRANCHES.

PROVIDE 3" LAYER OF MULCH AS SPECIFIED OVER ENTIRE WATERING SAUCER AT ALL TREE PITS, OR OVER ENTIRE TREE BED. DO NOT PLACE MULCH WITHIN 3" OF TRUNK.

TRUNK FLARE TO BE COMPLETELY EXPOSED. SET 1" TO 2" ABOVE ESTABLISHED FINISH GRADE.

3' LONG CEDAR STAKES, MIN. 3" DIA., (SPACED 120° IN PLAN). STAKES TO BE DRIVEN IN AFTER ATTACHING TO TENSION WIRE.

FORM 4" HIGH TOPSOIL LIP AT EDGE OF TREE PIT TO FORM WATERING SAUCER

CUT AND REMOVE BINDING FROM TRUNK AND FROM AROUND AS MUCH OF BALL AS POSSIBLE. CUT AND REMOVE BURLAP AT UPPER 1/3 OF ROOT BALL. IF SYNTHETIC WRAP IS USED, REMOVE COMPLETELY.

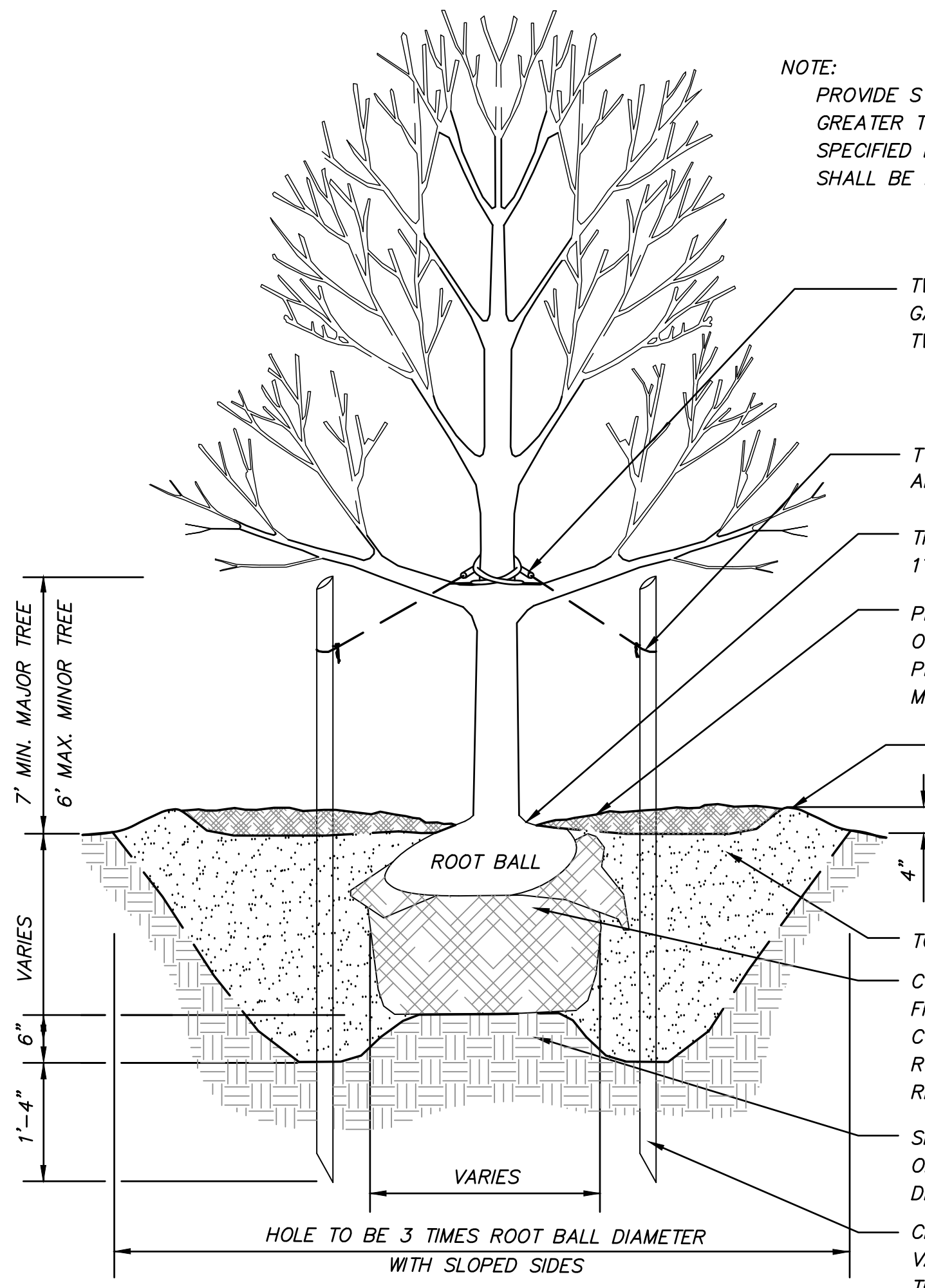
SIT ROOT BALL ON EXISTING UNDISTURBED SOIL OR ON COMPACTED SUBGRADE. DO NOT DIG DEEPER THAN THE DEPTH OF ROOT BALL.

NOTE:
PROVIDE STAKING AND GUYING FOR TREES PLANTED ON SLOPES GREATER THAN 3H:1V, IN EXPOSED, WINDY AREAS AND AS SPECIFIED BY LANDSCAPE ARCHITECT. GUY WIRES AND STAKES SHALL BE REMOVED WITHIN TWELVE MONTHS OF PLANTING.

EVERGREEN TREE PLANTING DETAIL

(N.T.S.)

NOTE:
PROVIDE STAKING AND GUYING FOR TREES PLANTED ON SLOPES GREATER THAN 3H:1V, IN EXPOSED, WINDY AREAS AND AS SPECIFIED BY LANDSCAPE ARCHITECT. GUY WIRES AND STAKES SHALL BE REMOVED WITHIN TWELVE (12) MONTHS OF PLANTING.



TWO (2) STRANDS NO. 12 GAUGE GALVANIZED ANNEALED STEEL WIRE TWISTED IN NEW RUBBER HOSE.

TWO (2) STRANDS, DOUBLE WRAPPED AND TWISTED.

TRUNK FLARE TO BE COMPLETELY EXPOSED. SET 1" TO 2" ABOVE ESTABLISHED FINISH GRADE.

PROVIDE 3" LAYER OF MULCH AS SPECIFIED OVER ENTIRE WATERING SAUCER AT ALL TREE PITS OR OVER ENTIRE TREE BED. DO NOT PLACE MULCH WITHIN 3" OF TRUNK.

FORM 4" HIGH TOPSOIL LIP AROUND EACH TREE PIT TO FORM WATERING SAUCER.

TOPSOIL MIX BACKFILL.

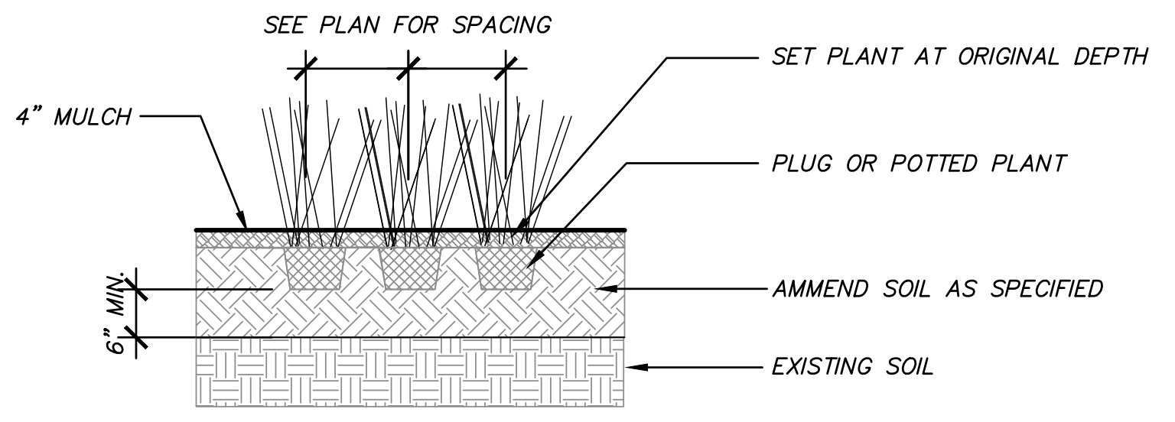
CUT AND REMOVE BINDING FROM TRUNK AND FROM AROUND AS MUCH OF BALL AS POSSIBLE. CUT AND REMOVE BURLAP AT UPPER 1/3 OF ROOT BALL. IF SYNTHETIC WRAP IS USED, REMOVE COMPLETELY.

SIT ROOT BALL ON EXISTING UNDISTURBED SOIL OR ON COMPACTED SUBGRADE. DO NOT DIG DEEPER THAN THE DEPTH OF ROOT BALL.

CEDAR STAKES, MIN. 3" DIA., LENGTH VARIES. 3 STAKES @ 120 DEG. PER MAJOR TREE. STAKES SHALL CLEAR ROOT BALL.

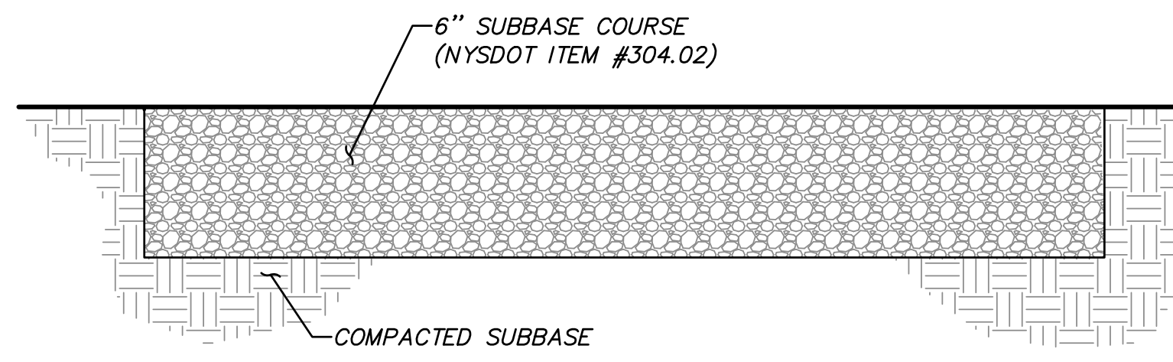
TREE PLANTING DETAIL

(N.T.S.)



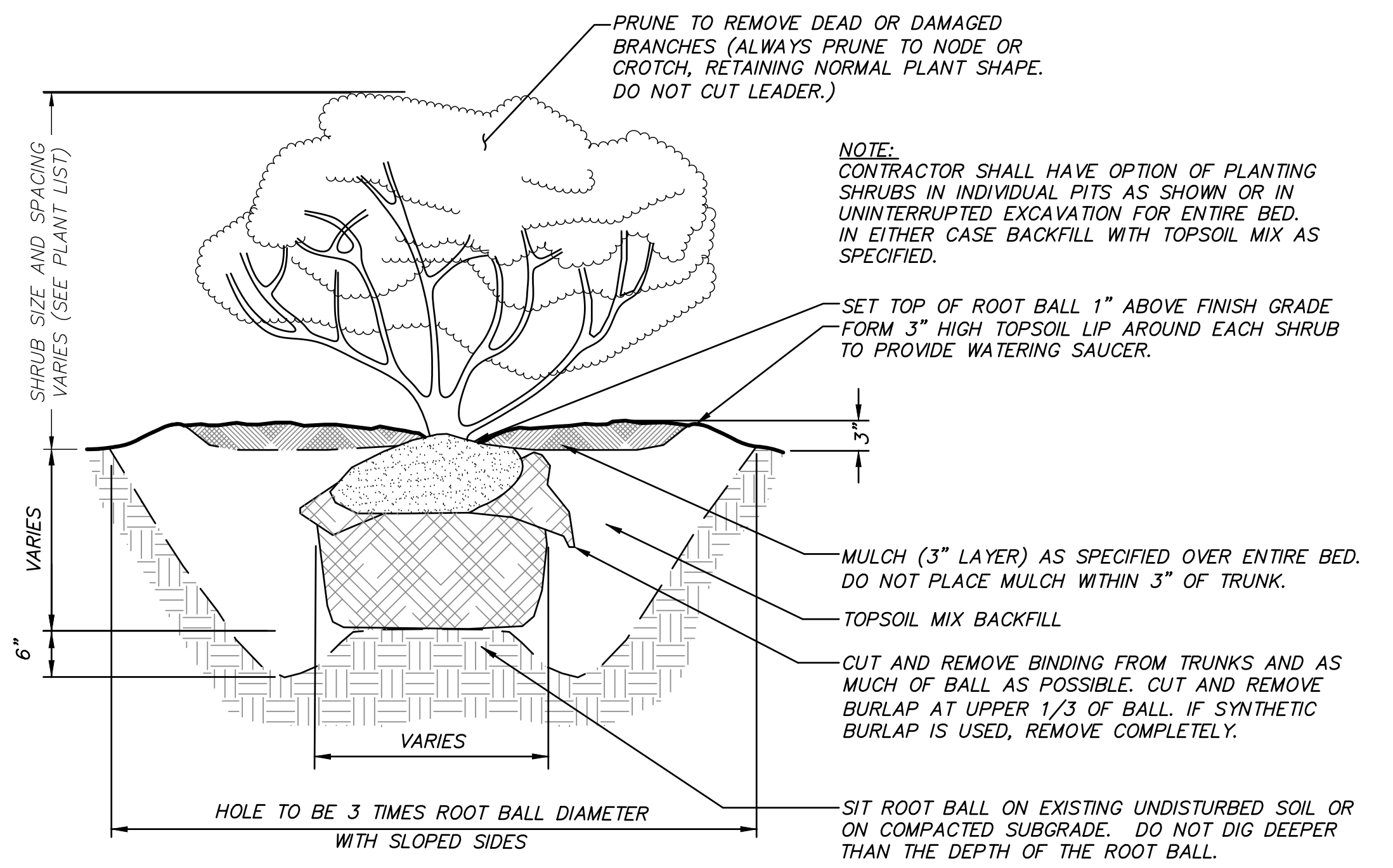
PERENNIAL / ORNAMENTAL GRASS PLANTING DETAIL

(N.T.S.)



GRAVEL PAVEMENT DETAIL FOR ENCLOSURES

(N.T.S.)



PRUNE TO REMOVE DEAD OR DAMAGED BRANCHES (ALWAYS PRUNE TO NODE OR CROTCH, RETAINING NORMAL PLANT SHAPE. DO NOT CUT LEADER.)

NOTE:
CONTRACTOR SHALL HAVE OPTION OF PLANTING SHRUBS IN INDIVIDUAL PITS AS SHOWN OR IN UNINTERRUPTED EXCAVATION FOR ENTIRE BED. IN EITHER CASE BACKFILL WITH TOPSOIL MIX AS SPECIFIED.

SET TOP OF ROOT BALL 1" ABOVE FINISH GRADE

FORM 3" HIGH TOPSOIL LIP AROUND EACH SHRUB TO PROVIDE WATERING SAUCER.

MULCH (3" LAYER) AS SPECIFIED OVER ENTIRE BED. DO NOT PLACE MULCH WITHIN 3" OF TRUNK.

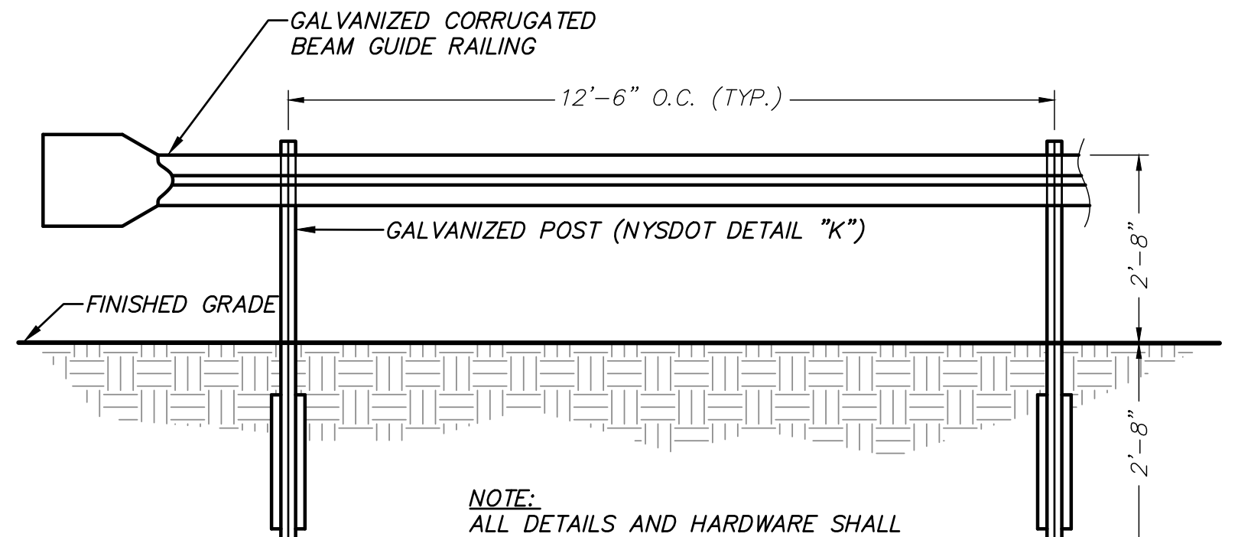
TOPSOIL MIX BACKFILL

CUT AND REMOVE BINDING FROM TRUNKS AND AS MUCH OF BALL AS POSSIBLE. CUT AND REMOVE BURLAP AT UPPER 1/3 OF BALL. IF SYNTHETIC BURLAP IS USED, REMOVE COMPLETELY.

SIT ROOT BALL ON EXISTING UNDISTURBED SOIL OR ON COMPACTED SUBGRADE. DO NOT DIG DEEPER THAN THE DEPTH OF THE ROOT BALL.

SHRUB PLANTING DETAIL

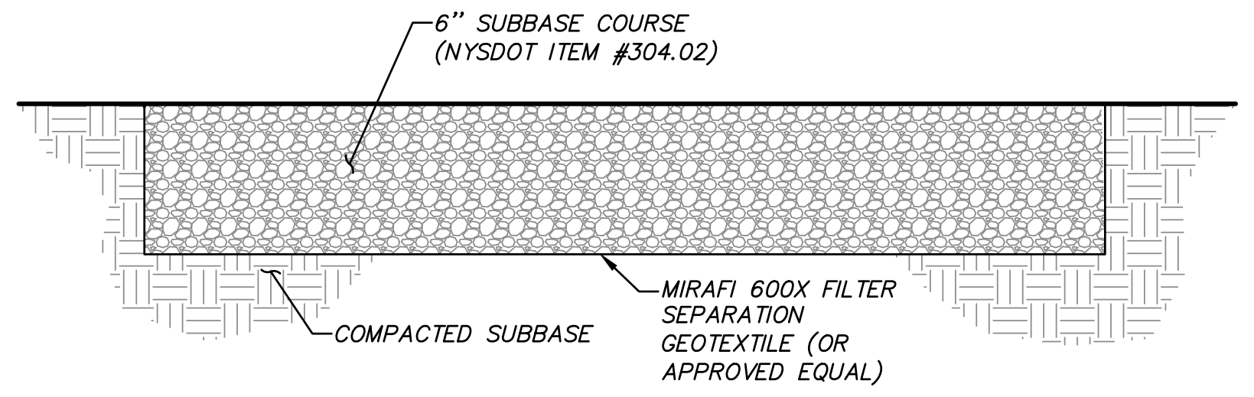
(N.T.S.)



NOTE:
ALL DETAILS AND HARDWARE SHALL CONFORM TO NYSDOT ITEM #606.16M SPECIFICATIONS

GUIDERAIL DETAIL

(N.T.S.)



GRAVEL PAVEMENT DETAIL FOR DRIVEWAYS

(N.T.S.)

NO.	DATE	REVISION	BY
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1	10-30-23	RESUBMISSION TO PLANNING BOARD	MEU

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PROJECT:

UNION ENERGY CENTER

MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:

DETAILS & NOTES

JEFFREY J. CONTELMO
61931

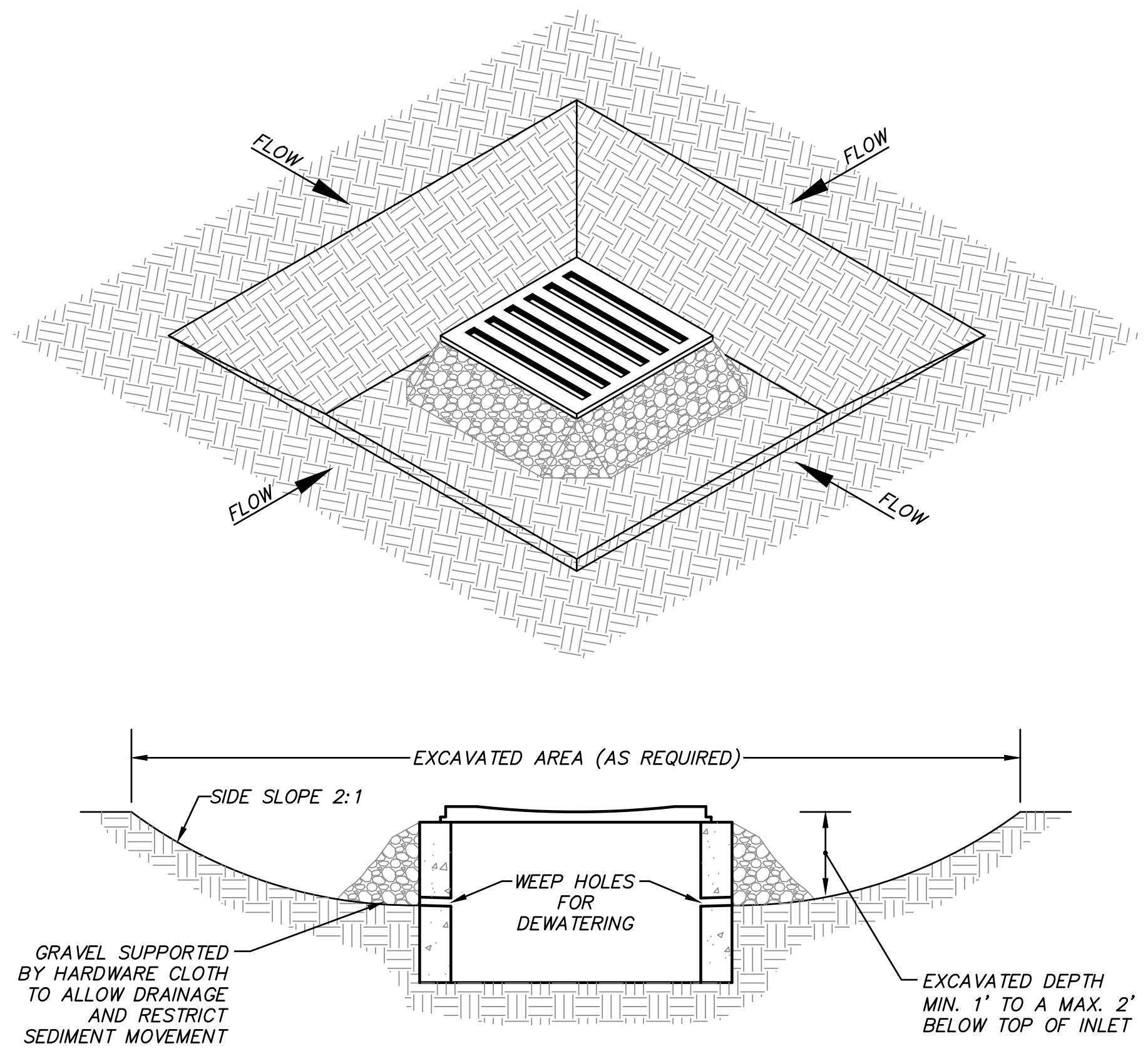
PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8-30-23	DRAWN BY	I.B.
SCALE	AS SHOWN	CHECKED BY	A.D.T.

DRAWING NO.
D-1

SHEET
11
12

ALTERATION OF THIS DOCUMENT, UNLESS UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, IS A VIOLATION OF SECTION 7209 OF ARTICLE 145 OF THE EDUCATION LAW.

Z:\E\21120100 East Point Energy, Union Valley Road\11 D-1.dwg, 11/30/2023 10:25:11 AM, kkloos, 1:1



1. CLEAR THE AREA OF ALL DEBRIS THAT WILL HINDER EXCAVATION
2. GRADE APPROACH TO THE INLET UNIFORMLY AROUND THE BASIN
3. WEEP HOLES SHALL BE PROTECTED BY GRAVEL
4. UPON STABILIZATION OF CONTRIBUTING DRAINAGE AREA, SEAL WEEP HOLES, FILL EXCAVATION WITH STABLE SOIL TO FINAL GRADE, COMPACT IT PROPERLY, AND STABILIZE WITH PERMANENT SEEDING
5. MAXIMUM DRAINAGE AREA = 1 ACRE

EXCAVATED DROP INLET PROTECTION DETAIL

(N.T.S.)

EROSION AND SEDIMENT CONTROL MAINTENANCE SCHEDULE

MONITORING REQUIREMENTS				MAINTENANCE REQUIREMENTS	
PRACTICE	DAILY	WEEKLY	AFTER RAINFALL	DURING CONSTRUCTION	AFTER CONSTRUCTION
SILT FENCE BARRIER	–	Inspect	Inspect	Clean/Replace	Remove
STABILIZED CONSTRUCTION ENTRANCE	Inspect	–	Inspect	Clean/Replace Stone and Fabric	Remove
DUST CONTROL	Inspect	–	Inspect	Mulching/ Spraying Water	N/A
*VEGETATIVE ESTABLISHMENT	–	Inspect	Inspect	Water/Reseed/ Remulch	Reseed to 80% Coverage
INLET PROTECTION	–	Inspect	Inspect	Clean/Repair/ Replace	Remove
SOIL STOCKPILES	–	Inspect	Inspect	Mulching/ Silt Fence Repair	Remove
SWALES	–	Inspect	Inspect	Clean/Mulch/ Repair	Mow Permanent Grass/Replace/ Repair Rip Rap
CHECK DAMS	–	Inspect	Inspect	Clean/Replace Stones/Repair	Clean/Replace Stones/Repair
CONCRETE DRAINAGE STRUCTURES	–	Inspect	Inspect	Clean Sumps/ Remove Debris/ Repair/Replace	Clean Sumps/ Remove Debris/ Repair/Replace
DRAINAGE PIPES	–	Inspect	Inspect	Clean/Repair	Clean/Repair
ROAD & PAVEMENT	–	Inspect	Inspect	Clean	Clean
*STORMWATER TRAP/BASIN	–	Inspect	Inspect	Clean/Mulch/ Repair/Reseed	See Permanent Stormwater Facilities Maintenance Schedule on Drawing SP–3.1

* Permanent vegetation is considered stabilized when 80% of the plant density is established. Erosion control measures shall remain in place until all disturbed areas area permanently stabilized.

Note: The party responsible for implementation of the maintenance schedule during and after construction is:

East Point Energy, LLC
310 4th Street NE 3rd Floor
Charlottesville, VA 22902

and/or the current owner(s) of the subject property.

REQUIRED POST–CONSTRUCTION STORMWATER MANAGEMENT PRACTICE COMPONENTS:

1. Pursuant to the NYSDEC "SPDES General Permit for Stormwater Discharges from Construction Activity" (GP–0–20–001), all construction projects needing post–construction stormwater management practices shall prepare a SWPPP that also includes practices designed in conformance with the most current version of the technical standard, New York State Stormwater Management Design Manual ("Design Manual"). Where post–construction stormwater management practices are not designed in conformance with this technical standard, the owner or operator must demonstrate equivalence to the technical standard. The following list of SWPPP components is provided in accordance with Part III.B.2a–f and III.B.3:
    - a. Identification of all post–construction stormwater management practices to be constructed as part of the project; This plan, and details/notes shown hereon serve to satisfy this SWPPP requirement.
    - b. A site map/construction drawing(s) showing the specific location and size of each post–construction stormwater management practice; This plan, and details/notes shown hereon serve to satisfy this SWPPP requirement.
    - c. A Stormwater Modeling and Analysis Report including pre–development conditions, post–development conditions, the results of the stormwater modeling, a summary table demonstrating that each practice has been designed in conformance with the sizing criteria, identification of and justification for any deviations from the Design Manual, and identification of any design criteria that are not required. The required analysis is provided in the report titled Amended Stormwater Pollution Prevention Plan for Braemar Living at Carmel.
    - d. Soil testing results and locations. This SWPPP requirement is provided in the report titled Amended Stormwater Pollution Prevention Plan for Braemar Living at Carmel.
    - e. Infiltration testing results. This SWPPP requirement is provided in the report titled Amended Stormwater Pollution Prevention Plan for Braemar Living at Carmel.
    - f. An operations and maintenance plan that includes inspection and maintenance schedules and actions to ensure continuous and effective operation of each post–construction stormwater management practice. The plan shall identify the entity that will be responsible for the long term operation and maintenance of each practice. The Permanent Stormwater Facilities Maintenance Schedule provided on these plans serves to satisfy this requirement.
2. Enhanced Phosphorus Removal Standards – Beginning on September 30, 2008, all construction projects identified in Table 2 of Appendix B that are located in the watersheds identified in Appendix C shall prepare a SWPPP that includes post–construction stormwater management practices designed in conformance with the Enhanced Phosphorus Removal Standards included in the most current version of the technical standard, New York Stormwater Management Design Manual. At a minimum, the post–construction stormwater management practice component of the SWPPP shall include items 2.a – 2.f above. The permanent stormwater practices for this project have been sized according to chapter 10 of the Design Manual Enhanced Phosphorus Removal Standards. Please see 2.a – 2.f above.

CONSTRUCTION SEQUENCE:

1. Install stabilized construction entrance/anti–tracking pad at driveway entrance.
2. Install silt fence in general locations indicated on the plan.
3. Begin clearing and grubbing operations associated with the driveway and enclosure area pads..
4. Strip and stockpile topsoil on site for later use in lawn and landscape areas.
5. Begin construction of the driveway and enclosure areas.
6. Begin construction of stormwater management practices and collection system.
7. Begin utility installations.
8. Upon completion of grading operations, install finished driveway surfaces.
9. Topsoil, seed, and mulch all disturbed areas as soon as practical in accordance with the Erosion and Sediment Control Notes contained on this page.

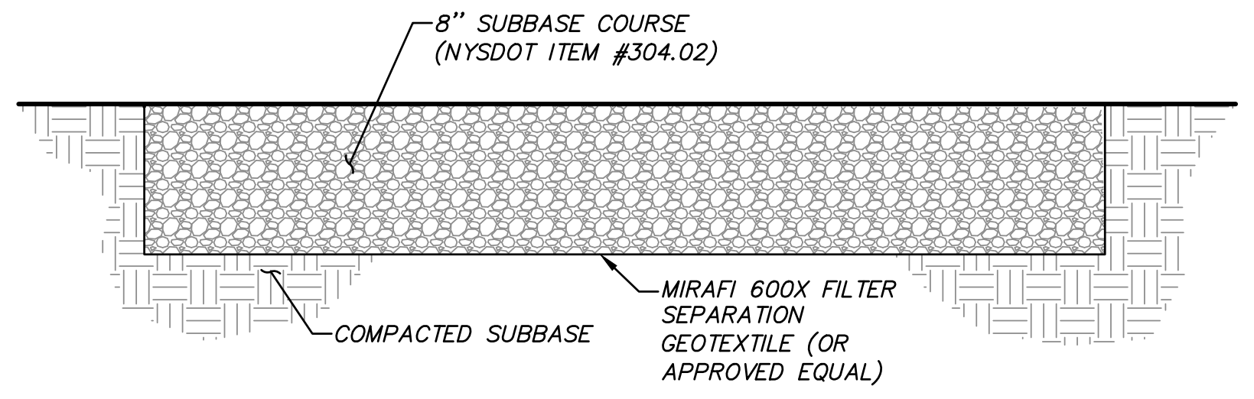
EROSION & SEDIMENT CONTROL NOTES:

1. The owner's field representative (O.F.R.) will be responsible for the implementation and maintenance of erosion and sediment control measures on this site prior to and during construction.
2. All construction activities involving the removal or disposition of soil are to be provided with appropriate protective measures to minimize erosion and contain sediment disposition within. Minimum soil erosion and sediment control measures shall be implemented as shown on the plans and shall be installed in accordance with "New York Standards and Specifications For Erosion and Sediment Control," latest edition.
3. Wherever feasible, natural vegetation should be retained and protected. Disturbance shall be minimized in the areas required to perform construction. No more than 5 acres of unprotected soil shall be exposed at any one time.
4. When land is exposed during development, the exposure shall be kept to the shortest practical period of time. In the areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures must be initiated by the end of the next business day and completed within seven (7) days from the date the current soil disturbance activity ceased. Disturbance shall be minimized to the areas required to perform construction.
5. Silt fence shall be installed as shown on the plans prior to beginning any clearing, grubbing or earthwork.
6. All topsoil to be stripped from the area being developed shall be stockpiled and immediately seeded for temporary stabilization. Ryegrass (annual or perennial) at a rate of 30 lbs. per acre shall be used for temporary seeding in spring, summer or early fall. 'Aristook' Winter Rye (cereal rye) shall be used for temporary seeding in late fall and winter.
7. Any disturbed areas not subject to further disturbance or construction traffic, permanent or temporary, shall have soil stabilization measures initiated for permanent vegetation cover in combination with a suitable mulch within 1 business day of final grading. All seeded areas to receive a minimum 4" screened topsoil from stockpile area. Seed mixes as noted in General Site Seeding Notes on drawing SP–1 are to be planted between March 21 and May 20, or between August 15 and October 15 or as directed by project representative.
8. Cut or fill slopes 3:1 and steeper shall be stabilized immediately after grading with Curlex I Single Net Erosion Control Blanket, or approved equal.
9. Paved roadways shall be kept clean at all times.
10. The site shall at all times be graded and maintained such that all stormwater runoff is diverted to soil erosion and sediment control facilities.
11. All storm drainage outlets shall be stabilized, as required, before the discharge points become operational.
12. Stormwater from disturbed areas must be passed through erosion control barriers before discharge beyond disturbed areas or discharged into other drainage systems.
13. Erosion and sediment control measures shall be inspected and maintained on a daily basis by the O.F.R. to insure that channels, temporary and permanent ditches and pipes are clear of debris, that embankments and berms have not been breached and that all straw bales and silt fences are intact. Any failure of erosion and sediment control measures shall be immediately repaired by the contractor and inspected for approval by the O.F.R. and/or site engineer.
14. Dust shall be controlled by sprinkling or other approved methods as necessary, or as directed by the O.F.R.
15. Cut and fills shall not endanger adjoining property, nor divert water onto the property of others.
16. All fills shall be placed and compacted in 6" lifts to provide stability of material and to prevent settlement.
17. The O.F.R. shall inspect downstream conditions for evidence of sedimentation on a weekly basis and after rainstorms.
18. As warranted by field conditions, special additional erosion and sediment control measures, as specified by the site engineer and/or the Town Engineer shall be installed by the contractor.
19. Erosion and sediment control measures shall remain in place until all disturbed areas are suitably stabilized.

REQUIRED EROSION CONTROL SWPPP CONTENTS:

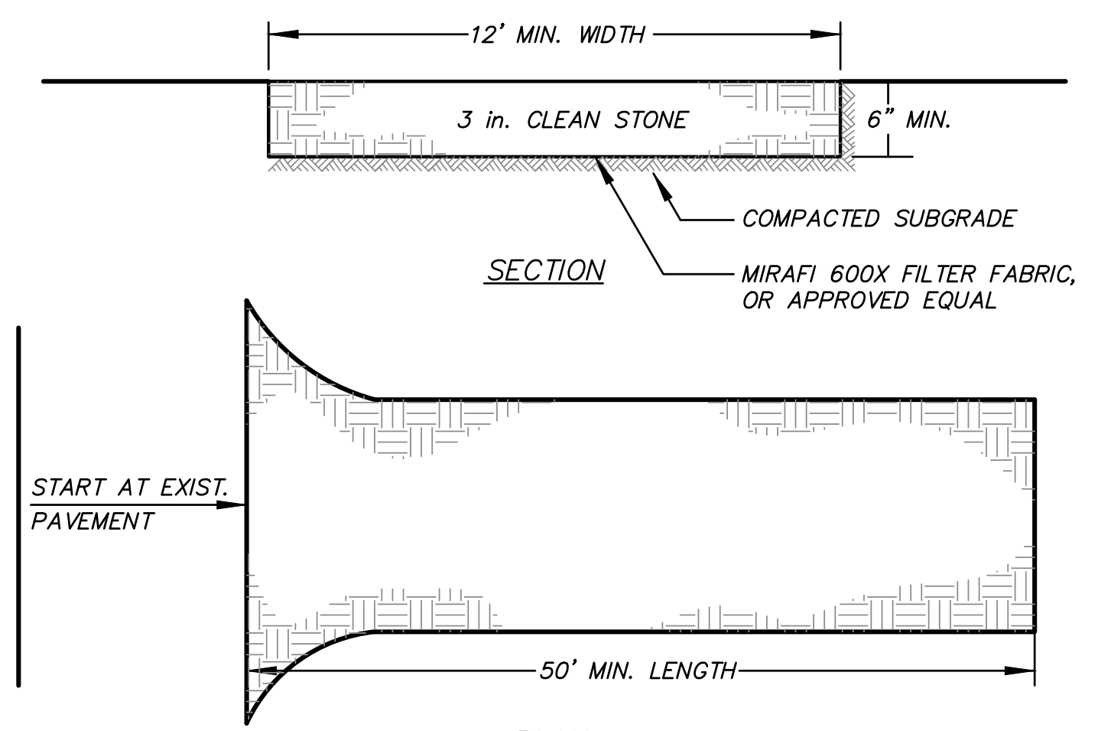
Pursuant to the NYSDEC "SPDES General Permit for Stormwater Discharges from Construction Activity" (GP–0–20–001), all Stormwater Pollution Prevention Plan's (SWPPP) shall include erosion and sediment control practices designed in conformance with the most current version of the technical standard, "New York Standards and Specifications for Erosion and Sediment Control." Where erosion and sediment control practices are not designed in conformance with this technical standard, the owner or operator must demonstrate equivalence to the technical standard. The following list of required SWPPP components is provided in accordance with Part III.B.1a–l of General Permit GP–0–20–001:

- a. Background Information: The subject project consists of the construction of a battery electric storage facility and two electrical substations
- b. Site map / construction drawing: These plans serve to satisfy this SWPPP requirement.
- c. Description of the soils present at the site: Onsite soils located within the proposed limits of disturbance consist of Ridgebury Complex (RgB), Paxton Fine Sandy Loam (PnD), and Woodbridge Loam (WdB), as identified on the Soil Conservation Service Web Soil Survey. These soil types belong to the Hydrologic Soil Group "B/D" and "C" respectively.
- d. Construction phasing plan / sequence of operations: The Construction Sequence and phasing found on these plans provide the required phasing. A Construction Sequence and Erosion and Sediment Control Maintenance Schedule has been provided. The Sedimentation and Erosion Control Notes contained hereon outline a general sequence of operations for the proposed project. In general all erosion and sediment control facilities shall be installed prior to commencement with land disturbing activities, and areas of disturbance shall be limited to the shortest period of time as practicable.
- e. Description of erosion and sediment control practices: This plan, and details / notes shown hereon serve to satisfy this SWPPP requirement.
- f. Temporary and permanent soil stabilization plan: The Sedimentation and Erosion Control Notes and Details provided heron identify temporary and permanent stabilization measures to be employed with respect to specific elements of the project, and at the various stages of development.
- g. Site map / construction drawing: This plan serves to satisfy this SWPPP requirement.
- h. The dimensions, material specifications, installation details, and operation and maintenance requirements for all erosion and sediment control practices: The details, Erosion and Sediment Control Notes, and Erosion and Sediment Control Maintenance Schedule serve to satisfy this SWPPP requirement.
- i. An inspection schedule: Inspections are to be performed twice weekly and by a qualified professional as required by the General Permit GP–0–20–001. In addition the NYSDEC Trained Contractor shall perform additional inspections as cited in the Sedimentation and Erosion Control Notes.
- j. A description of pollution prevention measures that will be used to control litter, construction chemicals and construction debris: In general, all construction litter / debris shall be collected and removed from the site. The general contractor shall supply either waste barrels or dumpster for proper waste disposal. Any construction chemicals utilized during construction shall either be removed from site daily by the contractor or stored in a structurally sound and weatherproof building. No hazardous waste shall be disposed of onsite, and shall ultimately be disposed of in accordance with all federal, state and local regulations. Material Safety Data Sheets (MSDS), material inventory, and emergency contact numbers shall be maintained by the general contractor for all construction chemicals utilized onsite. Finally, temporary sanitary facilities (portable toilets) shall be provided onsite during the entire length of construction, and inspected weekly for evidence of leaking holding tanks.
- k. A description and location of any stormwater discharges associated with industrial activity other than construction at the site: There are no known industrial stormwater discharges present or proposed at the site.
- l. Identification of any elements of the design that are not in conformance with the technical standard, "New York Standards and Specifications for Erosion and Sediment Control." All proposed elements of this SWPPP have been designed in accordance with the "New York Standards and Specifications for Erosion and Sediment Control."



GRAVEL PAVEMENT DETAIL

(N.T.S.)

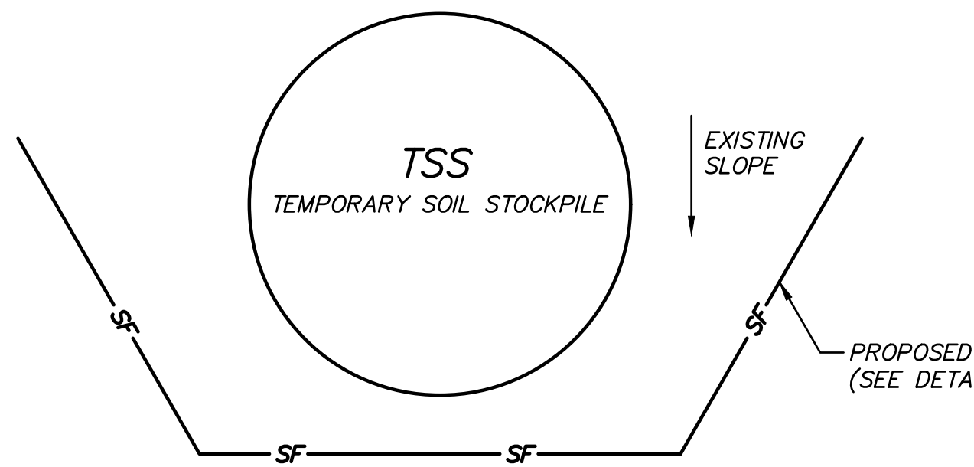


INSTALLATION NOTES

1. STONE SIZE – USE 3" STONE
2. LENGTH – AS REQUIRED, BUT NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLLY
3. THICKNESS – NOT LESS THAN SIX (6) INCHES.
4. WIDTH – 12 FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCUR. TWENTY FOUR (24) FOOT IF SINGLE ACCESS TO SITE.
5. FILTER CLOTH – WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE. FILTER CLOTH WILL NOT BE REQUIRED ON A SINGLE FAMILY RESIDENCE LOT.
6. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT OF WAY . THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT OF WAY MUST BE REMOVED IMMEDIATELY.
8. WASHING – WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT OF WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

STABILIZED CONSTRUCTION ACCESS DETAIL

(N.T.S.)

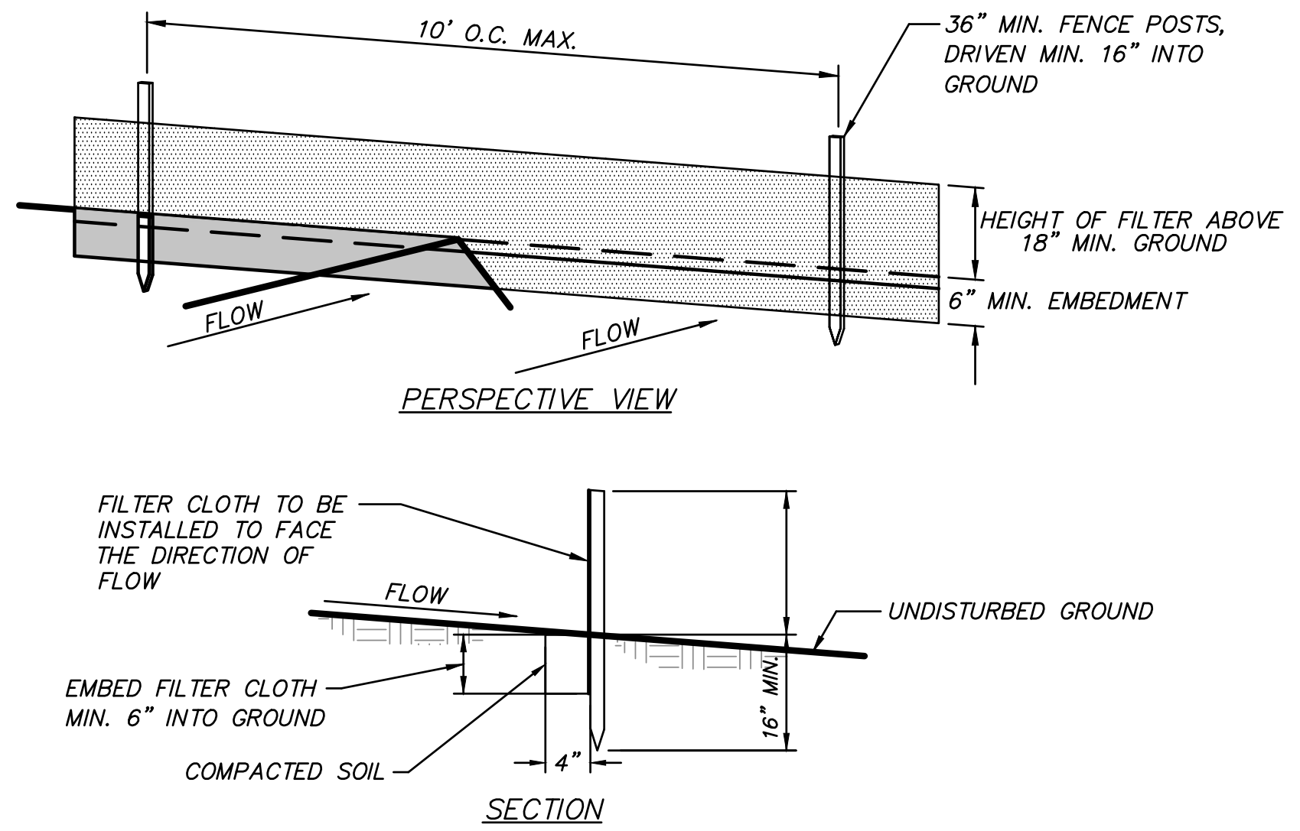


NOTES:

1. AREA CHOSEN FOR STOCKPILE LOCATION SHALL BE DRY AND STABLE.
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2:1.
3. UPON COMPLETION OF SOIL STOCKPILING, EACH PILE SHALL BE IMMEDIATELY SEEDED WITH K31 PERENNIAL TALL FESCUE.
4. ALL STOCKPILES SHALL BE PROTECTED WITH SILT FENCING INSTALLED ON THE DOWNGRADIENT SIDE.

TEMPORARY SOIL STOCKPILE DETAIL

(N.T.S.)

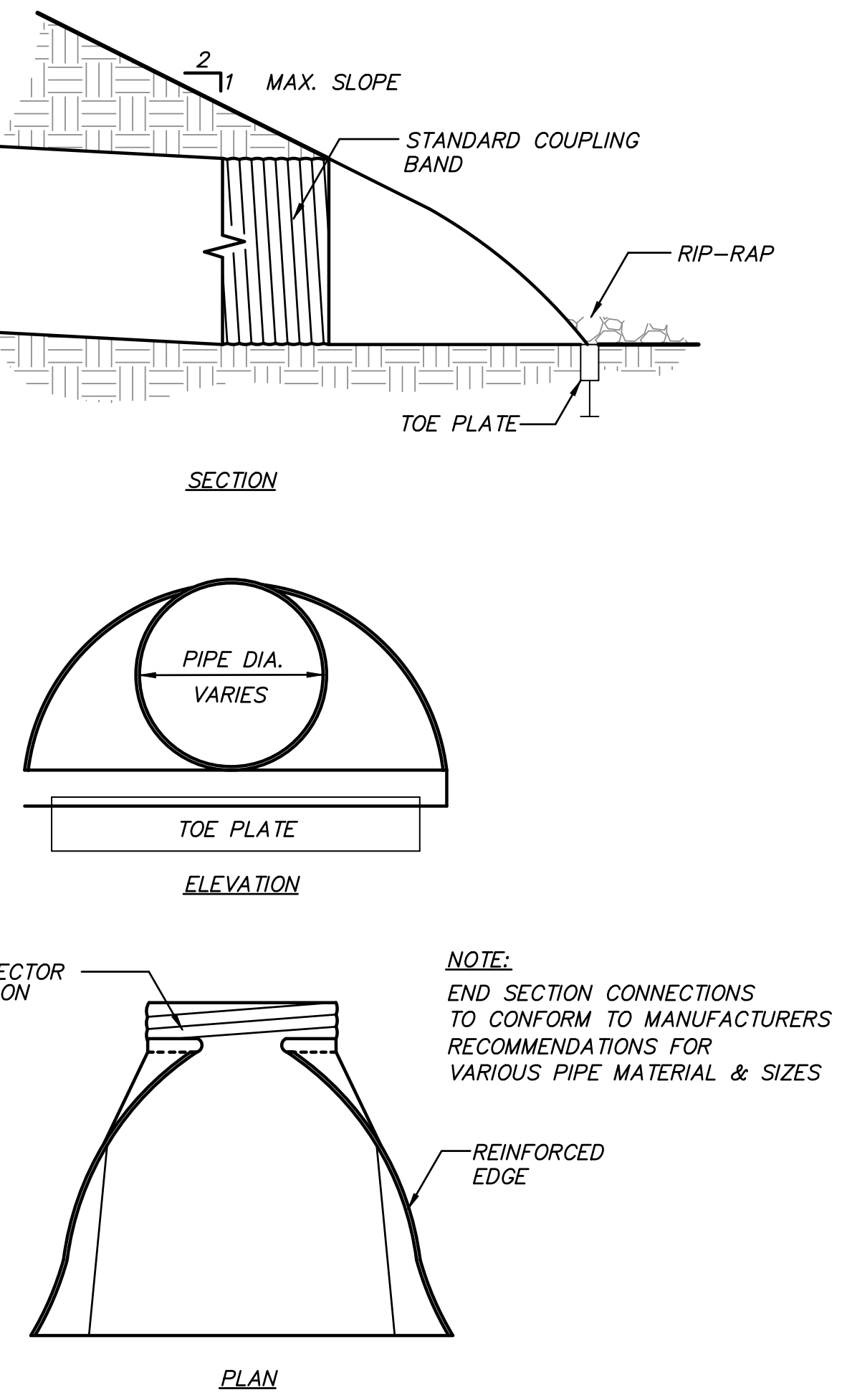


CONSTRUCTION NOTES FOR FABRICATED SILT FENCE

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.
2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 6" MAXIMUM MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER–LAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.
4. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE, OR APPROVED EQUIVALENT.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

STANDARD SILT FENCE DETAIL

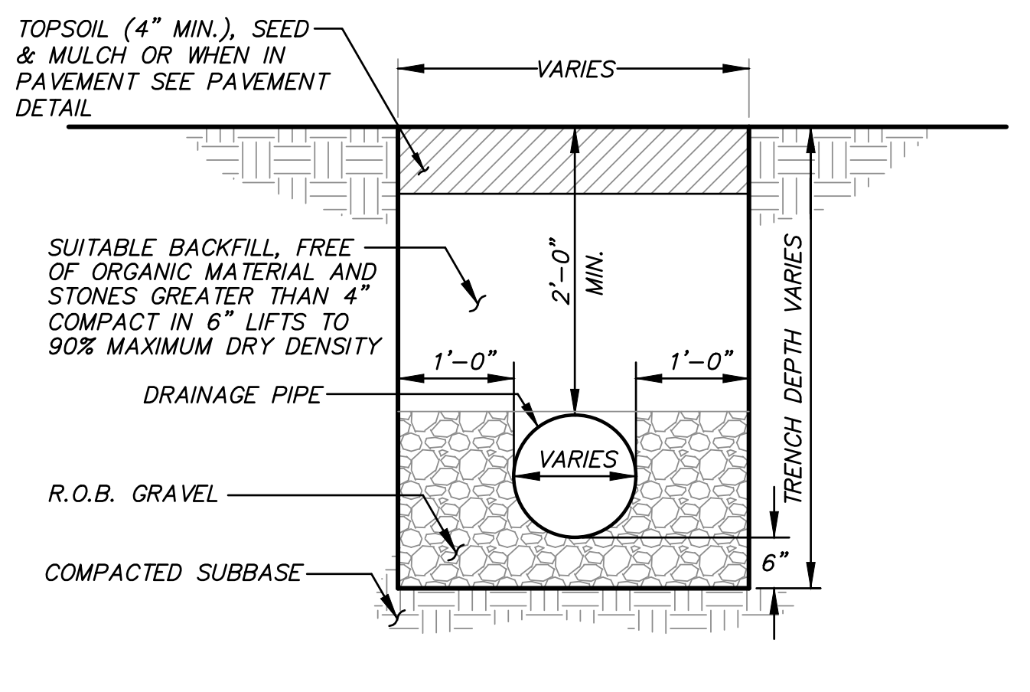
(N.T.S.)



NOTE:
END SECTION CONNECTIONS TO CONFORM TO MANUFACTURERS RECOMMENDATIONS FOR VARIOUS PIPE MATERIAL & SIZES

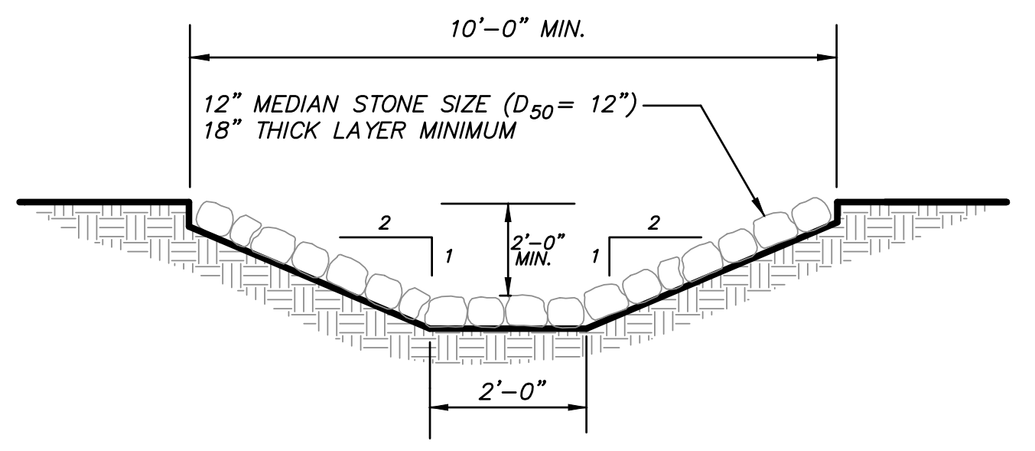
HDPE END SECTION DETAIL

(N.T.S.)



DRAINAGE LINE TRENCH DETAIL

(N.T.S.)



RIP RAP SWALE DETAIL

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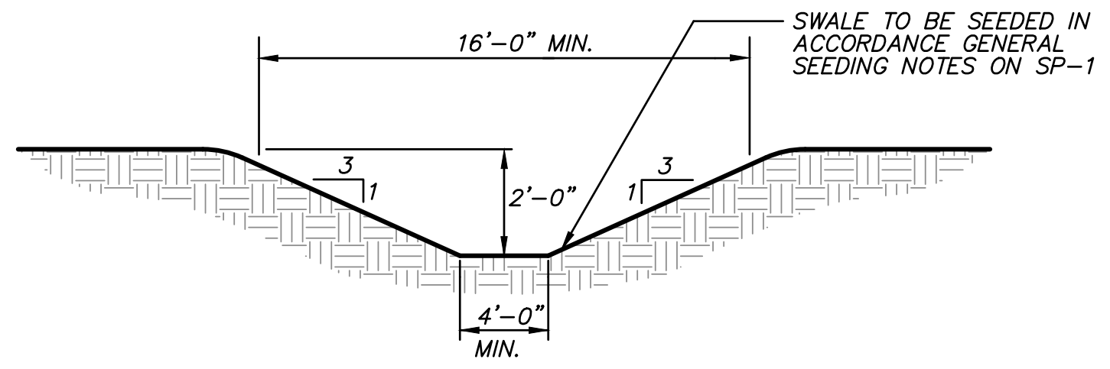

GRASS SWALE TO BE LINED WITH CHANNEL LINER C–125 AS MANUFACTURED BY "NORTH AMERICAN GREEN" OR APPROVED EQUAL.

GRASS SWALE DETAIL

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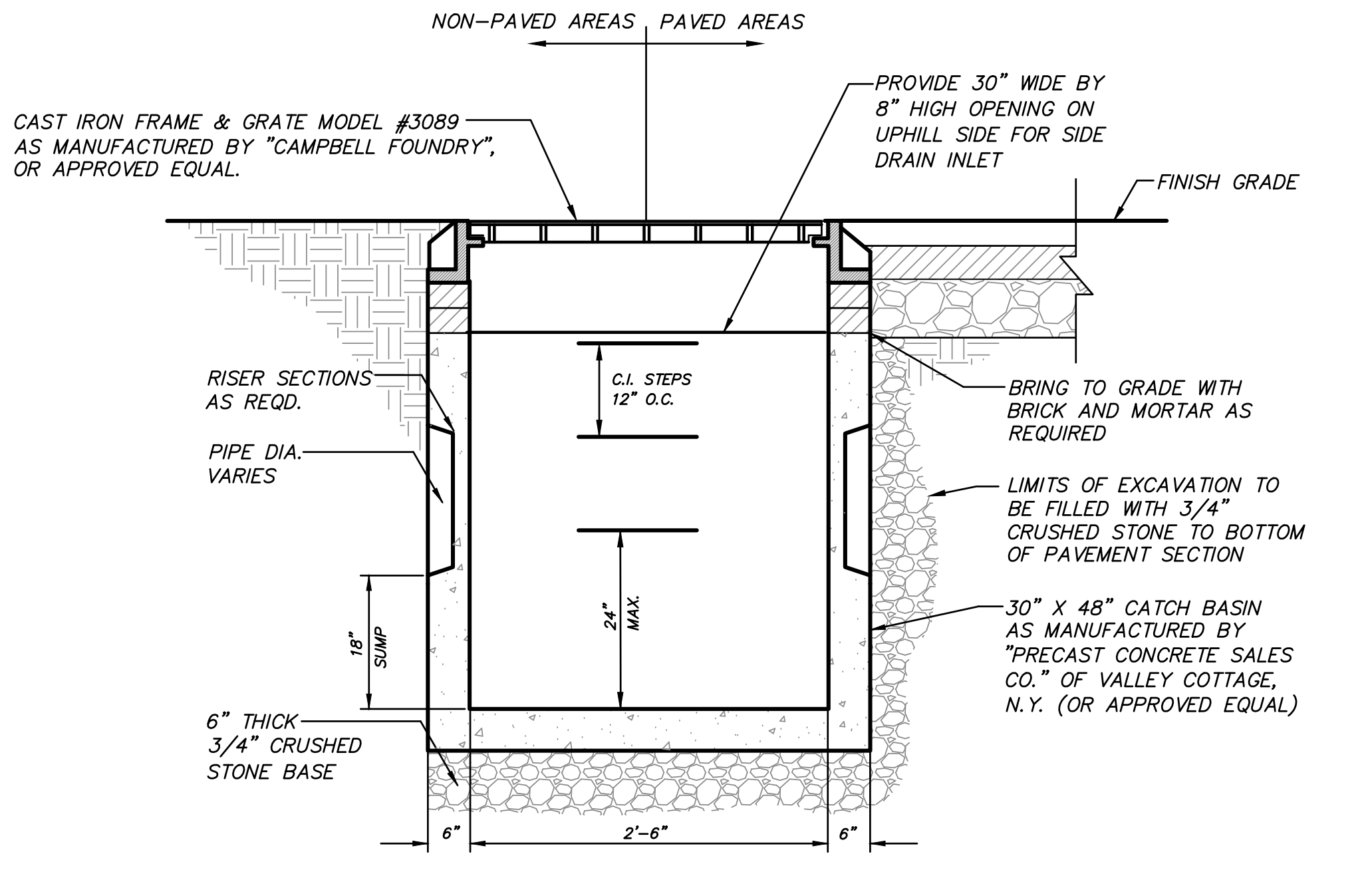


DRAIN INLET DETAIL

(N.T.S.)
(STRUCTURE AND GRATE TO BE DESIGNED FOR H–20 LOADING)

NO.	DATE	REVISION	BY
2	12–4–23	REVISED PER PLANNING BOARD COMMENTS	KJK
1	10–30–23	RESUBMISSION TO PLANNING BOARD	MEU

INSITE
ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

3 Garrett Place
Carmel, NY 10512
(845) 225–9690
(845) 225–9717 fax
www.insite–eng.com

PROJECT:
UNION ENERGY CENTER
MILLER ROAD, TOWN OF CARMEL, PUTNAM COUNTY NEW YORK

DRAWING:
DETAILS AND NOTES

JEFFREY J. CONTELMO
61931

PROJECT NUMBER	21120.100	PROJECT MANAGER	J.J.C.
DATE	8–30–23	DRAWN BY	I.B.
SCALE	NTS	CHECKED BY	A.D.T.

DRAWING NO.
D–2

SHEET
12
12

ALTERATION OF THIS DOCUMENT, UNLESS UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, IS A VIOLATION OF SECTION 7209 OF ARTICLE 145 OF THE EDUCATION LAW.

INSITE
ENGINEERING, SURVEYING &
LANDSCAPE ARCHITECTURE, P.C.

December 4, 2023

Town of Carmel Planning Board
60 McAlpin Avenue
Mahopac, New York 10541

RE: Union Energy Center, LLC Subdivision
24 Miller Road
Mahopac, NY 10541
TM#'s: 86.11-1-14

Dear Chairman Paeprer and Members of the Board:

Please find enclosed the following plans and documents in support of an application for subdivision approval for the above referenced project:

- Preliminary Subdivision Plat, dated December 4, 2023.

In response to comments received from Director of Code Enforcement, Michael Carnazza, dated November 8, 2023, we offer the below responses:

1. This comment is acknowledged.
2. This comment is acknowledged.
3. This comment is acknowledged.
4. The requested zoning table, lot depth and lot width dimensions have been added to the plat.

In response to comments received from Town Planner, Patrick Cleary, AICP, dated September 14, 2023, we offer the following responses:

1. This comment is acknowledged.
2. This comment is acknowledged.
3. This comment is acknowledged.

Please place the project on the December 14, 2023 Planning Board agenda for discussion of the project with the Board. Should you have any questions or comments regarding this information, please feel free to contact our office.

Very truly yours,

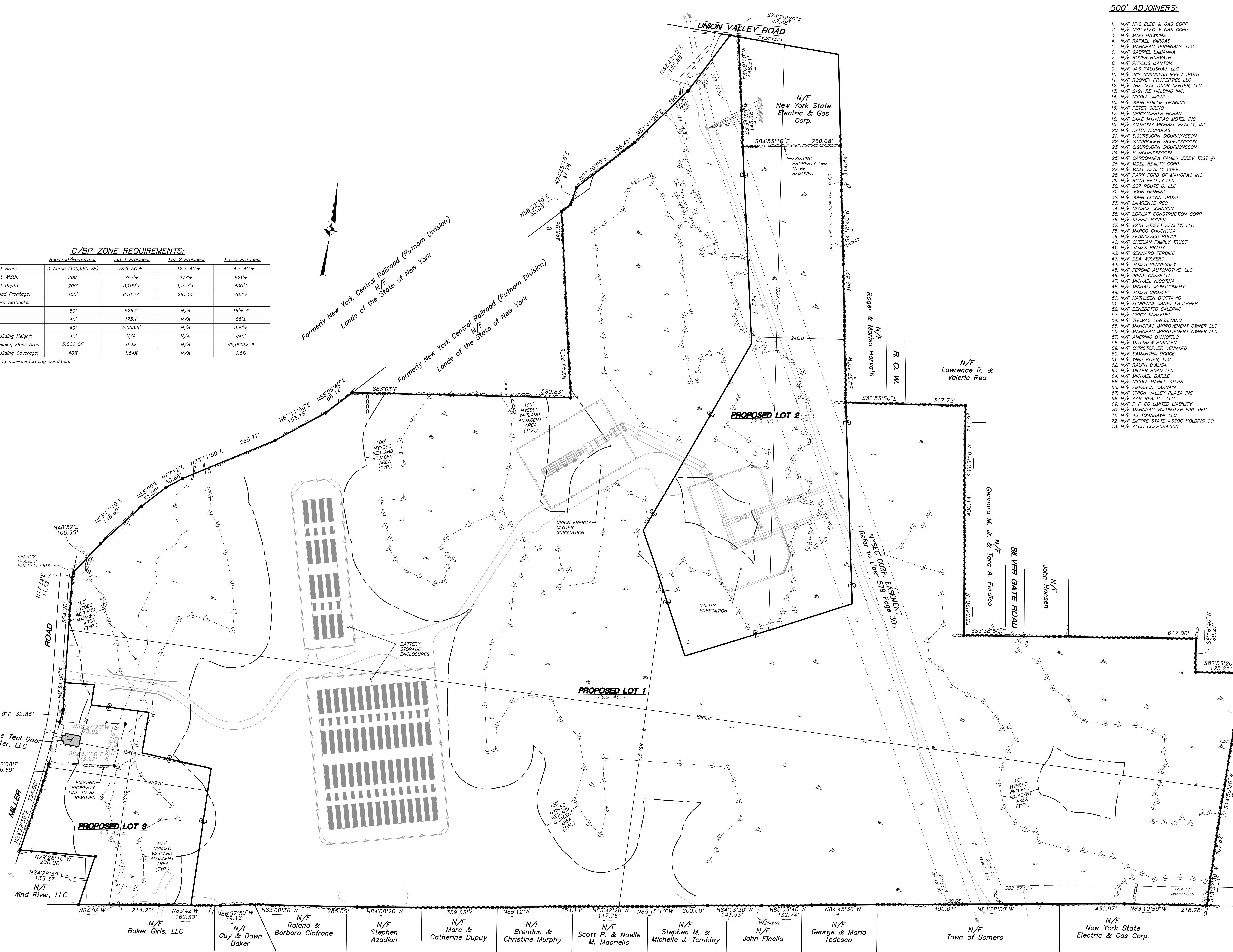
INSITE ENGINEERING, SURVEYING & LANDSCAPE ARCHITECTURE, P.C.

By: ______________________
Jeffrey J. Contelmo, PE
Senior Principal Engineer

Z:\E\21120100 East Point Energy, Union Valley Road\Correspondence\2023\120423cbp-subdivision.doc

JJC/adt

Enclosures
cc: (All via email only)
    Scott Connuck
    Compton Donohue
    Frank Smith, Esq
    William Shilling, Esq
    Mahopac Volunteer Fire Dept



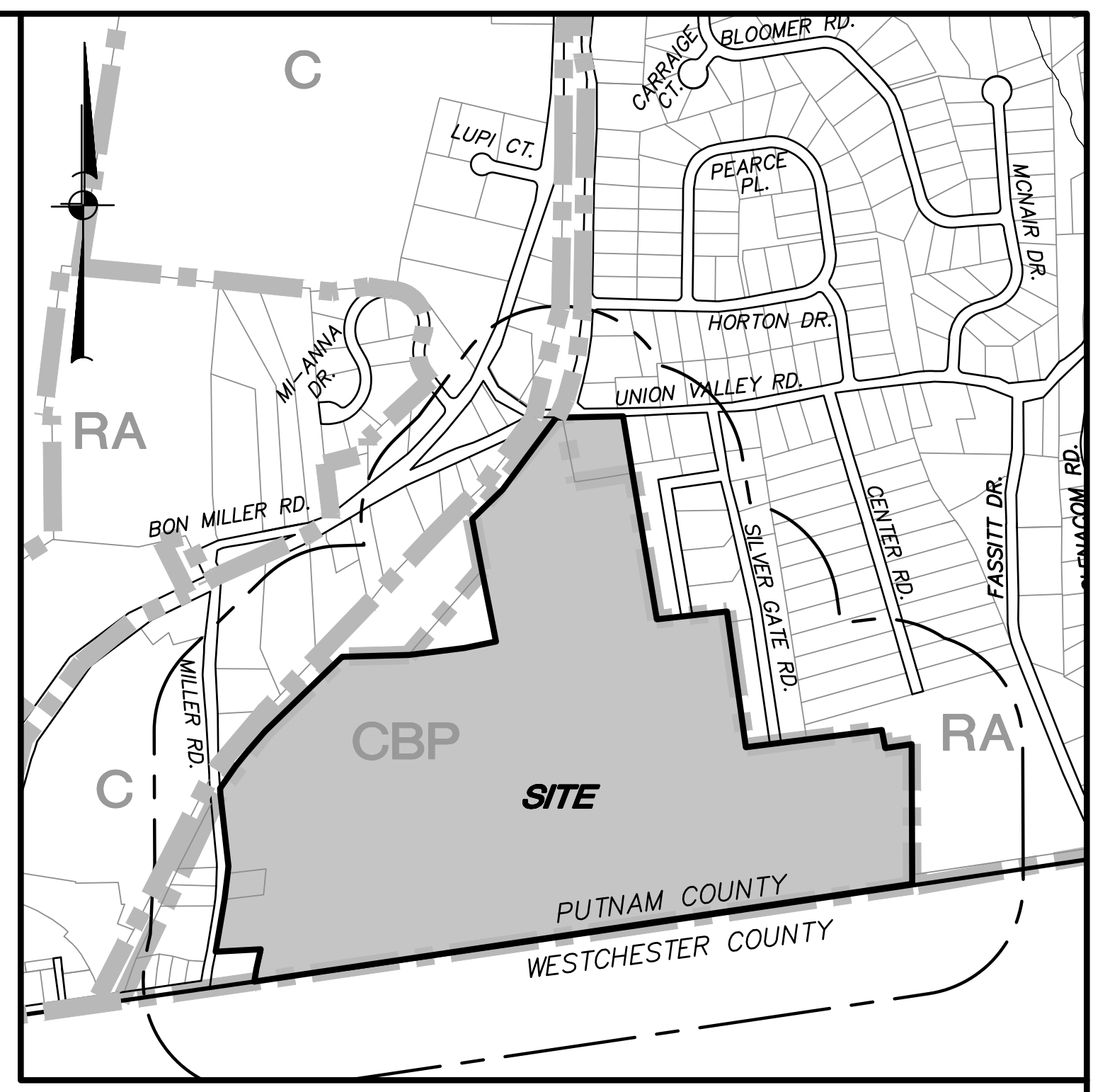
C/BP ZONE REQUIREMENTS:

	Required/Permitted:	Lot 1 Provided:	Lot 2 Provided:	Lot 3 Provided:
Minimum Lot Area:	3 Acres (130,680 SF)	78.9 AC.±	12.3 AC.±	4.3 AC.±
Minimum Lot Width:	200'	853'±	248'±	521'±
Minimum Lot Depth:	200'	3,100'±	1,557'±	430'±
Minimum Road Frontage:	100'	640.27'	267.14'	462'±
Minimum Yard Setbacks:				
Front:	50'	626.1'	N/A	16'± *
Side:	40'	175.1'	N/A	88'±
Rear:	40'	2,053.9'	N/A	356'±
Maximum Building Height:	40'	N/A	N/A	<40'
Minimum Building Floor Area	5,000 SF	0 SF	N/A	<5,000SF *
Maximum Building Coverage:	40%	1.54%	N/A	0.6%

* Pre-existing non-conforming condition.

500' ADJOINERS:

1. N/F NYS ELEC & GAS CORP
2. N/F NYS ELEC & GAS CORP
3. N/F MARI HAWKINS
4. N/F RAFAEL VARGAS
5. N/F MAHOPAC TERMINALS, LLC
6. N/F GABRIEL LAMANNA
7. N/F ROGER HORVATH
8. N/F PHYLLIS MANTOVI
9. N/F JAS PALUSHAJ, LLC
10. N/F IRIS GORODESS IRREV TRUST
11. N/F ROONEY PROPERTIES LLC
12. N/F THE TEAL DOOR CENTER, LLC
13. N/F 2121 RE HOLDING INC.
14. N/F NICOLE JIMENEZ
15. N/F JOHN PHILLIP GKANIOS
16. N/F PETER CIRINO
17. N/F CHRISTOPHER HORAN
18. N/F LAKE MAHOPAC MOTEL INC
19. N/F ANTHONY MICHAEL REALTY, INC
20. N/F DAVID NICHOLAS
21. N/F SIGURBJORN SIGURJONSSON
22. N/F SIGURBJORN SIGURJONSSON
23. N/F SIGURBJORN SIGURJONSSON
24. N/F S SIGURJONSSON
25. N/F CARBONARA FAMILY IRREV TRST #1
26. N/F VIDEL REALTY CORP.
27. N/F VIDEL REALTY CORP.
28. N/F PARK FORD OF MAHOPAC INC
29. N/F RCTA REALTY LLC
30. N/F 287 ROUTE 6, LLC
31. N/F JOHN HENNING
32. N/F JOHN GLYNN TRUST
33. N/F LAWRENCE REO
34. N/F GEORGE JOHNSON
35. N/F LORMAT CONSTRUCTION CORP
36. N/F KERRIL HYNES
37. N/F 12TH STREET REALTY, LLC
38. N/F MARCO CHUCHUCA
39. N/F FRANCESCO PULICE
40. N/F CHERIAN FAMILY TRUST
41. N/F JAMES BRADY
42. N/F GENNARO FERDICO
43. N/F DEA WOLFERT
44. N/F JAMES HENNESSEY
45. N/F FERONE AUTOMOTIVE, LLC
46. N/F IRENE CASSETTA
47. N/F MICHAEL NICOTINA
48. N/F MICHAEL MONTGOMERY
49. N/F JAMES CROWLEY
50. N/F KATHLEEN D'OTTAVIO
51. N/F FLORENCE JANET FAULKNER
52. N/F BENEDETTO SALERNO
53. N/F CHRIS SCHEEDEL
54. N/F THOMAS LONGHITANO
55. N/F MAHOPAC IMPROVEMENT OWNER LLC
56. N/F MAHOPAC IMPROVEMENT OWNER LLC
57. N/F AMERINO D'ONOFRIO
58. N/F MATTHEW ROSOLEN
59. N/F CHRISTOPHER VENNARD
60. N/F SAMANTHA DODGE
61. N/F WIND RIVER, LLC
62. N/F RALPH D'ALISA
63. N/F MILLER ROAD LLC
64. N/F MICHAEL BARILE
65. N/F NICOLE BARILE STERN
66. N/F EMERSON CARGAIN
67. N/F UNION VALLEY PLAZA INC
68. N/F AAK REALTY LLC
69. N/F P P CO LIMITED LIABILITY
70. N/F MAHOPAC VOLUNTEER FIRE DEP
71. N/F 46 TOMAHAWK LLC
72. N/F EMPIRE STATE ASSOC HOLDING CO
73. N/F ALOU CORPORATION



LOCATION MAP SCALE: 1" = 800'±

OWNER:

MILLER RD LLC
888 ROUTE 6
MAHOPAC NY 10541

NYS ELEC & GAS CORP.
39 UNION VALLEY ROAD
MAHOPAC NY 10541

THE TEAL DOOR CENTER, LLC
18 MILLER ROAD
MAHOPAC NY 10541

SITE DATA:

Zone: C/BP
Total Acreage 95.5 AC.±
Tax Map Nos.:
1. 86.11-1-14 (93.5 AC.±)
2. 86.8-2-85 (1.6 AC.±)
3. 86.14-1-8 (0.4 AC.±)

APPLICANT:

EAST POINT ENERGY, LLC
310 4th STREET NE, 3rd FLOOR
CHARLOTTESVILLE, VA 22902

GENERAL NOTES:

1. The boundaries, topography, and wetland flags shown hereon are taken from a survey by Insite Engineering, Surveying & Landscape Architecture, P.C., entitled "Survey of Property Prepared for East Point Energy", last revised on March 29, 2023.
2. No reserve recreational open space is proposed.
3. Site conditions on Now or Formerly The Teal Door Center, LLC area approximated from aerial orthoimagery.

LEGEND

━━━━━━	EXISTING PROPERTY LINE
— — —PL— — —	EXISTING PROPERTY LINE TO BE REMOVED
— — — — —	EXISTING EASEMENT
∞∞∞∞∞∞	EXISTING STONE WALL
—○—	EXISTING SIGN
— — —△— — —	EXISTING NYSDEC WETLAND BOUNDARY
|||	EXISTING WETLAND
——— — ———	EXISTING NYSDEC WETLAND ADJACENT AREA
——···——···——	EXISTING WATERCOURSE
━━━PL━━━	PROPOSED PROPERTY LINE
	EXISTING TREELINE

Putnam County Department of Health Approval "Non-Jurisdictional" Approval Statement

This is to certify that the division of land as represented on this map does not fall within the definition of subdivision as specified in Section 1115 of the Public Health Law, and Section 1117 of the Public Health Law, and therefore, is not applicable. This map in no way, explicit or implied, conveys the approval of the Putnam County Department of Health. Approval of this plat is not required, but all other provisions of the Putnam County Sanitary Code apply.

By: ______________________ Date: ____________
Environmental Health Services

Expiration Date ______________________

Town of Carmel Planning Board Approval

Approved by resolution of the Planning Board of the Town of Carmel, Putnam County, New York, on the ______ day of ______________ , ________ subject to all requirements and conditions of said resolution. Any change, erasure, modification or revision of the plat, as approved shall void this approval.

Signed this ______________ day of ______________ , ______.

By: ______________________
Chairman, Carmel Planning Board

This plat is valid for filing until ______________ , ______.

Consent to File

The undersigned owner of the property hereon states that he is familiar with this map, its contents and its legends, and hereby consents to all its said terms and conditions as stated hereon, and to the filing of this map in the Office of the Clerk of the County of Putnam.

Signed this ______________ day of ______________ , ____.

By: ______________________
NYS ELEC & GAS CORP
C/O AVANGRID MGMT CO
1 CITY CENTER FL 5
PORTLAND, ME 04101

By: ______________________
MILLER RD LLC
888 ROUTE 6
MAHOPAC NY 10541

By: ______________________
THE TEAL DOOR CENTER, LLC
18 MILLER ROAD
MAHOPAC NY 10541

Land Surveying by Insite Engineering, Surveying & Landscape Architecture, P.C.

Land Surveyor's Certification

We hereby certify that the survey shown hereon was completed by us on ____________; that this map was completed ________, 2023; and that this survey has been prepared in accordance with the existing Code of Practice for Land Surveys as adopted by the New York State Association of Professional Land Surveyors, Inc.

By: ______________________
INSITE ENGINEERING, SURVEYING,
AND LANDSCAPE ARCHITECTURE P.C.
By JEFFREY B. DeROSA
New York State License No. 50749

Certification by Real Property Tax Dept.

To Real Property Tax Department:

Please certify that Tax Map Numbers

86.11-1-14 (93.5 AC.±)
86.8-2-85 (1.6 AC.±)
86.14-1-8 (0.4 AC.±)

in the Town of Carmel are the correct Tax Map numbers for this preliminary plat.

____
Director of Real Property Taxes

Certification by Putnam County Commissioner of Finance

The Commissioner of Finance hereby certifies that all town, county and village real property taxes forwarded to this office for collection as of ___/___/___ have been paid for the parcel or parcels described as:

Tax Map Nos.:
86.11-1-14 (93.5 AC.±)
86.8-2-85 (1.6 AC.±)
86.14-1-8 (0.4 AC.±)

Signed: ______________________
Commissioner of Finance

Preliminary Plat
of
Subdivision of Property for Union Energy Center

Situate in the

Town of Carmel County of Putnam

State of New York

Scale: 1"=100'

Date: 8-30-23
Revised: 12-4-23

GRAPHIC SCALE
0 50 100 200
(IN FEET)
1 inch = 100 ft.

Job No. 21120.100
PP-1.dwg

TOWN OF CARMEL

SITE PLAN APPLICATION INSTRUCTIONS

The Town of Carmel Planning Board meetings are held twice a month, on the second **Thursday** and fourth **Wednesday**, at 7:00 PM at Carmel Town Hall, 60 McAlpin Avenue, Carmel

The submission deadline is 10 days prior to the Planning Board meeting. New site plan applications that have been deemed complete will be placed on the agenda in the order they are received.

No application will be placed on the agenda that is incomplete

Pre-Submission:

Prior to the formal submission of the site plan, a pre-submission conference may be requested by the applicant to be conducted with representatives from the Town, which may include the Town Planner, Town Engineer, Director of Code Enforcement and/or the Planning Board Attorney. This conference will serve to educate the applicant on the process he/she must follow, clarify the information required to submit a complete site plan application, and to highlight any specific areas of concern. You may arrange a pre-submission conference through the Planning Board Secretary at (845) 628-1500 extension 190.

Submission Requirements:

At least 10 days prior to the Planning Board meeting, the site plan application shall be submitted to the Planning Board Secretary as follows:

All site plans shall be signed, sealed and folded with the title box legible. The application package shall include:

- ☑ 5 copies of the Site Plan Application Form, signed and notarized.
- ☑ 5 copies of the SEQR Environmental Assessment Form (use of short form or long form shall be determined at pre-submission conference).
- ☑ 5 full size sets of the Site Plan (including floor plans and elevations)
- ☑ 1 CD (in pdf. format) containing an electronic version of the Site Plan
- ☑ 2 copies of the Disclosure Statement
- ☑ 5 copies of the Site Plan Completeness Certification Form
- ☑ All supplemental studies, reports, plans and renderings.
- ☑ 2 copies of the current deed.
- ☐ N/A 2 copies of all easements, covenants and restrictions.
- ☑ The appropriate fee, determined from the attached fee schedule. Make checks payable to the *Town of Carmel.*

Rose Trombetta 11/29/23
Planning Board Secretary; Date

11/28/23
Town Engineer; Date

TOWN OF CARMEL
SITE PLAN APPLICATION

Per Town of Carmel Code – Section 156 - Zoning

SITE IDENTIFICATION INFORMATION

Application Name: AMERICO SERINO
Application # 23-0009
Date Submitted: 11/28/23

Site Address:
No. 205 Street: EAST LAKE BLvd, Hamlet: MAHOPAC NY 10541

Property Location: *(Identify landmarks, distance from intersections, etc.)*
APPROX 800' NORTH OF CROTON FALLS Rd.

Town of Carmel Tax Map Designation:
Section 65.17 *Block* 1 *Lot(s)* 6

Zoning Designation of Site: R

Property Deed Recorded in County Clerk's Office
Date 4-13-89 *Liber* 1054 *Page* 122

Liens, Mortgages or other Encumbrances
Yes [✓ *No*]

Existing Easements Relating to the Site
[✓ *No*] *Yes* *Describe and attach copies:*

Are Easements Proposed?
[✓ *No*] *Yes* *Describe and attach copies:*

Have Property Owners within a 500' Radius of the Site Been Identified?
Yes *No* *Attached List to this Application Form*

APPLICANT/OWNER INFORMATION

Property Owner: AMERICO SERINO
Phone #: 845-628-3110
~~Fax~~#: cell 914-4206782
Email: AOL.COM ASERINO49@

Owners Address:
No. 205 *Street:* EAST LAKE BLvd -A *Town:* MAHOPAC *State:* NY *Zip:* 10541

Applicant (If different than owner):
Phone #:
Fax#:
Email:

Applicant Address (If different than owner):
No. *Street:* *Town:* *State:* *Zip:*

Individual/ Firm Responsible for Preparing Site Plan: DAN MONACO PE
Phone #: 845-656-4455
Fax#:
Email:

Address:
No. 704 *Street:* RT 6 *Town:* MAhopAc *State:* NY *Zip:* 10541

Other Representatives: —
Phone #: —
Fax#:
Email:

Owners Address:
No. *Street:* — *Town:* — *State:* *Zip:*

PROJECT DESCRIPTION

Describe the project, proposed use and operation thereof: REMOVE EXISTING Dock AND A shed AND BUILT A BOATHOUSE WITH PATIO

TOWN OF CARMEL SITE PLAN APPLICATION

PROJECT INFORMATION

Lot size: *Acres:* *Square Feet:*	**Square footage of all existing structures (by floor):** 4'x4' = 8' ~~[illegible]~~'
# of existing parking spaces: 1	**# of proposed parking spaces:** 1
# of existing dwelling units: 0	**# of proposed dwelling units** 0

Is the site served by the following public utility infrastructure:

- **Is project in sewer district or will private septic system(s) be installed?** Not Required
- **If yes to Sanitary Sewer answer the following:**

▸ **Does approval exist to connect to sewer main? Yes: ☐ No: ☑**
▸ **Is this an in-district connection? ______ Out-of district connection? _____**
▸ **What is the total sewer capacity at time of application? ____________**
▸ **What is your anticipated average and maximum daily flow ____________**

For Town of Carmel Town Engineer

▸ ***What is the sewer capacity*** Not Applicable

- **Water Supply** **Yes: ☐ No: ☐**

If Yes: ▸ **Does approval exist to connect to water main? Yes: ☐ No: ☑**
▸ **What is the total water capacity at time of application? ____________**
▸ **What is your anticipated average and maximum daily demand ____________**

- **Storm Sewer** **Yes: ☐ No: ☐**
- **Electric Service** **Yes: ☑ No: ☐**
- **Gas Service** **Yes: ☐ No: ☐**
- **Telephone/Cable Lines** **Yes: ☐ No: ☐**

For Town of Carmel Town Engineer

Water Flows NA
Sewer Flows NA

RTP 11/28/2
Town Engineer; Date

What is the predominant soil type(s) on the site?	**What is the approximate depth to water table?**

Site slope categories:	**15-25% ___%**	**25-35% ___%**	**>35% ___%**
Estimated quantity of excavation:	**Cut (C.Y.) ________**	**Fill (C.Y.) ________**	
Is Blasting Proposed Yes: ☐	**No: ☐**	**Unknown: ☐**	
Is the site located in a designated Critical Environmental Area?	**Yes: ☐**	**No: ☐**	

Does a curb cut exist on the site? Yes: ☐ No: ☐	**Are new curb cuts proposed? Yes: ☐ No: ☐**	**What is the sight distance?** **Left______ Right ______**

Is the site located within 500' of:

- **The boundary of an adjoining city, town or village** **Yes: ☐ No: ☑**
- **The boundary of a state or county park, recreation area or road right-of-way** **Yes: ☐ No: ☑**
- **A county drainage channel line.** **Yes: ☐ No: ☑**
- **The boundary of state or county owned land on which a building is located** **Yes: ☐ No: ☑**

TOWN OF CARMEL SITE PLAN APPLICATION

Is the site listed on the State or Federal Register of Historic Place (or substantially contiguous)
Yes: ☐ No: ☑

Is the site located in a designated floodplain?
Yes: ☐ No: ☑

Will the project require coverage under the Current NYSDEC Stormwater Regulations
Yes: ☐ No: ☑

Will the project require coverage under the Current NYCDEP Stormwater Regulations
Yes: ☐ No: ☑

Does the site disturb more than 5,000 sq ft **Yes: ☐ No: ☑**

Does the site disturb more than 1 acre **Yes: ☐ No: ☑**

Does the site contain freshwater wetlands?
Yes: ☐ No: ☑ LAKE
Jurisdiction:
NYSDEC: ☑ Town of Carmel: ☑

?

If present, the wetlands must be delineated in the field by a Wetland Professional, and survey located on the Site Plan.

Are encroachments in regulated wetlands or wetland buffers proposed? **Yes: ☐ No: ☑**

?

Does this application require a referral to the Environmental Conservation Board? **Yes: ☑ No: ☐**

Does the site contain waterbodies, streams or watercourses? **Yes: ☑ No: ☐**

Are any encroachments, crossings or alterations proposed? **Yes: ☐ No: ☑**

Is the site located adjacent to New York City watershed lands? **Yes: ☐ No: ☑**

yes it is in a NYCDEP Designated MAIN STREET area

Is the project funded, partially or in total, by grants or loans from a public source?
Yes: ☐ No: ☑

Will municipal or private solid waste disposal be utilized?
Public: ☐ Private: ☐ NONE

Has this application been referred to the Fire Department? **Yes: ☐ No: ☐**

What is the estimated time of construction for the project?
6 MONTHS WEATER PERMITTING

ZONING COMPLIANCE INFORMATION

Zoning Provision	Required	Existing	Proposed
Lot Area	3,000'–	2,609'	391'
Lot Coverage	15 %	42 %	28 %
Lot Width	50'	5,694'	NONE
Lot Depth	30'	52.19	NONE
Front Yard	N/A	N/A	N/A
Side Yard	15'	4'	11'
Rear Yard	N/A	N/A	N/A
Minimum Required Floor Area			
Floor Area Ratio			
Height	70'	70'	NONE
Off-Street Parking	7	7	NONE
Off-Street Loading	N/A	N/A	N/A

TOWN OF CARMEL SITE PLAN APPLICATION

Will variances be required? Yes: ☒ No: ☐	**If yes, identify variances:** 1) LOT AREA 391' 2) LOT COVERAGE 2890' 3) Side YARD 11'
PROPOSED BUILDING MATERIALS	
Foundation	CONCRETE
Structural System	STEEL CANTILEVERED
Roof	RUBBER WITH TIMBERTECK DECKING
Exterior Walls	wood with VINYL Siding To MATCH HOUSE ACROSS

APPLICANTS ACKNOWLEDGEMENT

I hereby depose and certify that all the above statements and information, and all statements and information contained in the supporting documents and drawings attached hereto are true and correct.

AMERICO SERINO
Applicants Name

Applicants Signature

Sworn before me this 28th **day of** 28 NOV **20**23

Alice Daly
Notary Public

ALICE DALY
Notary Public, State of New York
No. 01DA6345218
Qualified in Putnam County
Commission Expires July 25, 2024

TOWN OF CARMEL
SITE PLAN COMPLETENSS CERTIFICATION FORM

All Site Plans submitted to the Planning Board for review shall include the following information and details, as set forth in Section 156-61 B of the Town of Carmel Zoning Ordinance.

This form shall be included with the site plan submission

	Requirement Data	To Be Completed by the Applicant	Waived by the Town
1	Name and title of person preparing the site plan	☑ ✓	☐
2	Name of the applicant and owner (if different from applicant)	☑ ✓	☐
3	Original drawing date, revision dates, scale and north arrow	☑ ✓	☐
4	Tax map, block and lot number(s), zoning district	☑ ✓	☐
5	All existing property lines, name of owner of each property within a 500' radius of the site	☑ ✓	☐
6	Contour lines at two-foot intervals, grades of all roads, driveways, sanitary and storm sewers	☑ ?	☐
7	The location of all water bodies, streams, watercourses, wetland areas, wooded areas, rights-of-way, streets, roads, highways, railroads, buildings, structures	☑ ✓	☐
8	The location of all existing and proposed easements	☑ NA ?	☐
9	The location of all existing and proposed structures, their use, setback dimensions, floor plans, front, side and rear elevations, buildable area.	☑	☐
10	On site circulation systems, access, egress ways and service roads, emergency service access and traffic mitigation measures	☐ N/A	☐
11	Sidewalks, paths and other means of pedestrian circulation	N/A ☐	☐
12	On-site parking and loading spaces and travel aisles with dimensions	☐ N/A	☐
13	The location, height and type of exterior lighting fixtures	Under ☐ Overhang only	☐
14	Proposed signage	☐ N/A	☐
15	For non-residential uses, an estimate of the number of employees who will be using the site, description of the operation, types of products sold, types of machinery and equipment used	☐ N/A	☐

alternate [illegible]?

TOWN OF CARMEL

SITE PLAN COMPLETENSS CERTIFICATION FORM

	Requirement Data	To Be Completed by the Applicant	Waived by the Town
16	The location of clubhouses, swimming pools, open spaces, parks or other recreational areas, and identification of who is responsible for maintenance	☐ N/A	☐
17	The location and design of buffer areas, screening or other landscaping, including grading and water management. A comprehensive landscaping plan in accordance with the Tree Conservation Law	☑	☐
18	The location of public and private utilities, maintenance responsibilities, trash and garbage areas	☐ N/A	☐
19	A list, certified by the Town Assessor, of all property owners within 500 feet of the site boundary	☑	☐
20	Any other information required by the Planning Board which is reasonably necessary to ascertain compliance with this chapter	☐ ?	☐

Applicants Certification (to be completed by the licensed professional preparing the site plan:

I DANIELE MONACO **hereby certify that the site plan to which I have attached my seal and signature, meets all of the requirements of §156-61B of the Town of Carmel Zoning Ordinance:**

STATE OF NEW YORK
DANIELE MONACO
095935
LICENSED PROFESSIONAL ENGINEER

Professionals Seal

11-28-23

Signature - Applicant **Date**

11-28-23

Signature - Owner **Date**

TOWN OF CARMEL
SITE PLAN COMPLETENSS CERTIFICATION FORM

Town Certification (to be completed by the Town)

I ________________________ hereby confirm that the site plan meets all of the requirements of §156-61B of the Town of Carmel Zoning Ordinance:

Rose Trombetta
Signature - Planning Board Secretary

11/29/23
Date

Signature - Town Engineer

11/28/23
Date

Short Environmental Assessment Form
Part 1 - Project Information

Instructions for Completing

Part 1 – Project Information. The applicant or project sponsor is responsible for the completion of Part 1. Responses become part of the application for approval or funding, are subject to public review, and may be subject to further verification. Complete Part 1 based on information currently available. If additional research or investigation would be needed to fully respond to any item, please answer as thoroughly as possible based on current information.

Complete all items in Part 1. You may also provide any additional information which you believe will be needed by or useful to the lead agency; attach additional pages as necessary to supplement any item.

Part 1 – Project and Sponsor Information

Name of Action or Project:
Serino Boat House

Project Location (describe, and attach a location map):
206 East Lake Blvd, Mahopac, NY 10541

Brief Description of Proposed Action:
Construct cantilever boat house, with cantilevered side deck/dock. Wood-framed boat house supported on steel cantilevered beams over water, supported by mat-counterweight foundation

Name of Applicant or Sponsor:
Americo Serino

Telephone: 914.420.6782

E-Mail: Aserino49@aol.com

Address:
205 East Lake Blvd

City/PO: Mahopac

State: NY

Zip Code: 10541

1. Does the proposed action only involve the legislative adoption of a plan, local law, ordinance, administrative rule, or regulation?
If Yes, attach a narrative description of the intent of the proposed action and the environmental resources that may be affected in the municipality and proceed to Part 2. If no, continue to question 2.
NO ☑ YES ☐

2. Does the proposed action require a permit, approval or funding from any other government Agency?
If Yes, list agency(s) name and permit or approval:
NO ☑ YES ☐

3. a. Total acreage of the site of the proposed action? 0.06 acres
b. Total acreage to be physically disturbed? 0.015 acres
c. Total acreage (project site and any contiguous properties) owned or controlled by the applicant or project sponsor? 0.06 acres

4. Check all land uses that occur on, are adjoining or near the proposed action:

5. ☐ Urban ☐ Rural (non-agriculture) ☐ Industrial ☐ Commercial ☑ Residential (suburban)
☐ Forest ☐ Agriculture ☑ Aquatic ☐ Other(Specify):
☐ Parkland

	NO	YES	N/A
5. Is the proposed action,			
a. A permitted use under the zoning regulations?	☐	☑	☐
b. Consistent with the adopted comprehensive plan?	☐	☐	☑

	NO	YES
6. Is the proposed action consistent with the predominant character of the existing built or natural landscape?	☐	☑
7. Is the site of the proposed action located in, or does it adjoin, a state listed Critical Environmental Area? If Yes, identify:	☑	☐
8. a. Will the proposed action result in a substantial increase in traffic above present levels?	☑	☐
b. Are public transportation services available at or near the site of the proposed action?	☑	☐
c. Are any pedestrian accommodations or bicycle routes available on or near the site of the proposed action?	☑	☐
9. Does the proposed action meet or exceed the state energy code requirements? If the proposed action will exceed requirements, describe design features and technologies:	☐	☑
10. Will the proposed action connect to an existing public/private water supply? If No, describe method for providing potable water: Potable water not required at site.	☑	☐
11. Will the proposed action connect to existing wastewater utilities? If No, describe method for providing wastewater treatment: Wastewater treatment not required at site.	☑	☐
12. a. Does the project site contain, or is it substantially contiguous to, a building, archaeological site, or district which is listed on the National or State Register of Historic Places, or that has been determined by the Commissioner of the NYS Office of Parks, Recreation and Historic Preservation to be eligible for listing on the State Register of Historic Places?	☑	☐
b. Is the project site, or any portion of it, located in or adjacent to an area designated as sensitive for archaeological sites on the NY State Historic Preservation Office (SHPO) archaeological site inventory?	☐	☑
13. a. Does any portion of the site of the proposed action, or lands adjoining the proposed action, contain wetlands or other waterbodies regulated by a federal, state or local agency?	☐	☑
b. Would the proposed action physically alter, or encroach into, any existing wetland or waterbody?	☐	☑
If Yes, identify the wetland or waterbody and extent of alterations in square feet or acres: Proposed boat house will extent over Lake Mahopac a distance of 22' from existing bulkhead		

14. Identify the typical habitat types that occur on, or are likely to be found on the project site. Check all that apply:

☑ Shoreline ☐ Forest ☐ Agricultural/grasslands ☐ Early mid-successional

☑ Wetland ☐ Urban ☑ Suburban

15. Does the site of the proposed action contain any species of animal, or associated habitats, listed by the State or Federal government as threatened or endangered? Northern Long-eared Bat	NO ☐	YES ☑
16. Is the project site located in the 100-year flood plan?	NO ☐	YES ☑
17. Will the proposed action create storm water discharge, either from point or non-point sources? If Yes,	NO ☐	YES ☑
a. Will storm water discharges flow to adjacent properties?	☑	☐
b. Will storm water discharges be directed to established conveyance systems (runoff and storm drains)? If Yes, briefly describe: Boat house roof drains will be directed to storm water infiltrators	☐	☑
18. Does the proposed action include construction or other activities that would result in the impoundment of water or other liquids (e.g., retention pond, waste lagoon, dam)? If Yes, explain the purpose and size of the impoundment:	NO ☑	YES ☐
19. Has the site of the proposed action or an adjoining property been the location of an active or closed solid waste management facility? If Yes, describe:	NO ☑	YES ☐
20. Has the site of the proposed action or an adjoining property been the subject of remediation (ongoing or completed) for hazardous waste? If Yes, describe:	NO ☑	YES ☐

I CERTIFY THAT THE INFORMATION PROVIDED ABOVE IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE

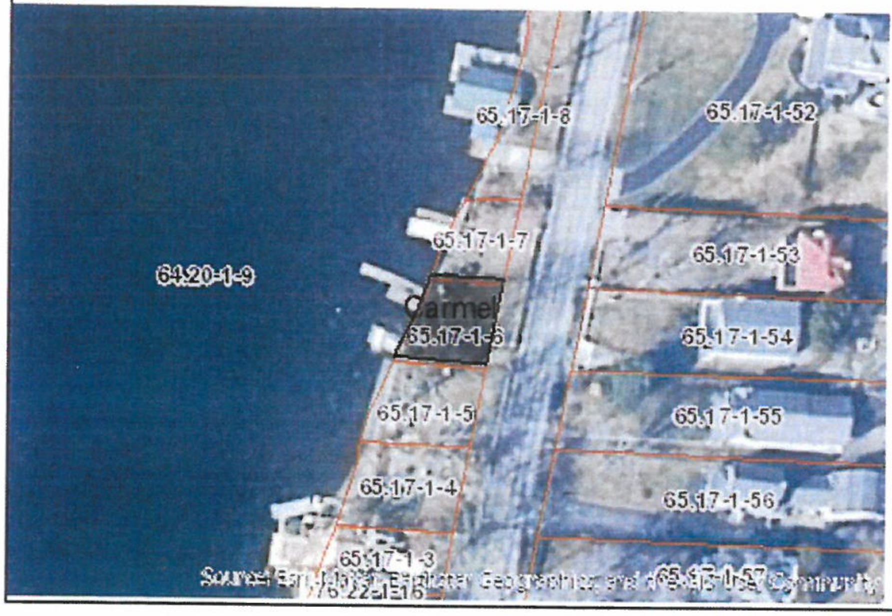
Applicant/sponsor/name: Americo Serino Date: 9-5-23

Signature: Title: OWNER

PRINT FORM

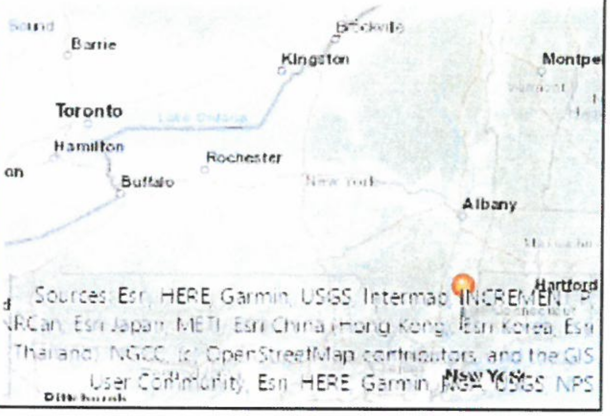
EAF Mapper Summary Report

Sunday, August 20, 2023 9:21 PM



Source: Esri, [illegible] Earthstar Geographics, and [illegible] Community

Disclaimer: The EAF Mapper is a screening tool intended to assist project sponsors and reviewing agencies in preparing an environmental assessment form (EAF). Not all questions asked in the EAF are answered by the EAF Mapper. Additional information on any EAF question can be obtained by consulting the EAF Workbooks. Although the EAF Mapper provides the most up-to-date digital data available to DEC, you may also need to contact local or other data sources in order to obtain data not provided by the Mapper. Digital data is not a substitute for agency determinations.



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community, Esri, HERE, Garmin, NGA, USGS, NPS

Part 1 / Question 7 [Critical Environmental Area]	No
Part 1 / Question 12a [National or State Register of Historic Places or State Eligible Sites]	No
Part 1 / Question 12b [Archeological Sites]	Yes
Part 1 / Question 13a [Wetlands or Other Regulated Waterbodies]	Yes - Digital mapping information on local and federal wetlands and waterbodies is known to be incomplete. Refer to EAF Workbook.
Part 1 / Question 15 [Threatened or Endangered Animal]	Yes
Part 1 / Question 15 [Threatened or Endangered Animal - Name]	Northern Long-eared Bat
Part 1 / Question 16 [100 Year Flood Plain]	Yes
Part 1 / Question 20 [Remediation Site]	No

NEW YORK STATE | Office of General Services

KATHY HOCHUL
Governor

JEANETTE M. MOY
Commissioner

October 6, 2023

Americo Serino
205 East Lake Blvd.
Mahopac, NY 10541

Dear Mr. Serino:

Re: Joint Application Form I-6393
Applicant: Americo Serino
Stream/Waterbody: Lake Mahopac
County: Putnam
Town: Mahopac

The New York State Office of General Services (NYSOGS) has received the Joint Application Form (JAF) to construct a boathouse. It has been assigned project No. I-6393.

Based on a review of the proposed activities, it has been determined that the activities do not require a permit from the NYSOGS. Please save this letter as proof of determination by this office of "No Permit Required" since we will not be sending additional correspondence related to this determination.

Please be aware that this determination does not obviate the need for permits and/or permissions from other involved agencies.

Thank you for your interest in the Lands Underwater Program which is administered by the Office of General Services. Should you have any questions, please do not hesitate to contact this office at (518) 474-2195.

Sincerely,

Ralph Hill

Ralph Hill, L.S.
Real Estate Officer 1
State Asset & Land Management

NEW YORK STATE | Department of Environmental Conservation | Office of General Services | Department of State | US Army Corps of Engineers

JOINT APPLICATION FORM

For Permits for activities activities affecting streams, waterways, waterbodies, wetlands, coastal areas, sources of water, and endangered and threatened species.

You must separately apply for and obtain Permits from each involved agency before starting work. Please read all instructions.

1. **Applications To:**

>NYS Department of Environmental Conservation ☐ Check here to confirm you sent this form to NYSDEC.

Check all permits that apply:
- ☐ Stream Disturbance
- ☐ Excavation and Fill in Navigable Waters
- ☑ Docks, Moorings or Platforms
- ☐ Dams and Impoundment Structures
- ☐ 401 Water Quality Certification*
- ☐ Freshwater Wetlands
- ☐ Tidal Wetlands
- ☐ Wild, Scenic and Recreational Rivers
- ☐ Coastal Erosion Management
- ☐ Water Withdrawal
- ☐ Long Island Well
- ☐ Incidental Take of Endangered / Threatened Species

* See Instructions (page 3)

>US Army Corps of Engineers ☐ Check here to confirm you sent this form to USACE.

Check all permits that apply: ☐ Section 404 Clean Water Act ☐ Section 10 Rivers and Harbors Act

Is the project Federally funded? Yes [✓ No]

If yes, name of Federal Agency:

General Permit Type(s), if known:

Preconstruction Notification: Yes No

>NYS Office of General Services ☑ Check here to confirm you sent this form to NYSOGS.

Check all permits that apply:
- ☑ State Owned Lands Under Water
- ☐ Utility Easement (pipelines, conduits, cables, etc.)
- ☑ Docks, Moorings or Platforms

>NYS Department of State ☐ Check here to confirm you sent this form to NYSDOS.

Check if this applies: ☐ Coastal Consistency Concurrence

2. **Name of Applicant**

Americo Serino

Taxpayer ID (if applicant is NOT an individual):

Mailing Address: 205 E Lake Blvd

Post Office / City: Mahopac

State: NY

Zip: 10541

Telephone: 914.420.6782

Email: aserino49@aol.com

Applicant Must be (check all that apply): ☑ Owner ☐ Operator ☐ Lessee

3. **Name of Property Owner (if different than Applicant)**

Mailing Address:

Post Office / City:

State:

Zip:

Telephone:

Email:

For Agency Use Only	Agency Application Number:

4. **Name of Contact / Agent**

Mailing Address

Post Office / City

State

Zip

Telephone

Email

5. **Project / Facility Name**
Serino Boat House

Property Tax Map Section / Block / Lot Number:
65.17-1-6

Project Street Address, if applicable
206 E Lake Blvd

Post Office / City
Mahopac

State
NY

Zip
10541

Provide directions and distances to roads, intersections, bridges and bodies of water
Approximately 550' north of the Croton Falls Road-East Lake Blvd intersection in Mahopac, NY. Located on Lake Mahopac.

[✓ Town] Village City
Mahopac

County
Putnam

Stream/Waterbody Name
Lake Mahopac

Project Location Coordinates: Enter Latitude and Longitude in degrees, minutes, seconds:
Latitude: 41 ° 22 ' 43.82 " Longitude: 73 ° 43 ' 43.10 "

6. **Project Description:** Provide the following information about your project. Continue each response and provide any additional information on other pages. **Attach plans on separate pages.**

a. Purpose of the proposed project:
Remove one existing dock and existing changing room and construct a cantilevered boat house over Lake Mahopac

b. Description of current site conditions:
Lake side property with ~51' road frontage, ~52' lake frontage, ~52' mean lot depth, ~2600Sq.ft.
Site has stone masonry street side wall, with gate entry into a 12'x20' paver parking space. There is a small changing room on the northwest corner of the site. There are two existing docks attached at the lake front edge. Property is predominantly open grass area.

c. Proposed site changes:
Remove the northern dock, install cantilever dock, supported by mat-counterweight foundation. Install new terrace area with retaining to retain grade.

d. Type of structures and fill materials to be installed, and quantity of materials to be used (e.g., square feet of coverage, cubic yards of fill material, structures below ordinary/mean high water, etc.):
Concrete mat-counterweight foundation. Steel cantilever beams to support wood framed boat house.

e. Area of excavation or dredging, volume of material to be removed, location of dredged material placement:
~640Sq.ft. disturbance area and ~60 cubic yards of soil to be excavated and hauled off site pertaining to installation of boat house and its foundation.

f. Is tree cutting or clearing proposed? [✓ Yes] If Yes, explain below. No
Timing of the proposed cutting or clearing (month/year): Winter 2024
Number of trees to be cut: 2
Acreage of trees to be cleared: 0

g. Work methods and type of equipment to be used:

Excavator to excavate soil from site and load into truck.

h. Describe the planned sequence of activities:

1. Install site fences and turbidity curtains as shown on plans prior to commencement of work. 2. Excavate area for mat-counterweight foundation. Haul soil off site. Existing lakeside bulkhead shall be left in place; excavation practices shall preclude damages to existing bulkhead 3. Form foundation, install reinforcing bars and set wide-flange steel beams from within excavated area behind bulkhead. 4. Cast concrete. Note: Edge of mat foundation will serve as new bulkhead. 5. Remove former bulkhead between extents of mouth of new mat foundation, Refer to plans. 6. Frame boathouse on steel framing in wood.

i. Pollution control methods and other actions proposed to mitigate environmental impacts:

All machinery, tools, forms and other apparatus used in construction of boathouse foundation should be clean of oils. Refueling of equipment shall occur at a distance from the water body which will prevent direct spills into open water. All fuel cans shall be store offsite, or at a safe distance from water bodies. Spill kits shall be stored on site at all times.

j. Erosion and silt control methods that will be used to prevent water quality impacts:

Turbidity curtain shall be installed in water, and silt fence shall be installed at waterfront, and around soil stock piles. Effluent water from foundation dewatering shall be pumped through crushed stone riprap, with two-layer silt fence surrounding the riprap.

k. Alternatives considered to avoid regulated areas. If no feasible alternatives exist, explain how the project will minimize impacts:

Lumber and construction cutting shall be performed on land, away from bulkhead.

l. Proposed use: ☑ Private ☐ Public ☐ Commercial

m. Proposed Start Date: ASAP Estimated Completion Date:

n. Has work begun on project? Yes If Yes, explain below. [✓ No]

o. Will project occupy Federal, State, or Municipal Land? [✓ Yes] If Yes, explain below. No

The cantilevered boathouse and foundation will extend over/be partially located on state-owned underwater land.

p. List any previous DEC, USACE, OGS or DOS Permit / Application numbers for activities at this location:

None

q. Will this project require additional Federal, State, or Local authorizations, including zoning changes?

[✓ Yes] If Yes, list below. ___ No

Approval from the local town boards will be required

7. **Signatures.**

Applicant and Owner (If different) must sign the application. If the applicant is the landowner, the **landowner attestation form** can be used as an electronic signature as an alternative to the signature below, if necessary. Append additional pages of this Signature section if there are multiple Applicants, Owners or Contact/Agents.

I hereby affirm that information provided on this form and all attachments submitted herewith is true to the best of my knowledge and belief.

Permission to Inspect - I hereby consent to Agency inspection of the project site and adjacent property areas. Agency staff may enter the property without notice between 7:00 am and 7:00 pm, Monday - Friday. Inspection may occur without the owner, applicant or agent present. If the property is posted with "keep out" signs or fenced with an unlocked gate, Agency staff may still enter the property. Agency staff may take measurements, analyze site physical characteristics, take soil and vegetation samples, sketch and photograph the site. I understand that failure to give this consent may result in denial of the permit(s) sought by this application.

False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the NYS Penal Law. Further, the applicant accepts full responsibility for all damage, direct or indirect, of whatever nature, and by whomever suffered, arising out of the project described herein and agrees to indemnify and save harmless the State from suits, actions, damages and costs of every name and description resulting from said project. In addition, Federal Law, 18 U.S.C., Section 1001 provides for a fine of not more than $10,000 or imprisonment for not more than 5 years, or both where an applicant knowingly and willingly falsifies, conceals, or covers up a material fact; or knowingly makes or uses a false, fictitious or fraudulent statement.

Signature of Applicant

Date: 9-5-23

Applicant Must be (check all that apply): ☑ Owner ☐ Operator ☐ Lessee

Printed Name: Americo Serino

Title: OWNER

Signature of Owner (if different than Applicant)

Date:

Printed Name:

Title:

Signature of Contact / Agent

Date:

Printed Name:

Title:

For Agency Use Only **DETERMINATION OF NO PERMIT REQUIRED**

Agency Application Number

(Agency Name) has determined that No Permit is required from this Agency for the project described in this application.

Agency Representative:

Printed Name: Title:

Signature: Date:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Permits, Region 3
21 South Putt Corners Road, New Paltz, NY 12561-1620
P: (845) 256-3054 | F: (845) 255-4659
www.dec.ny.gov

NEW YORK STATE OF OPPORTUNITY | **Department of Environmental Conservation**

IMPORTANT NOTICE TO ALL PERMITTEES

The permit you requested is enclosed. Please read it carefully and note the conditions that are included in it. The permit is valid for only that activity expressly authorized therein; work beyond the scope of the permit may be considered a violation of law and be subject to appropriate enforcement action. Granting of this permit does not relieve the permittee of the responsibility of obtaining any other permission, consent or approval from any other federal, state, or local government which may be required.

Please note the expiration date of the permit. Applications for permit renewal should be made well in advance of the expiration date (minimum of 30 days) and submitted to the Regional Permit Administrator at the above address. For SPDES, Solid Waste and Hazardous Waste Permits, renewals must be made at least 180 days prior to the expiration date.

The DEC permit number & program ID number noted on page 1 under "Permit Authorization" of the permit are important and should be retained for your records. These numbers should be referenced on all correspondence related to the permit, and on any future applications for permits associated with this facility/project area.

If a permit notice sign is enclosed, you must post it at the work site with appropriate weather protection, as well as a copy of the permit per General Condition 1.

If you have any questions on the extent of work authorized or your obligations under the permit, please contact the staff person indicated below or the Division of Environmental Permits at the above address.

Frank Benedetto
Frank Benedetto
Division of Environmental Permits, Region 3
Telephone (845) 256-0208
Frank.benedetto@dec.ny.gov

PERMIT
Under the Environmental Conservation Law (ECL)

Permittee and Facility Information

Permit Issued To:
Americo Serino
205 E Lake Blvd
Mahopac, NY 10541

Facility:
Serino Property Boathouse
205 E Lake Blvd
Mahopac, NY 10541

Facility Location: in CARMEL in PUTNAM COUNTY
Facility Principal Reference Point: NYTM-E: 606.366 NYTM-N: 4581.592
Latitude: 41°22'43.8" Longitude: 73°43'40.7"

Authorized Activity: This permit authorizes excavation and fill to Lake Mahopac associated with the construction of a 640 square foot boathouse.

Permit Authorizations

Excavation & Fill in Navigable Waters - Under Article 15, Title 5
Permit ID 3-3720-00481/00001
New Permit Effective Date: 11/8/2023 Expiration Date: 12/31/2028

NYSDEC Approval

By acceptance of this permit, the permittee agrees that the permit is contingent upon strict compliance with the ECL, all applicable regulations, and all conditions included as part of this permit.

Permit Administrator: TRACEY L O'MALLEY, Deputy Regional Permit Administrator
Address: NYSDEC Region 3 Headquarters
21 S Putt Corners Rd
New Paltz, NY 12561

Authorized Signature: Tracey L. M. O'Malley Digitally signed by Tracey L. M. O'Malley Date: 2023.11.08 12:42:39 -05'00' Date 11/ 8 /2023

Distribution List

Sarah Pawliczak; NYSDEC
Brian Orzel; USACE
Town of Carmel
Dan Monaco

Permit Components

NATURAL RESOURCE PERMIT CONDITIONS

GENERAL CONDITIONS, APPLY TO ALL AUTHORIZED PERMITS

NOTIFICATION OF OTHER PERMITTEE OBLIGATIONS

Permit Attachments

Permit Sign

NATURAL RESOURCE PERMIT CONDITIONS - Apply to the Following Permits: EXCAVATION & FILL IN NAVIGABLE WATERS

1. **Conformance With Plans** All activities authorized by this permit must be in strict conformance with the approved plans submitted by the applicant or applicant's agent as part of the permit application. Such approved plans were prepared by the applicant and consist of Joint Application Form and all attached pictures and "Zoning and Site Plan", "Site Construction Plan", "Boathouse Elevation", and "Boathouse Plan and Section", received by DEC on September 5, 2023.

2. **Notice of Intent to Commence Work** The permittee or their representative must notify Sarah Pawliczak of the DEC Bureau of Ecosystem Health via email (sarah.pawliczak@dec.ny.gov) no less than 48 hours prior to the commencement of work.

3. **Prior Approval of Changes** If the permittee desires to make any minor changes to the scope of work shown in the approved plans referenced in Natural Resources Permit Condition 1 or seeks minor changes to timeframes or deadlines in any conditions of this permit, the permittee shall submit a request via email to Sarah Pawliczak of the DEC Bureau of Ecosystem Health (sarah.pawliczak@dec.ny.gov) to make such proposed changes. The proposed changes shall not be implemented unless authorized in writing by the Department. Issuance of such approval without modification of the permit is at the Department's discretion.

4. **Post Permit Sign** The permit sign enclosed with this permit shall be posted in a conspicuous location on the worksite and adequately protected from the weather.

5. **Install Turbidity Barrier** Prior to commencing the project, a turbidity barrier shall be installed to isolate the work area from the rest of the lake in accordance with the approved plans. The turbidity barrier shall be entirely removed upon completion of work.

6. **Install Erosion Controls** Before any soil is disturbed on the subject site, the permittee shall install erosion and sedimentation controls which are adequate to prevent erosion and sedimentation off-site. Such controls shall be maintained until the unpaved portions of subject site, if any, are stabilized by a self-sustaining cover of vegetation that is adequate to prevent erosion and sedimentation on and off such

site. Before such controls are removed, the permittee shall remove all sediment that has accumulated at such controls.

7. **No Turbidity from Dewatering** No turbid water resulting from dewatering operations shall be discharged directly to or allowed to enter the water. Such water shall be pumped to settling basins or to an upland vegetated area prior to any discharge to the water. All other necessary measures shall be implemented to prevent any visible increase in turbidity or sedimentation downstream of the work site.

8. **No Equipment in the Water** Heavy equipment operation in the water is prohibited. With backhoes and similar heavy equipment, the bucket may enter the water.

9. **Use Pressure Treated Wood** Where treated wood lumber is to be used in the construction of in-water structures, only pressure treated wood with a preservative and treatment process approved (stamped or otherwise marked as certified) by the American Wood Preservative Association can be used. Wood treated with CCA (Chromated Copper Arsenate) or ACQ (Alkaline Copper Quat) can be used in all aquatic environments. Wood treated with Pentachlorophenol can only be used in freshwater applications.

10. **No Cutting Wood Over Water** Cutting, shaping, drilling, and other construction activities shall not be conducted near or over the water where sawdust, chips, or other debris might fall into the water.

11. **Clean Fill Only** All fill shall consist of clean soil, sand and/or gravel that is free of the following substances: asphalt, slag, flyash, broken concrete, demolition debris, garbage, household refuse, tires, woody materials including tree or landscape debris, and metal objects. The introduction of materials toxic to aquatic life is expressly prohibited.

12. **Equipment Cleaning** Before equipment and materials are used in any project work area involving regulated waters, the equipment must be inspected for, and cleaned of, any visible soils, vegetation, and debris to prevent the potential introduction of invasive species into regulated waters from other areas.

13. **Concrete Leachate** During construction, no wet or fresh concrete or leachate shall be allowed to escape into any wetlands or waters of New York State, nor shall washings from ready-mixed concrete trucks, mixers, or other devices be allowed to enter any wetland or waters. Only watertight or waterproof forms shall be used. Wet concrete shall not be poured to displace water within the forms.

14. **Bulkhead Replacement** The replacement wall shall follow the contours of the existing wall as closely as possible. The new wall shall not extend out into the waters of Lake Mahopac farther than 18 inches from the existing wall, in accordance with the approved plan.

15. **Seed, Mulch Disturbed Areas** All areas of soil disturbance resulting from this project shall be seeded with an appropriate perennial grass, and mulched with straw immediately upon completion of the project, within two days of final grading, or by the expiration of the permit, whichever is first.

16. **Vegetation Debris Disposal** Invasive species, host material and attached soil material that has been removed from vehicles, equipment, and materials, or generated from cleaning operations shall be rendered incapable of any growth or reproduction by placing in plastic bags at least 3 mil thick, hauled in a covered truck, and properly disposed of offsite; or the material shall be managed within the infested project area, provided that no filling of any wetland or adjacent area will occur. A list of prohibited and regulated invasive species is contained within 6 NYCRR Part 575 and available at https://www.dec.ny.gov/animals/99141.html.

17. **Disposal of Material** Any demolition debris, excess construction materials, and/or excess excavated materials shall be immediately and completely disposed of on an approved upland site more than 100 feet from any regulated waterbody or wetland. These materials shall be suitably stabilized so as not to re-enter any water body, wetland, or wetland adjacent area; and must be disposed of in accordance with all local, state, and federal statutes, regulations, or ordinances.

18. **Boathouse Not for Habitation** This permit is granted with the understanding that this building is to be utilized as a boathouse, meaning a structure having a direct connection to a navigable body of water that is used primarily for the storage of boats and not as a human habitation.

19. **Precautions Against Contamination of Waters** All necessary precautions shall be taken to preclude contamination of any wetland or waterway by suspended solids, sediments, fuels, solvents, lubricants, epoxy coatings, paints, concrete, leachate or any other environmentally deleterious materials associated with the project.

20. **State Not Liable for Damage** The State of New York shall in no case be liable for any damage or injury to the structure or work herein authorized which may be caused by or result from future operations undertaken by the State for the conservation or improvement of navigation, or for other purposes, and no claim or right to compensation shall accrue from any such damage.

21. **No Interference With Navigation** There shall be no unreasonable interference with navigation by the work herein authorized.

22. **State May Require Site Restoration** If upon the expiration or revocation of this permit, the project hereby authorized has not been completed, the applicant shall, without expense to the State, and to such extent and in such time and manner as the Department of Environmental Conservation may lawfully require, remove all or any portion of the uncompleted structure or fill and restore the site to its former condition. No claim shall be made against the State of New York on account of any such removal or alteration.

23. **State May Order Removal or Alteration of Work** If future operations by the State of New York require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Department of Environmental Conservation it shall cause unreasonable obstruction to the free navigation of said waters or flood flows or endanger the health, safety or welfare of the people of the State, or cause loss or destruction of the natural resources of the State, the owner may be ordered by the Department to remove or alter the structural work, obstructions, or hazards caused thereby without expense to the State, and if, upon the expiration or revocation of this permit, the structure, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the owners, shall, without expense to the State, and to such extent and in such time and manner as the Department of Environmental Conservation may require, remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable and flood capacity of the watercourse. No claim shall be made against the State of New York on account of any such removal or alteration.

GENERAL CONDITIONS - Apply to ALL Authorized Permits:

1. **Facility Inspection by The Department** The permitted site or facility, including relevant records, is subject to inspection at reasonable hours and intervals by an authorized representative of the Department of Environmental Conservation (the Department) to determine whether the permittee is complying with this permit and the ECL. Such representative may order the work suspended pursuant to ECL 71- 0301 and SAPA 401(3).

The permittee shall provide a person to accompany the Department's representative during an inspection to the permit area when requested by the Department.

A copy of this permit, including all referenced maps, drawings and special conditions, must be available for inspection by the Department at all times at the project site or facility. Failure to produce a copy of the permit upon request by a Department representative is a violation of this permit.

2. **Relationship of this Permit to Other Department Orders and Determinations** Unless expressly provided for by the Department, issuance of this permit does not modify, supersede or rescind any order or determination previously issued by the Department or any of the terms, conditions or requirements contained in such order or determination.

3. **Applications For Permit Renewals, Modifications or Transfers** The permittee must submit a separate written application to the Department for permit renewal, modification or transfer of this permit. Such application must include any forms or supplemental information the Department requires. Any renewal, modification or transfer granted by the Department must be in writing. Submission of applications for permit renewal, modification or transfer are to be submitted to:

Regional Permit Administrator
NYSDEC Region 3 Headquarters
21 S Putt Corners Rd
New Paltz, NY12561

4. **Submission of Renewal Application** The permittee must submit a renewal application at least 30 days before permit expiration for the following permit authorizations: Excavation & Fill in Navigable Waters.

5. **Permit Modifications, Suspensions and Revocations by the Department** The Department reserves the right to exercise all available authority to modify, suspend or revoke this permit. The grounds for modification, suspension or revocation include:

   a. materially false or inaccurate statements in the permit application or supporting papers;

   b. failure by the permittee to comply with any terms or conditions of the permit;

   c. exceeding the scope of the project as described in the permit application;

   d. newly discovered material information or a material change in environmental conditions, relevant technology or applicable law or regulations since the issuance of the existing permit;

   e. noncompliance with previously issued permit conditions, orders of the commissioner, any provisions of the Environmental Conservation Law or regulations of the Department related to the permitted activity.

6. **Permit Transfer** Permits are transferrable unless specifically prohibited by statute, regulation or another permit condition. Applications for permit transfer should be submitted prior to actual transfer of ownership.

NOTIFICATION OF OTHER PERMITTEE OBLIGATIONS

Item A: Permittee Accepts Legal Responsibility and Agrees to Indemnification
The permittee, excepting state or federal agencies, expressly agrees to indemnify and hold harmless the Department of Environmental Conservation of the State of New York, its representatives, employees, and agents ("DEC") for all claims, suits, actions, and damages, to the extent attributable to the permittee's acts or omissions in connection with the permittee's undertaking of activities in connection with, or operation and maintenance of, the facility or facilities authorized by the permit whether in compliance or not in compliance with the terms and conditions of the permit. This indemnification does not extend to any claims, suits, actions, or damages to the extent attributable to DEC's own negligent or intentional acts or omissions, or to any claims, suits, or actions naming the DEC and arising under Article 78 of the New York Civil Practice Laws and Rules or any citizen suit or civil rights provision under federal or state laws.

Item B: Permittee's Contractors to Comply with Permit
The permittee is responsible for informing its independent contractors, employees, agents and assigns of their responsibility to comply with this permit, including all special conditions while acting as the permittee's agent with respect to the permitted activities, and such persons shall be subject to the same sanctions for violations of the Environmental Conservation Law as those prescribed for the permittee.

Item C: Permittee Responsible for Obtaining Other Required Permits
The permittee is responsible for obtaining any other permits, approvals, lands, easements and rights-of-way that may be required to carry out the activities that are authorized by this permit.

Item D: No Right to Trespass or Interfere with Riparian Rights
This permit does not convey to the permittee any right to trespass upon the lands or interfere with the riparian rights of others in order to perform the permitted work nor does it authorize the impairment of any rights, title, or interest in real or personal property held or vested in a person not a party to the permit.

Item E: SEQR Unlisted Action, No Lead Agency, No Significant Impact Under the State Environmental Quality Review Act (SEQR), the project associated with this permit is classified as an Unlisted Action and the Department of Environmental Conservation has determined that it will not have a significant effect on the environment. Other involved agencies may reach an independent determination of environmental significance for this project.

New York State
Department of Environmental Conservation

NOTICE

The Department of Environmental Conservation (DEC) has issued permit(s) pursuant to the Environmental Conservation Law for work being conducted at this site. For further information regarding the nature and extent of work approved and any Department condition on it, contact the DEC at 845-256-3054 or dep.r3@dec.ny.gov. Please refer to the permit number shown when contacting the DEC.

Permittee: Americo Serino

Permit No. 3-3720-00481/00001

Effective Date: 11/08/2023

Expiration Date: 12/31/2028

☐ Applicable if checked. No instream work allowed between October 1 & April 30

NOTE: This notice is **NOT** a permit.

NEW YORK STATE OF OPPORTUNITY. | **Department of Environmental Conservation**

APPLICATION FOR PERMIT
FOR THE CONSTRUCTION, RECONSTRUCTION OR EXPANSION OF DOCKING AND MOORING FACILITIES
(Including Platforms and Breakwaters)

Supplement D-2

FOR AGENCY USE ONLY
DEC APPLICATION NUMBER:
U.S. ARMY CORPS OF ENGINEERS APPLICATION NUMBER:

Please read all instructions on the following page.
TYPE OR PRINT CLEARLY IN INK.
Attach additional information as needed.

PROJECT CONSTRUCTION DESCRIPTION:

1. TYPE OF ACTIVITY:

☑ New Facility Construction ☐ Substantial Reconstruction ☐ Expansion ☐ Change in Use

2. CAPACITY OF DOCKING FACILITY OR MOORING AREA:

Maximum number of boats to be docked: 1

Maximum number of boats to be moored: 0

Boat type and size ranges to be served: Recreational use boats no larger than 25' long.

Total surface area of facility perimeter: ~504 square feet

3. IDENTIFY STRUCTURE TYPES AND THE USE OF SUCH STRUCTURES, INCLUDE SIZE, TYPE OF CONSTRUCTION AND MATERIALS TO BE USED, IF SUBSTANTIAL RECONSTRUCTION IS REQUIRED, EXPLAIN EXTENT OF ACTIVITY INCLUDING PERCENTAGE OF THE TOTAL STRUCTURE SIZE AFFECTED.

Cantilever boat house, with cantilevered side deck/dock. Wood-framed boat house supported on steel cantilevered beams over water, supported by mat-counterweight foundation

(continue on attached sheet if necessary)

4. FOR NEW FACILITY, EXPANSION OF EXISTING FACILITY OR CHANGE IN USE, CHECK APPROPRIATE ITEMS AND DESCRIBE THE SERVICES TO BE PROVIDED:

☐ Water Supply:
☐ Sewage Disposal:
☑ Electrical Supply: NYSEG power supply already exists at site.
☐ Gas Supply:
☐ Gasoline/Oil Supply:
☐ Other:

(continue on attached sheet if necessary)

5. SIGNATURE: DATE: 9-5-23

(rev. 3/16)

Reset

Serino Boat house
206 East Lake Blvd.
Mahopac, NY 10541
Tax Map No.: 65.17-1-6

August 30, 2023

Figure 1: Entrance to 206 E. Lake Blvd. (Looking West).

Figure 2: Project Site (Looking East).

Serino Boat house
206 East Lake Blvd.
Mahopac, NY 10541
Tax Map No.: 65.17-1-6

August 30, 2023

Figure 3: Project Site (Looking North).

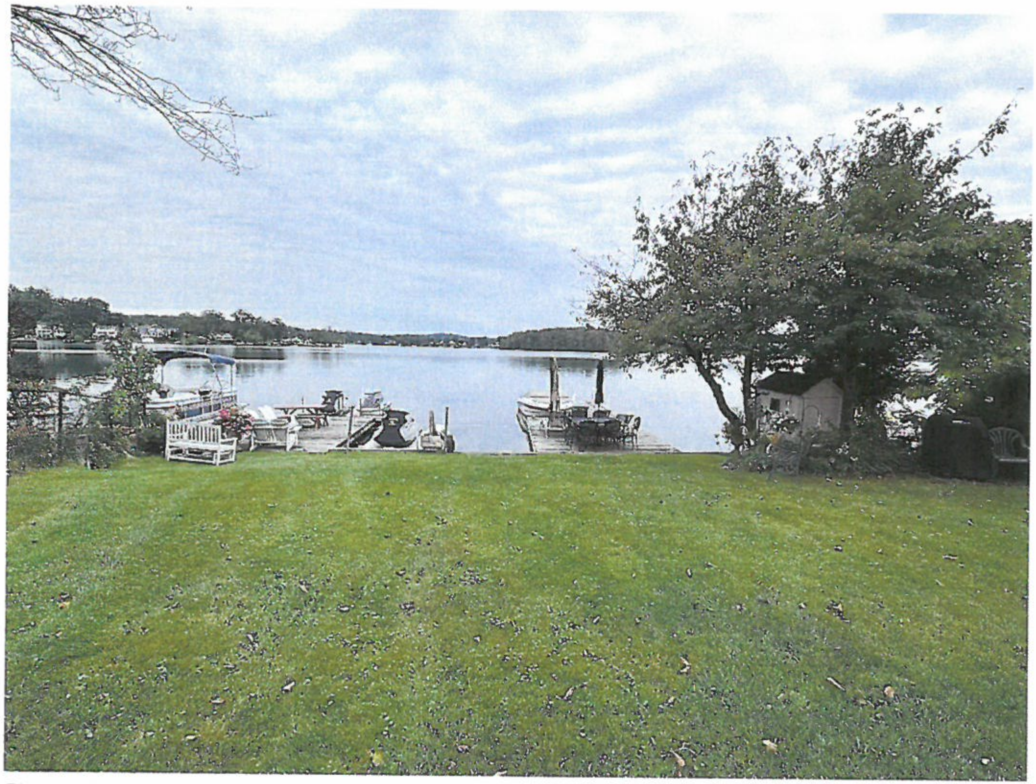


Figure 4: Project Shoreline on Lake Mahopac (Looking West).

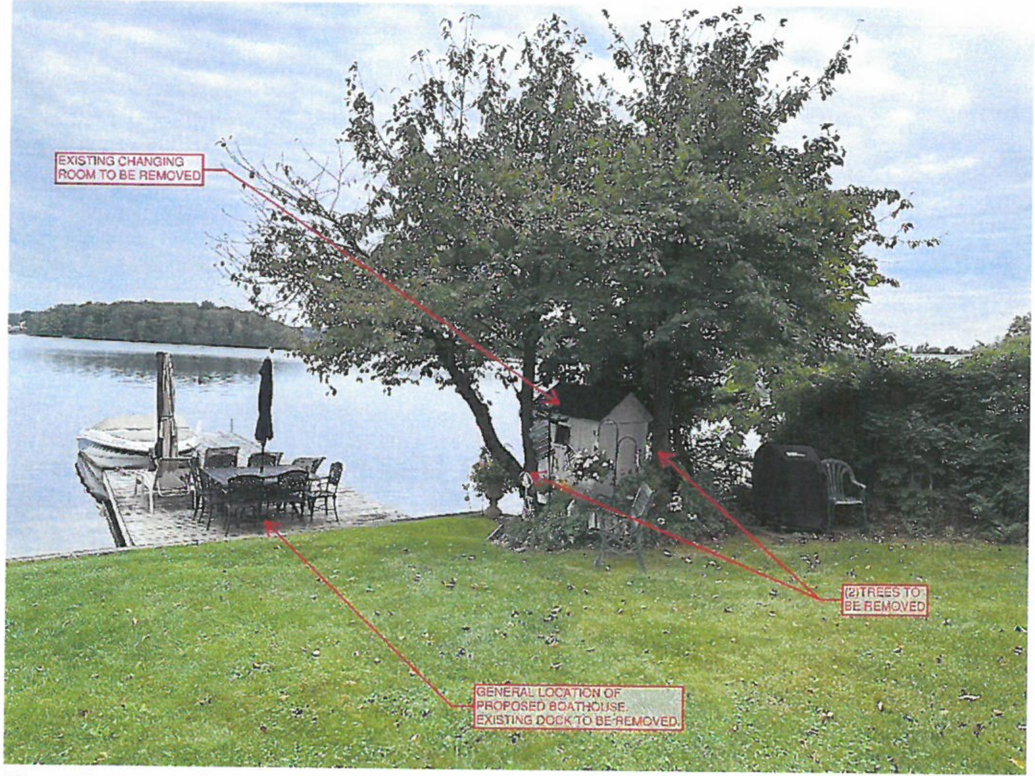


Figure 5: General Location of Proposed Boathouse.

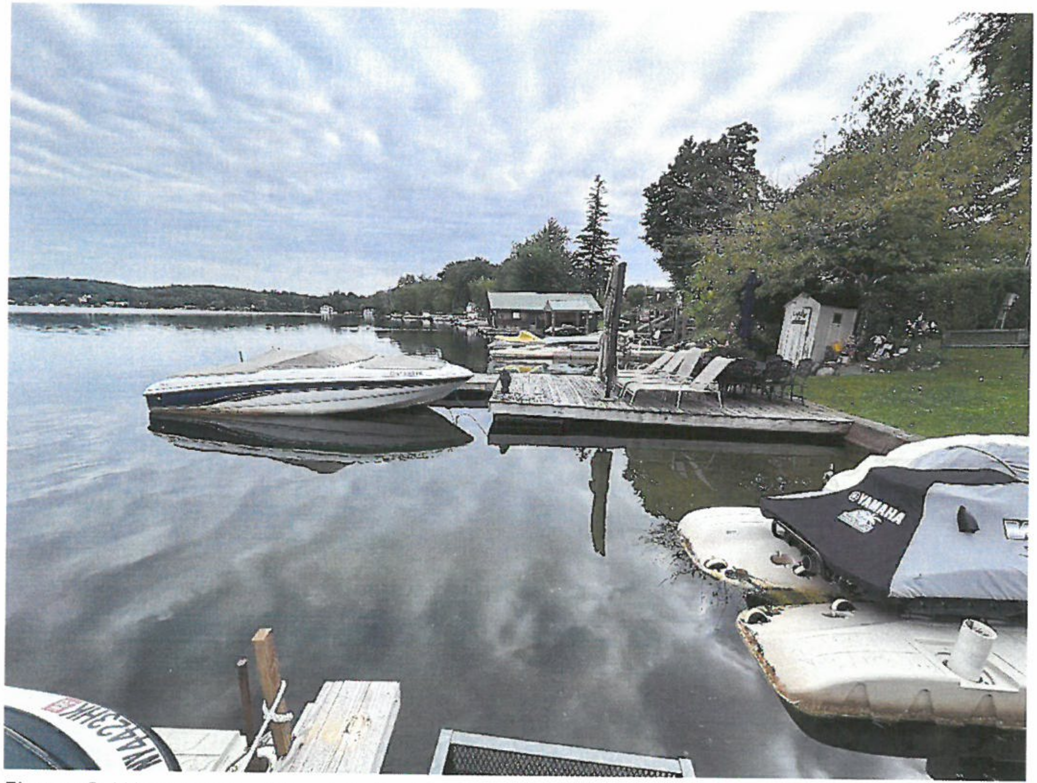
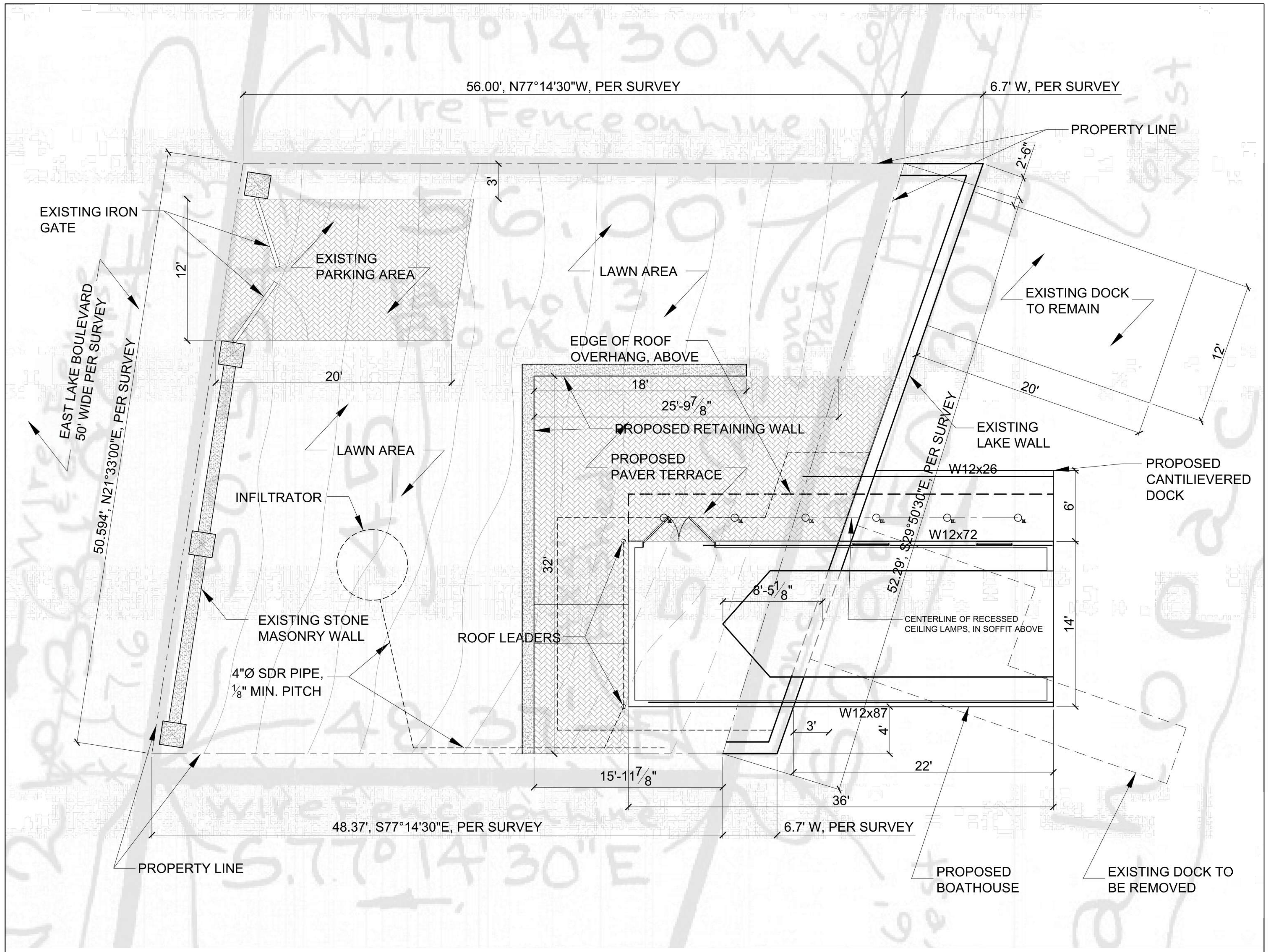


Figure 6: Waterview of Dock to be Removed and Proposed Location of Boathouse.

Figure 7: Existing Dock to Remain.

Figure 8: Project Site (Looking South).



PROPOSED SITE PLAN

SCALE: 3/16" = 1'-0"

NOTES:
1. SURVEY PROVIDED FOR PROPERTY LINE SET BACKS ONLY.
2. SURVEY BY EDWARD G. MIHALCZO, OF YONKERS, NY DATED 11/16/1988.
3. PROPERTY LINE DRAWN SCALED PER GEOMETRY PROVIDED ON SURVERY.
4. ELEVATION CONTOURS NOT TO SCALE; PROVIDED FOR VISUAL REFERENCE ONLY. GRADE GRADUALLY SLOPES DOWN TO LAKE.

LOCATION MAP

SCALE: 1" = 2000'

AREA MAP

SCALE: 1" = 200'

TOWN OF CARMEL NY CODE

§156-27 PRIVATE WATER-RELATED FACILITIES.

[AMENDED 8-7-2013 BY L.L. NO. 4-2013]

A PRIVATE BEACH, WHARF, DOCK, BOATHOUSE OR BATHHOUSE SHALL BE PERMITTED, PROVIDED THAT:

A. A PRIVATE BEACH, WHARF, DOCK, BOATHOUSE OR BATHHOUSE, WHEN NOT LOCATED ON A PARCEL IMPROVED BY AT LEAST ONE RESIDENTIAL DWELLING UNIT, SHALL REQUIRE MINIMUM LAKE FRONTAGE OF AT LEAST 50 FEET, A MINIMUM MEAN DEPTH OF AT LEAST 30 FEET AND A MINIMUM AREA OF AT LEAST 3,000 SQUARE FEET.

B. THE USE OF THE SITE SHALL BE LIMITED TO THE OWNER OR LESSEE AND THE IMMEDIATE FAMILY OR BONA FIDE GUESTS OF SUCH OWNER OR LESSEE OF THE PARCEL.

C. NO BOATHOUSE, WHARF OR DOCK, OR SUCH SIMILAR IMPROVEMENT, WHICH IS PHYSICALLY ATTACHED TO ANY LAKEFRONT PROPERTY SHALL EXTEND INTO OR OVER THE SURFACE OF ANY LAKE FOR A DISTANCE OF MORE THAN 25 FEET FROM THE HIGH-WATER MARK. BOATHOUSES SHALL NOT EXCEED 10 FEET IN HEIGHT. A SIDE YARD OF AT LEAST 15 FEET SHALL BE PROVIDED ADJOINING A BOATHOUSE.

D. NO BATHHOUSE SHALL BE DESIGNED AND/OR USED FOR COOKING, SLEEPING OR OTHER FUNCTIONS GENERALLY OCCURRING IN A DWELLING, AND IT SHALL BE ERECTED AT LEAST 15 FEET FROM ANY PROPERTY LINE. SUCH BATHHOUSE SHALL BE NO MORE THAN 10 FEET IN HEIGHT AND MAY BE EQUIPPED WITH APPROPRIATE SANITARY FACILITIES APPROVED BY THE COUNTY OF PUTNAM AND SUBJECT TO ANY OTHER STANDARDS OF THE TOWN'S ENVIRONMENTAL CONSERVATION BOARD.

E. ONE OFF-STREET PARKING SPACE SHALL BE PROVIDED FOR EACH 750 SQUARE FEET OF LOT AREA OR MAJOR PORTION THEREOF FOR ANY PARCEL NOT IMPROVED BY AT LEAST ONE RESIDENTIAL DWELLING UNIT.

F. FENCING OR SCREENING OF ANY SUCH PARCEL SHALL NOT EXCEED FOUR FEET IN HEIGHT.

PROPERTIES WITHIN 500' RADIUS

76.22-1-21 Nestor Ramos 10 Croton Falls Rd Mahopac, NY 10541	**76.22-1-25 Logan Gaylor 10 Miller Ave Mahopac, NY 10541**	**76.22-1-24 Michael Williams PO BOX 25 Mahopac, NY 10541**
76.22-1-23 Dung Van Huynh 16 Miller Ave Mahopac, NY 10541	**65.17-1-61 Andrew Ryder 2723 Quaker Church Rd Yorktown, NY 10598**	**76.22-1-9 David Nicholas PO BOX 770 Mahopac, NY 10541**
76.22-1-8 Lakefront Apartments Inc PO BOX 770 Mahopac, NY 10541	**76.22-1-10 Peter Ferone Revocable Trust 44 Mi-Anna Dr Mahopac, NY 10541**	**76.22-1-20 185 East Lake, LLC 87 Vista Ter N Mahopac, NY 10541**
76.22-1-12 William Bloomer PO BOX 5 Mahopac, NY 10541	**76.22-1-19 Nikole Derosa 190 East Lake Blvd Mahopac, NY 10541**	**65.17-1-58 Rosemary Romash 19 Miller Ave Mahopac, NY 10541**
76.22-1-13 Nikole Derosa 190 East Lake Blvd Mahopac, NY 10541	**76.22-1-18 William Spain 191 East Lake Blvd Mahopac, NY 10541**	**76.22-1-14 William Spain 191 East Lake Blvd Mahopac, NY 10541**
76.22-1-17 Roderick Carr 195 East Lake Blvd Mahopac, NY 10541	**76.22-1-15 Roderick Carr 2 East Lake Blvd Mahopac, NY 10541**	**65.17-1-57 Katherine OConnor 197 East Lake Blvd Mahopac, NY 10541**
76.22-1-16 Rosemary Romash 19 Miller Ave 19 Miller Ave Mahopac, NY 10541	**65.17-1-56 Henry Monaco 199 East Lake Blvd Mahopac, NY 10541**	**65.17-1-3 Katherine OConnor 197 East Lake Blvd Mahopac, NY 10541**
65.17-1-55 Melody Fuchs 201 East Lake Blvd Mahopac, NY 10541	**65.17-1-4 Henry Monaco 199 E Lake Blvd Mahopac, NY 10541**	**65.17-1-5 Melody Fuchs 201 East Lake Blvd Mahopac, NY 10541**
65.17-1-54 Americo Serino 205 East Lake Blvd Mahopac, NY 10541	**65.17-1-6 Americo Serino 205 East Lake Blvd Mahopac, NY 10541**	**65.17-1-7 Aiden Devaney 209 East Lake Blvd Mahopac, NY 10541**
65.17-1-53 Aiden Devaney 209 East Lake Blvd Mahopac, NY 10541	**65.17-1-59 Melody Fuchs 201 East Lake Blvd Mahopac, NY 10541**	**65.17-1-52 Kurt Ebinger 211 East Lake Blvd Mahopac, NY 10541**
65.17-1-8 Kurt Ebinger 211 East Lake Blvd Mahopac, NY 10541	**65.17-1-51 John Scarfi 213 East Lake Blvd Mahopac, NY 10541**	**65.17-1-9 Robert Molfetta 5 Bucyrus Ave Carmel, NY 10512**
65.17-1-10 Benjamin Liberatore 81 Beech Hill Rd Pleasantville, NY 10570	**65.17-1-50 St John The Evangelist 235 East Lake Blvd Mahopac, NY 10541**	**65.17-1-11 Linda Liberatore 81 Beech Hill Rd Pleasantville, NY 10570**
65.17-1-49 St John The Evangelist 235 East Lake Blvd Mahopac, NY 10541	**65.17-1-12 Richard Salat 1 Miro Pl Port Washington, NY 11050**	**65.17-1-60 Americo Serino 205 East Lake Blvd Apt A Mahopac, NY 10541**
76.22-1-22 James McCabe PO BOX 472 Baldwin Place, NY 10505	**76.22-1-26 TM Apartments LLC 8 Burr Ln Holmes, NY 12531**	**64.20-1-9 State Of New York 40 Gleneida Ave Carmel, NY 10512**

SITE DATA

OWNER:	AMERICO AND MARIA SERINO 205 EAST LAKE BLVD MAHOPAC, NY 10541
SITE ADDRESS:	206 EAST LAKE BLVD MAHOPAC, NY 10541
TAX MAP NUMBER:	65.17-1-6
ZONING:	RESIDENTIAL (R)
USE:	RECREATIONAL
ZONING:	TOWN OF CARMEL CODE SECTION 156-27
PROPOSED CHANGES:	ADD NEW PAVER PATIO AND CONSTRUCT BOATHOUSE

ZONING REGULATIONS PER §156-27	REQUIRED/ALLOWABLE	EXISTING/PROPOSED	CHANGE/ VAR. REQ'D.
LOT AREA	3,000 SQ. FT.	2,609 SQ. FT.	391 SQ. FT.
LOT WIDTH	50'	50.694'	NO VARIANCE REQ'D.
MEAN LOT DEPTH	30'	52.19'	NO VARIANCE REQ'D.
FRONT YARD SETBACK	N/A	N/A	N/A
SIDE YARD SETBACK	15'	4'	11'
REAR YARD SETBACK	N/A	N/A	N/A
BOATHOUSE EXTENSION OVER LAKE FROM HIGH WATER MARK	25'	22'	NO VARIANCE REQ'D.
MAX. BOATHOUSE HEIGHT	10'	≤ 10'	NO VARIANCE REQ'D.
LOT COVERAGE	15%	35%	20% VARIANCE REQ'D.

ISSUED FOR PERMIT
11/27/2023

SERINO LAKESIDE PROPERTY

206 EAST LAKE BLVD
MAHOPAC, NY 10541
TAX MAP NO.: 65.17-1-6

Owner
AMERICO AND MARIA SERINO
205 EAST LAKE BLVD
MAHOPAC, NY 10541

Engineer
DAN MONACO, P.E.
704 ROUTE 6
MAHOPAC, NY 10541

No.	Date	Revision

No.	Date	Submission
	11/27/2023	ISSUED FOR PERMIT
	9/5/2023	FOR NYS DEC AND OGS PERMIT

Title:

ZONING AND SITE PLAN

DANIELE MONACO
095935

Job No.:	1
Scale:	As indicated
Drawn By:	DM
Checked By:	DM

Sheet No.: S-001.00

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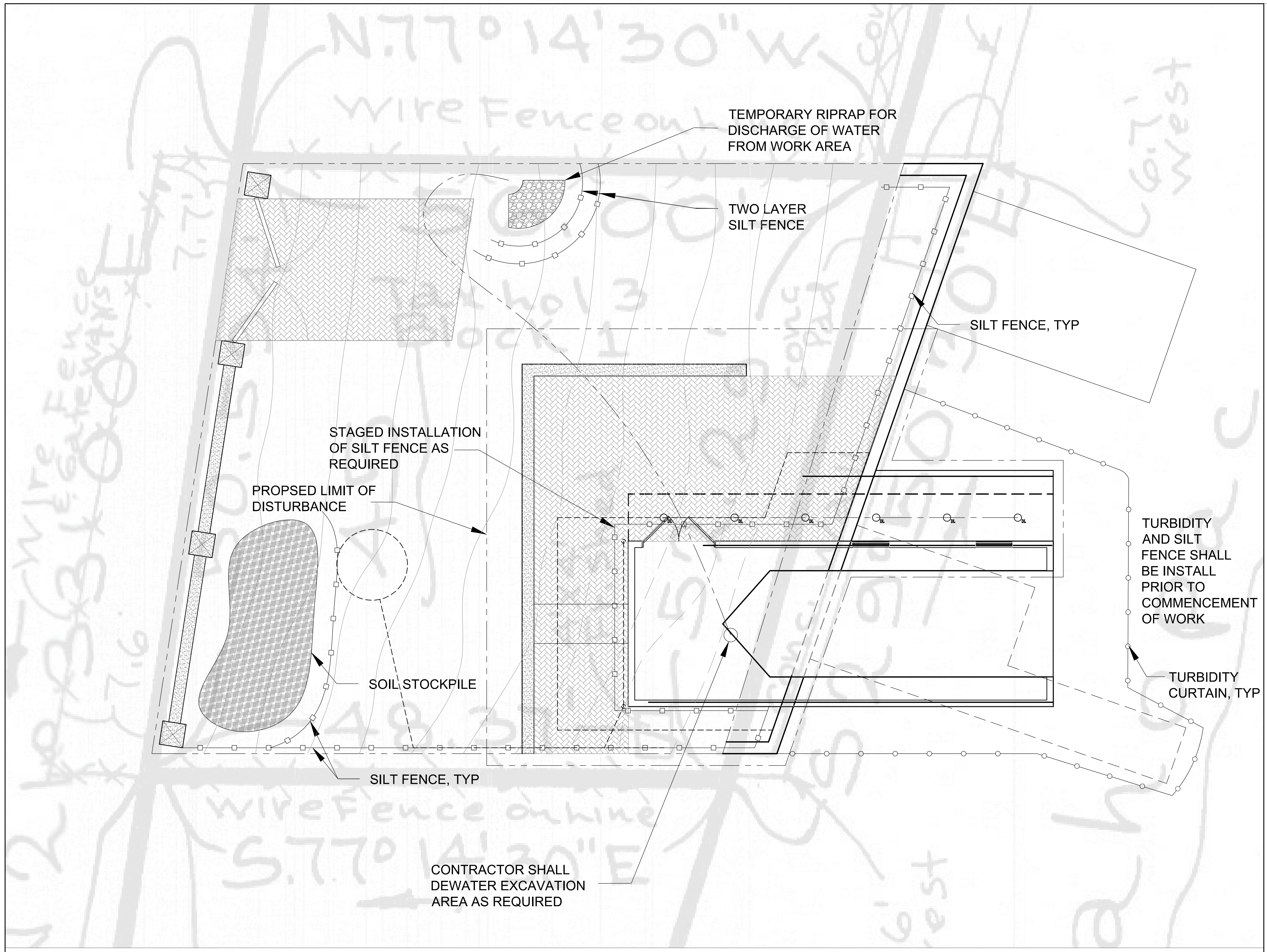
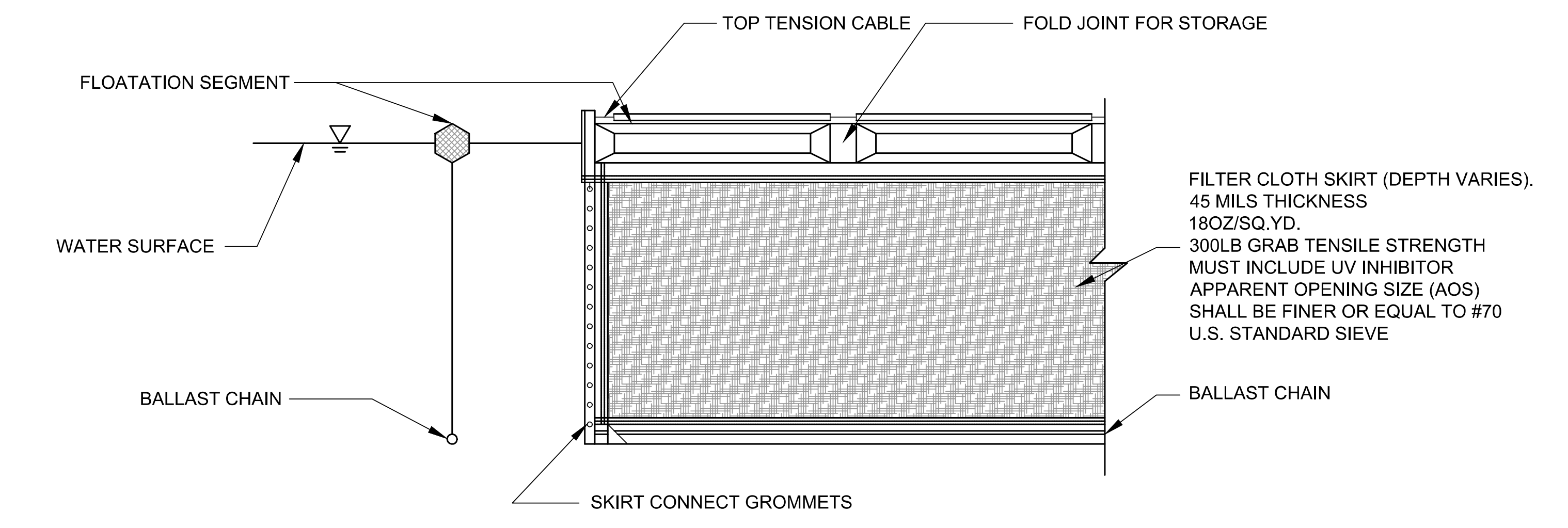


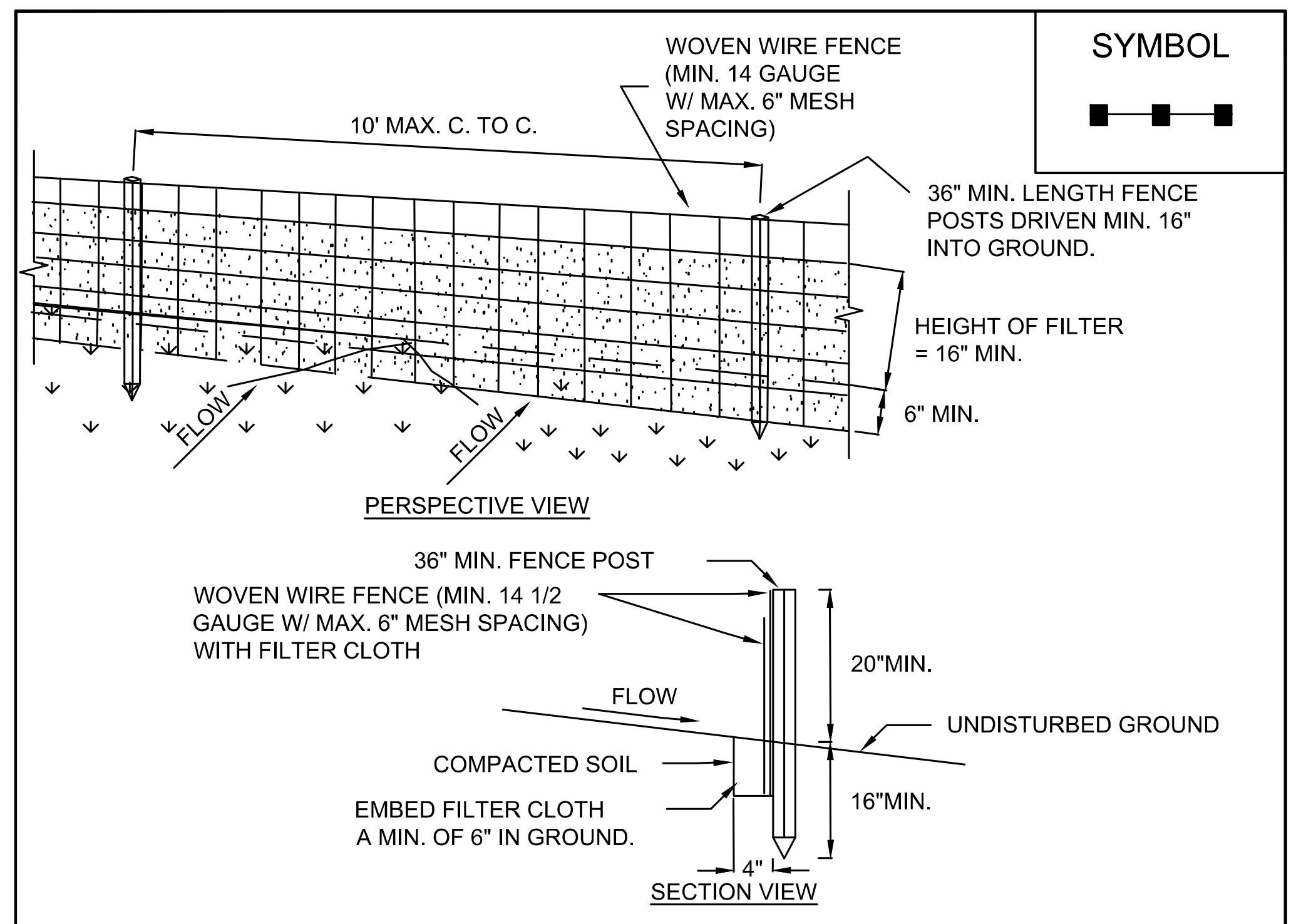
SITE CONSTRUCTION PLAN

SCALE: 3/16" = 1'-0"

NOTES:
1. SURVEY PROVIDED FOR PROPERTY LINE SET BACKS ONLY.
2. SURVEY BY EDWARD G. MIHALCZO, OF YONKERS, NY DATED 11/16/1988.
3. PROPERTY LINE DRAWN SCALE PER GEOMETRY PROVIDED ON SURVERY.
4. ELEVATION CONTOURS PROVIDED FOR REFERENCE ONLY. GRADE IS GRADUALLY SLOPES DOWN TO LAKE.



FLOATING TUBIDITY CURTAIN TYPICAL DETAIL



CONSTRUCTION SPECIFICATIONS

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.

2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 6" MAXIMUM MESH OPENING.

3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.

4. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE, OR APPROVED EQUIVALENT.

5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS,
NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

SILT FENCE

SILT FENCE TYPICAL DETAIL

GENERAL EROSION CONTROL NOTES:

1. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE WITH ALL SEDIMENT AND EROSION CONTROL PRACTICES. THE SEDIMENT AND EROSION CONTROL PRACTICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCES, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED. ROAD SURFACE FLOWS FROM THE SITE SHOULD BE DISSIPATED WITH TRACKING PAD OR APPROPRIATE MEASURES DURING ADJACENT ROAD SHOULDER REGRADING. CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF ALL SOIL EROSION AND SEDIMENTATION CONTROL DEVICES THROUGHOUT THE COURSE OF CONSTRUCTION.

2. ALL STRUCTURES SHALL BE MAINTAINED IN GOOD WORKING ORDER AT ALL TIMES. THE SEDIMENT LEVEL IN ALL SEDIMENT TRAPS SHALL BE CLOSELY MONITORED AND SEDIMENT REMOVED PROMPTLY WHEN MAXIMUM LEVELS ARE REACHED OR AS ORDERED BY THE ENGINEER. ALL SEDIMENT CONTROL STRUCTURES SHALL BE INSPECTED ON A REGULAR BASIS, AND AFTER EACH HEAVY RAIN TO ENSURE PROPER OPERATION AS DESIGNED. AN INSPECTION SCHEDULE SHALL BE SET FORTH PRIOR TO THE START OF CONSTRUCTION.

3. THE LOCATIONS AND THE INSTALLATION TIMES OF THE SEDIMENT CAPTURING STANDARDS SHALL BE AS SPECIFIED IN THESE PLANS, AS ORDERED BY THE ENGINEER, AND IN ACCORDANCE WITH THE LATEST EDITION OF THE "NEW YORK STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL" (NYSSESC).

4. ALL TOPSOIL SHALL BE PLACED IN A STABILIZED STOCKPILE FOR REUSE ON THE SITE. ALL STOCKPILE MATERIAL REQUIRED FOR FINAL GRADING AND STORED ON SITE SHALL BE TEMPORARILY SEEDED AND MULCHED WITHIN 7 DAYS. REFER TO SOIL STOCKPILE DETAILS.

5. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN 7 DAYS AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, SHALL IMMEDIATELY RECEIVE TEMPORARY SEEDING. MULCH SHALL BE USED IF THE SEASON PREVENTS THE ESTABLISHMENT OF A TEMPORARY COVER. DISTURBED AREAS SHALL NOT BE LIMED AND FERTILIZED PRIOR TO TEMPORARY SEEDING.

6. SEDIMENT AND EROSION CONTROL STRUCTURES SHALL BE REMOVED AND THE AREA STABILIZED WHEN THE DRAINAGE AREA HAS BEEN PROPERLY STABILIZED BY PERMANENT MEASURES.

7. ALL SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH CURRENT

ISSUED FOR PERMIT
11/27/2023

SERINO LAKESIDE PROPERTY

206 EAST LAKE BLVD
MAHOPAC, NY 10541
TAX MAP NO.: 65.17-1-6

Owner
AMERICO AND MARIA SERINO
205 EAST LAKE BLVD
MAHOPAC, NY 10541

Engineer
DAN MONACO, P.E.
704 ROUTE 6
MAHOPAC, NY 10541

No.	Date	Revision
	11/27/2023	ISSUED FOR PERMIT
	9/5/2023	FOR NYS DEC AND OGS PERMIT
No.	Date	Submission

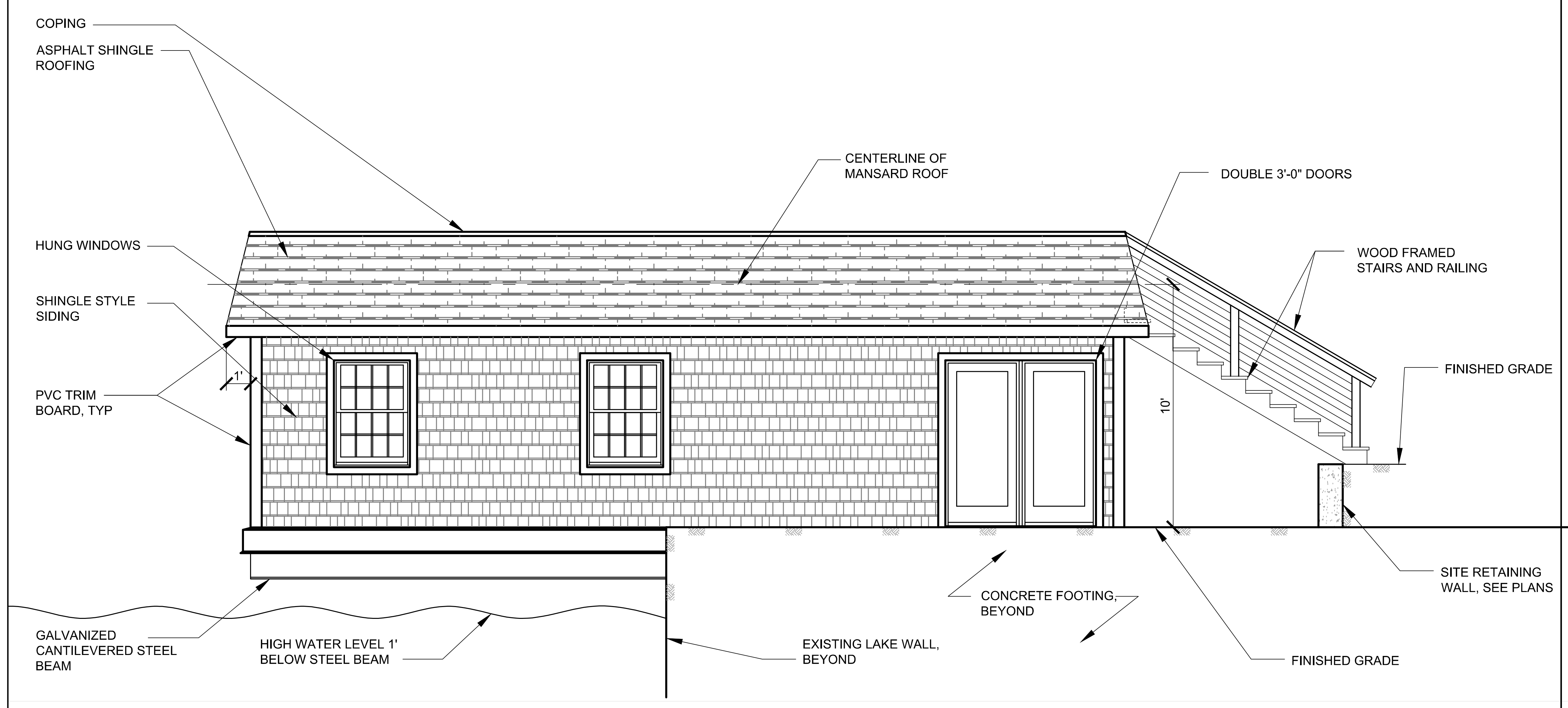
Title:

SITE CONSTRUCTION PLAN

DANIELE MONACO
095935

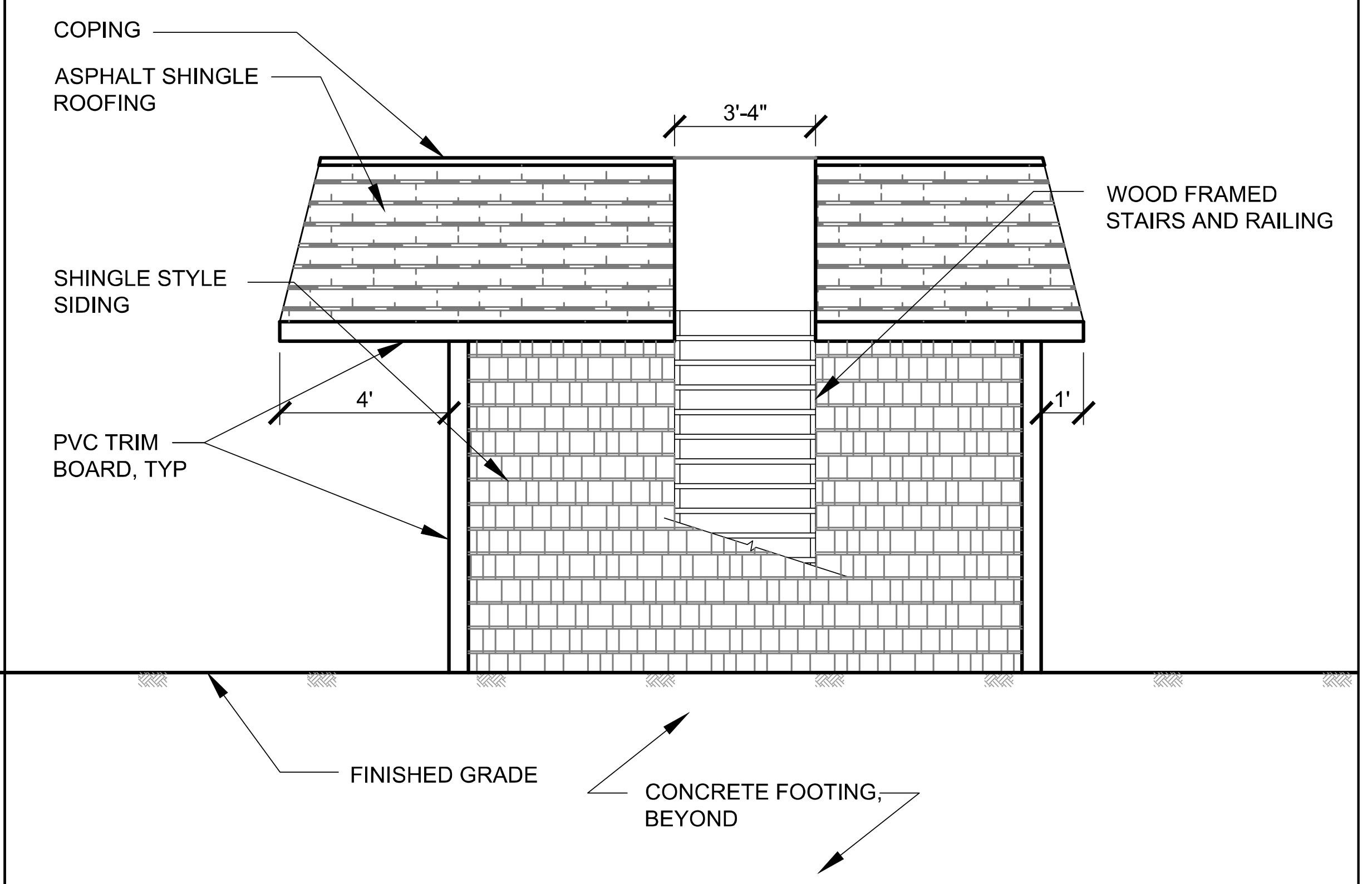
Job No.: 1
Scale: As indicated
Drawn By: DM
Checked By: DM

Sheet No.: S-002.00
___ of ___



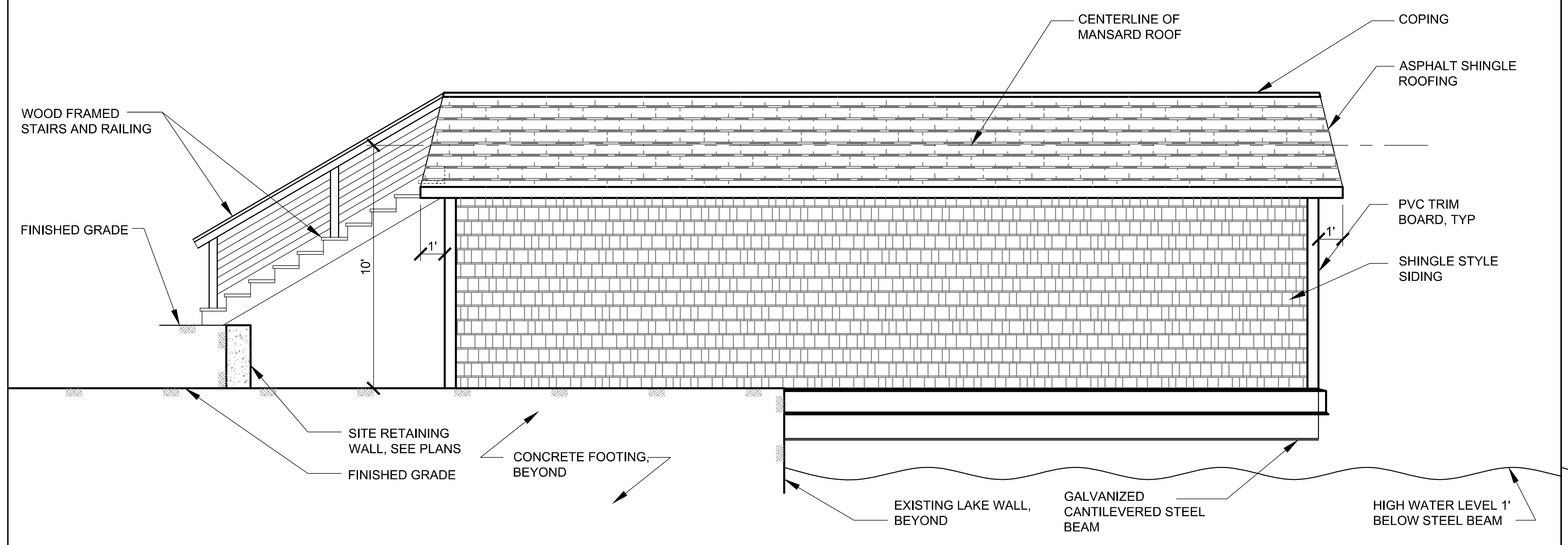
PROPOSED SOUTH ELEVATION

SCALE: 1/4" = 1'-0"



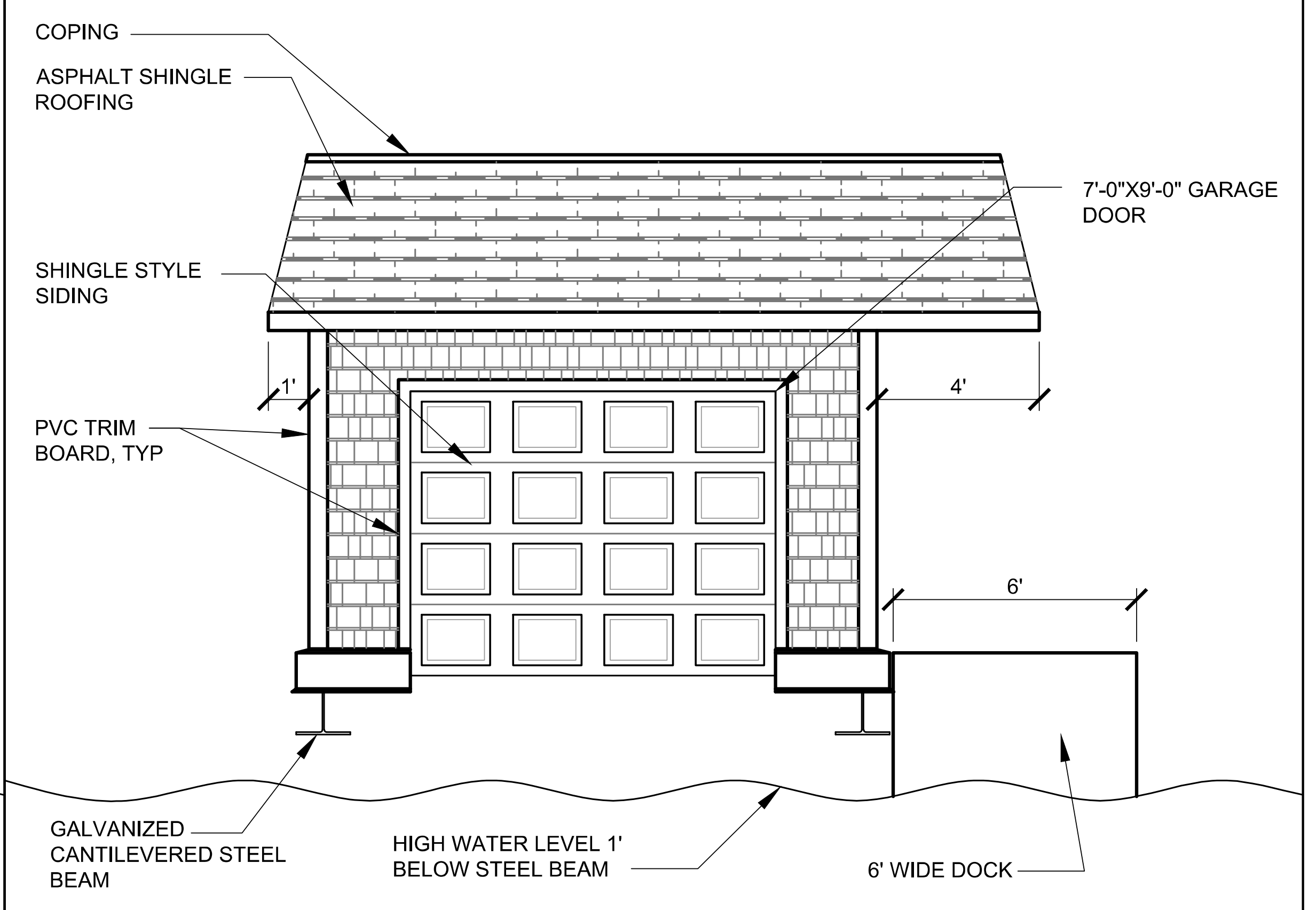
PROPOSED EAST ELEVATION

SCALE: 1/4" = 1'-0"



PROPOSED NORTH ELEVATION

SCALE: 1/4" = 1'-0"



PROPOSED WEST ELEVATION

SCALE: 1/4" = 1'-0"

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11/27/2023

SERINO LAKESIDE PROPERTY

206 EAST LAKE BLVD
MAHOPAC, NY 10541
TAX MAP NO.: 65.17-1-6

Owner

AMERICO AND MARIA SERINO
205 EAST LAKE BLVD
MAHOPAC, NY 10541

Engineer

DAN MONACO, P.E.
704 ROUTE 6
MAHOPAC, NY 10541

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BOATHOUSE ELEVATION

DANIELE MONACO
095935

Job No.: 1
Scale: As indicated
Drawn By: DM
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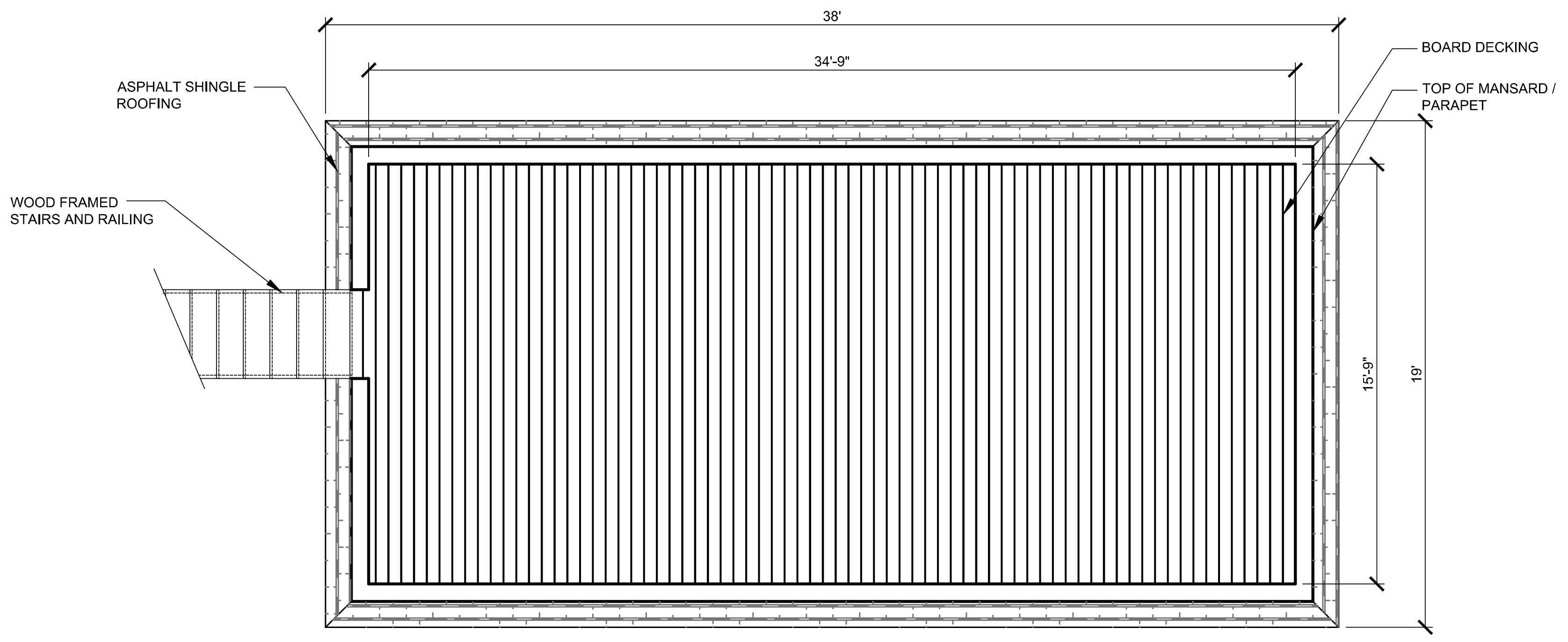
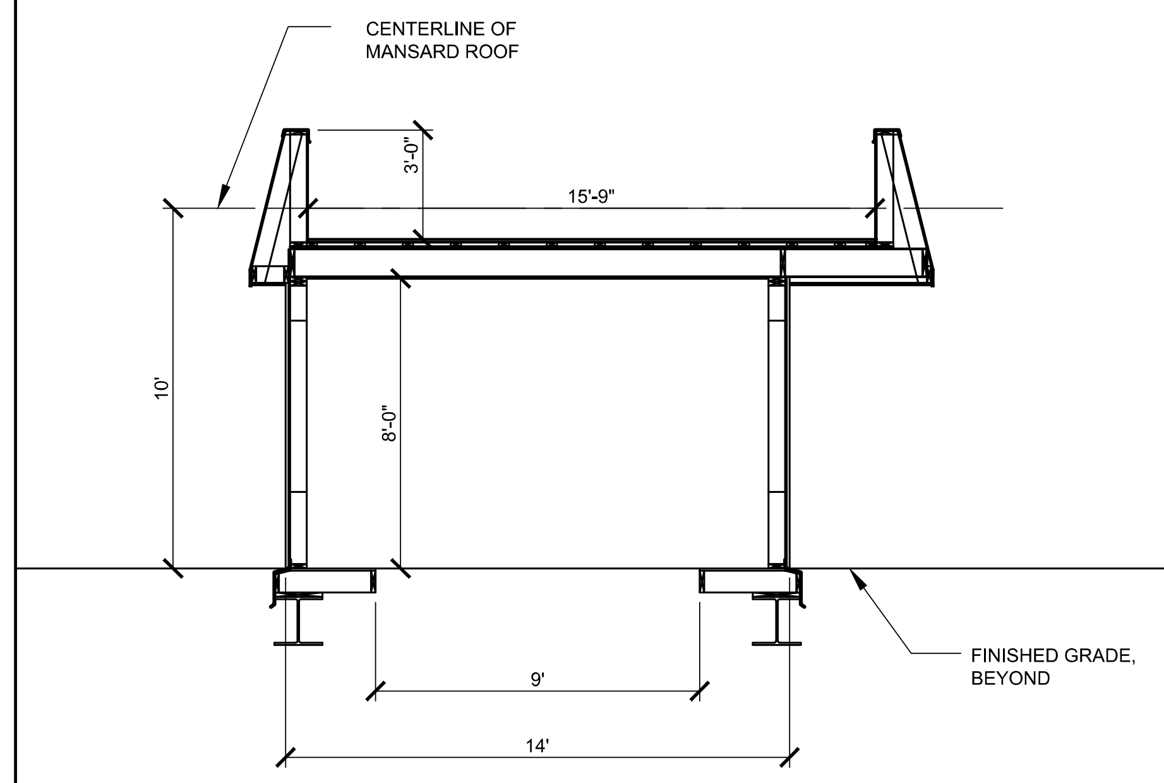


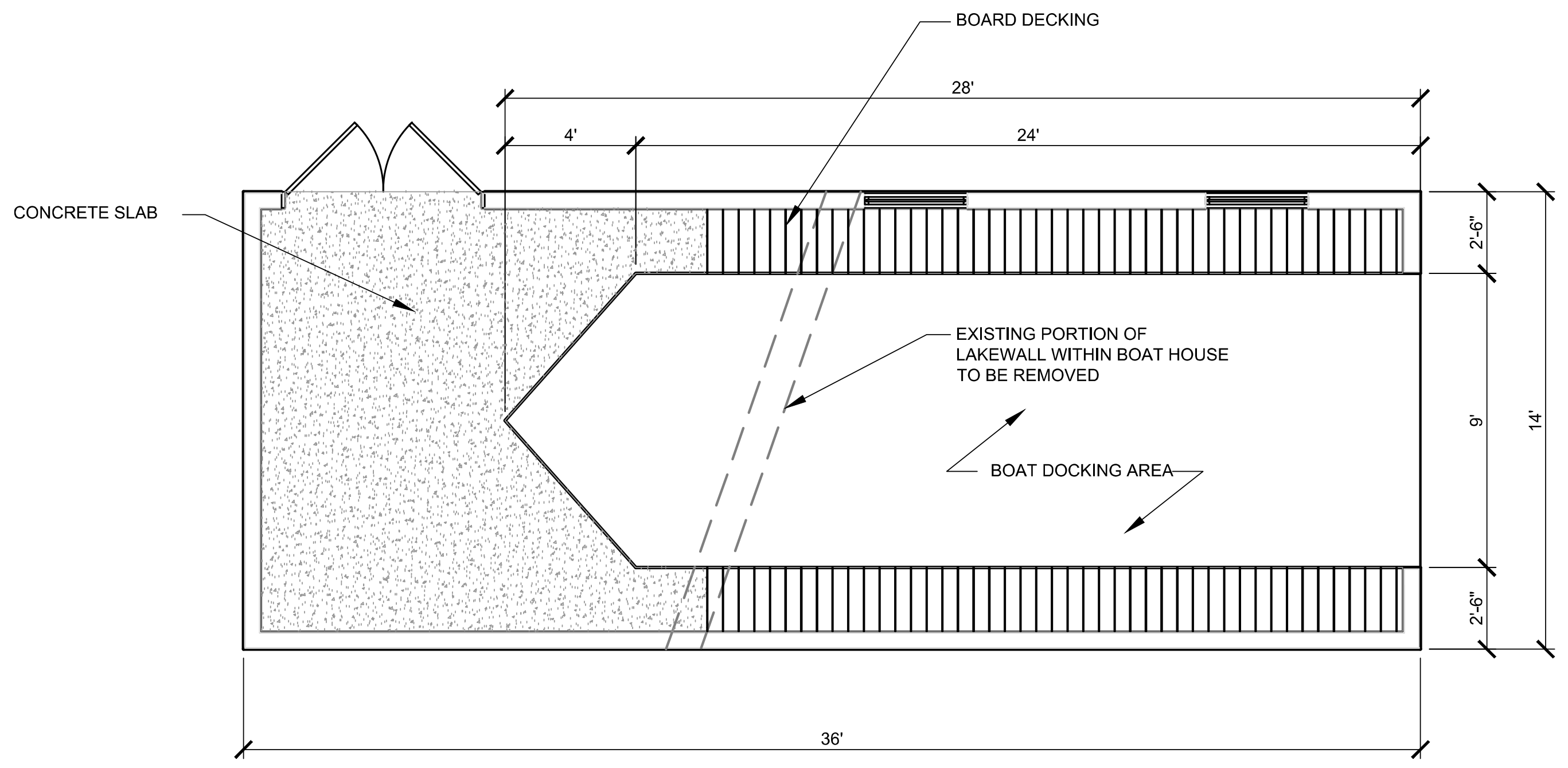
PROPOSED ROOF PLAN

SCALE: 3/16" = 1'-0"



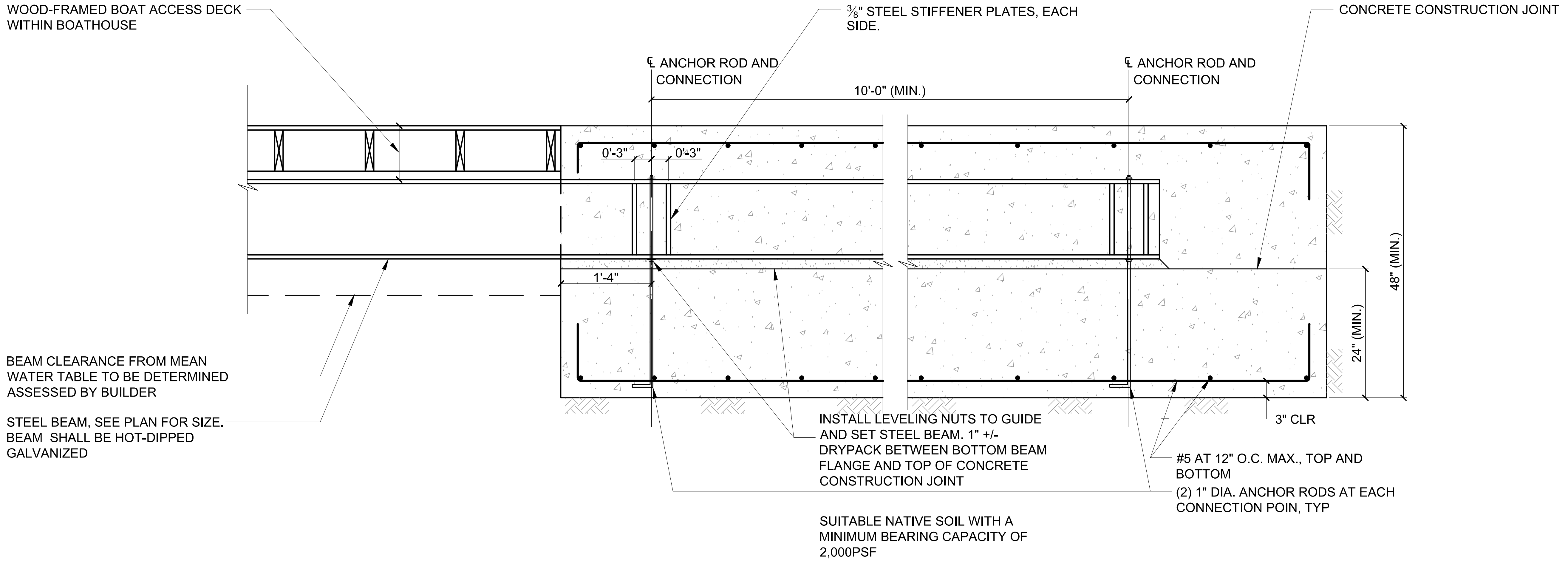
BOATHOUSE SECTION

SCALE: 3/16" = 1'-0"



PROPOSED BOATHOUSE PLAN

SCALE: 3/16" = 1'-0"



STEEL BEAM FRAMING DETAIL

SCALE: N.T.S.

BUILDING CODE COMPLIANCE:

2020 BUILDING CODE OF NEW YORK STATE
2020 RESIDENTIAL CODE OF NEW YORK STATE
2020 EXISTING BUILDING CODE OF NEW YORK STATE
2020 FIRE CODE OF NEW YORK STATE
2020 PLUMBING CODE OF NEW YORK STATE
2020 MECHANICAL CODE OF NEW YORK STATE
2020 FUEL GAS CODE OF NEW YORK STATE
2020 ENERGY CONSERVATION CODE OF NEW YORK STATE
NATIONAL ELECTRIC CODE 2017 OF NEW YORK STATE
LOCAL CODE HAVING JURISDICTION

GENERAL NOTES:

1. WHERE EXISTING WORK IS TO BE CUT AND/OR UNDERPINNED, CONTRACTOR SHALL PROVIDE ALL FOUNDATION SHORING, BRACING, WEDGING AND DRY-PACKING, AND SHALL BE RESPONSIBLE FOR SAFETY OF THE STRUCTURE DURING THE OPERATION
2. THE DESIGN IS BASED UPON FIELD OBSERVATIONS AND/OR ASSUMPTIONS REGARDING THE EXISTING CONDITIONS AT THE SITE. VARIATIONS BETWEEN FIELD CONDITIONS AND THESE DRAWINGS MAY EXIST. WHERE SUCH VARIATIONS ARE ENCOUNTERED, THEY SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND OWNER.
3. ALL WORK SHALL BE DONE IN ACCORDANCE WITH ALL APPLICABLE CODES, RULES AND REGULATIONS OF THE MUNICIPALITY HAVING JURISDICTION, AND THE ADOPTED BUILDING CODE OF THE STATE OF NEW YORK, AND OTHER CODES HAVING JURISDICTION; LATEST EDITIONS.
4. NO SUBSTITUTIONS SHALL BE MADE WITHOUT THE WRITTEN AUTHORIZATION OF THE ENGINEER AND/OR OWNER.
5. ALL DIMENSIONS AND ELEVATIONS ARE TO BE USED FOR GENERAL INFORMATION ONLY. THE CONTRACTOR SHALL VERIFY CONDITIONS AT SPECIFIC LOCATIONS AS REQUIRED TO CONFIRM AND PERFORM ALL WORK AS SPECIFIED.
6. ALL EXTERIOR WALL PLAN DIMENSIONS ARE INDICATED TO THE OUTSIDE FACE OF WOOD FRAMING, MASONRY WALLS AND FOUNDATION WALLS. ALL WINDOW AND DOOR OPENING DIMENSIONS REFER TO ROUGH OPENINGS (R.O.).
7. DO NOT SCALE DRAWINGS. FOLLOW WRITTEN DIMENSIONS. THE WRITTEN DIMENSIONS HAVE PRECEDENCE OVER SCALED DIMENSIONS. THE CONTRACTOR SHALL VERIFY ALL SITE CONDITIONS PRIOR TO THE COMMENCEMENT OF WORK & PRIOR OF ORDERING ANY PRODUCT OR PROPRIETARY SYSTEM. DETAILS, DIMENSIONS, AND CONDITIONS ON SMALLER SCALE DRAWINGS ARE PRECEDED BY THOSE ON LARGER SCALE DRAWINGS. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND OWNER OF ANY EXISTING CONDITIONS REQUIRING MODIFICATION PRIOR TO THE BEGINNING OF ANY WORK.
8. IN CASE OF OMISSIONS OR DISCREPANCIES IN THESE DOCUMENTS, CONSULT WITH THE ENGINEER PRIOR TO ORDERING ANY PRODUCT, MATERIAL, OR PROPRIETARY SYSTEMS, OR PRIOR TO PROCEEDING WITH SHOP DRAWINGS OR ANY OTHER WORK. DETAILS NOT SHOWN ARE SIMILAR IN CHARACTER TO THOSE SHOWN. WHERE SPECIFIC DIMENSIONS, DETAILS OR DESIGN INTENT CANNOT BE DETERMINED CONSULT WITH THE ENGINEER BEFORE PROCEEDING WITH WORK.
9. THE CONTRACTOR IS RESPONSIBLE FOR THE ACCURATE PLACEMENT OF THE BUILDING AND/OR ADDITIONS ON THE SITE.
10. THE CONTRACTOR SHALL PROVIDE ALL SHORING, BRACING, BARRICADES, TEMPORARY FENCES, PARTITIONS, EXCAVATION, ETC. AS REQUIRED TO ACCOMPLISH THE WORK IN AN APPROVED MANNER.
11. THE CONTRACTOR SHALL PROVIDE TEMPORARY FENCING AND GATES AS REQUIRED TO RESTRICT UNAUTHORIZED ACCESS TO THE JOB SITE.
12. THE CONTRACTOR SHALL PROVIDE TEMPORARY GUARD RAILS, STAIRS, AND OTHER PROTECTION AS REQUIRED TO MAINTAIN SAFE WORKING CONDITIONS.
13. THE CONTRACTOR SHALL PROVIDE ALL MISC. STEEL & METAL FABRICATIONS, REQUIRED BRACING, STIFFENERS, BACKING PLATES, BRACKETS, ETC., AS SPECIFIED HEREIN, IN THE SPECIFICATIONS, OR AS NEEDED FOR THE PROPER FABRICATION, ERECTION, INSTALLATION, OR CONSTRUCTION OF THIS PROJECT. SCOPE TO INCLUDE, BUT SHALL NOT BE LIMITED TO, PARTITIONS, SUSPENDED SOFFITS & CEILINGS, AS WELL AS WALL MOUNTED OR SUSPENDED MECHANICAL, ELECTRICAL, FIRE PROTECTION, A/V, SECURITY, ETC. CONTRACTOR TO VERIFY SCOPE.
14. THE CONTRACTOR SHALL PROVIDE ADEQUATE WATERPROOFING AS SPECIFIED HEREIN, IN THE SPECIFICATIONS, OR AS REQUIRED FOR THE PROPER CONSTRUCTION OF THIS PROJECT.
15. THE CONTRACTOR SHALL COORDINATE THE PLACEMENT OF ALL CEILING ELEMENTS AND SYSTEMS WITH TRADES. PROVIDE COORDINATION DRAWINGS INCLUDING ALL TRADES WHERE DISCREPANCIES MAY OCCUR. CONSULT WITH THE ENGINEER PRIOR TO PROCEEDING WITH WORK.
16. THE CONTRACTOR SHALL COORDINATE THE PLACEMENT OF ALL WALL SURFACE PLATES, SWITCHES, OUTLETS, OR OTHER ELECTRICAL FIXTURES. PROVIDE COORDINATION DRAWINGS INCLUDING ALL TRADES WHERE DISCREPANCIES MAY OCCUR. CONSULT WITH ENGINEER PRIOR TO PROCESSING WITH THE WORK.
17. PROVIDE ACCESS PANELS AS REQUIRED BY APPLICABLE CODES & AS REQUIRED FOR MECHANICAL EQUIPMENT. ALL ACCESS PANELS SHALL BE CONCEALED AND ALL LOCATIONS SHALL BE REVIEWED BY THE ENGINEER PRIOR TO PROCEEDING WITH WORK.
18. ALL EXTERIOR JOINTS AROUND WINDOWS, DOORS, ETC. TO BE LEAKAGE/AIR INFILTRATION FREE.
19. THE CONTRACTOR SHALL COORDINATE ALL EQUIPMENT BASE & HOUSEKEEPING PADS WITH MEP CONTRACTORS. INSTALL PADS BENEATH THE FULL PROJECTED AREA OF EQUIPMENT.
20. THE CONTRACTOR SHALL COORDINATE ALL SLAB PENETRATIONS, FIRE-RATED WALL AND CEILING OPENINGS, AS WELL AS FOUNDATION WALL SLEEVE LOCATIONS. NO CORE DRILLING WILL BE ALLOWED ON FOUNDATION WALLS WITH AUTHORIZATION FROM THE ENGINEER.
21. THE CONTRACTOR SHALL COORDINATE AND PROVIDE BLOCKING AS REQUIRED IN PARTITIONS AND CEILINGS FOR ALL MILLWORK AND OTHER ITEMS ATTACHED TO OR MOUNTED TO WALLS OR CEILINGS.
22. ALL OUTSIDE CORNERS AT DRYWALL PARTITIONS SHALL HAVE METAL CORNER BEADS. TAPE AND SPACKLE SMOOTH WHERE REQUIRED.
23. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING FIRE-RATED CONSTRUCTION (WALLS, FLOOR, CEILINGS, ETC.) WHERE SHOWN ON DRAWINGS. INSTALL APPROVED FIRE-STOPPING AS REQUIRED.
24. FOR ADDITIONAL NOTES, SEE PLANS AND BUILDING ELEVATION DRAWINGS AND PROJECT SPECIFICATIONS.

ISSUED FOR PERMIT
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SERINO LAKESIDE PROPERTY

206 EAST LAKE BLVD
MAHOPAC, NY 10541
TAX MAP NO.: 65.17-1-6

Owner
AMERICO AND MARIA SERINO
205 EAST LAKE BLVD
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Engineer
DAN MONACO, P.E.
704 ROUTE 6
MAHOPAC, NY 10541

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BOATHOUSE PLAN AND SECTION

DANIELE MONACO
095935

Job No.: 1
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Drawn By: DM
Checked By: DM

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