

TECHNICAL REPORT
WINDHAM ENERGY CENTER
LAKE ROAD, KILLINGLY, CONNECTICUT



by
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for
Windham Energy Center, LLC

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Table of Contents

	Page
List of Tables	ii
List of Figures	ii
List of Appendices	ii
List of Abbreviations	iii
1. Introduction	1
1.1 APPLICANT INFORMATION	1
1.2 PROJECT PURPOSE AND INTENT	2
1.3 PROJECT SELECTION PROCESS	2
1.3.1 Consideration of Alternative Project Sizes	2
1.3.2 Consideration of Alternative Project Sites	2
2. Windham Energy Center – Project Description	5
3. Regulatory Review Process	6
3.1 CONNECTICUT SITING COUNCIL	6
3.2 OTHER STATE AND FEDERAL PROGRAMS	6
3.3 MUNICIPAL CONSULTATION PROCESS	7
4. Environmental Considerations	8
4.1 AIR QUALITY	8
4.2 WETLANDS AND WATERCOURSES	8
4.3 WILDLIFE AND SPECIES EVALUATION	8
4.4 WATER USE AND DISCHARGE	10
4.5 STORMWATER MANAGEMENT	10
4.6 VISUAL IMPACTS	10
4.7 CULTURAL RESOURCES	10
4.8 NOISE	10
4.9 TRAFFIC	12
4.10 SOLID WASTE DISPOSAL	12
4.11 EMERGENCY RESPONSE	12
4.11.1 Equipment Characteristics	13
4.11.2 Current Safety Standards	14
4.11.3 Project Technology Testing	15
4.11.4 Failure Modes and Effects Analysis	15
4.11.5 Additional Safety Precautions	16
4.12 ELECTRIC AND MAGNETIC FIELD EFFECT	16
5. Public Benefits	17
6. Project Schedule	18

List of Tables

Table No.	Title
1	Summary of Characteristics for Optional Sites
2	Potential Environmental Permitting Requirements – Pre-Construction
3	CTDEEP Noise Limits (A-Weighted Decibels)
4	Typical Noise Sources and Acoustic Environments

List of Figures

Figure No.	Title
1	Project Location (Topographic Map)
2	Project Location (Aerial Imagery)
3	Electric Transmission and Renewable Energy Development
4	Alternative BESS Sites Considered
5	BESS Engineering Layout
6	Project and Interconnection Layout
7	Wetland and Habitat Mapping
8	Project Rendering
9	Equipment Details
10	Anticipated Schedule

List of Appendices

Appendix	Title
A	Vendor Specifications
B	Natural Resources Report
C	Species Correspondence
D	Cultural Resources Correspondence
E	Safety Procedures

List of Abbreviations

Abbreviation	Definition
AC	Alternating Current
Applicant	Windham Energy Center, LLC
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
BESS	Battery Energy Storage System
BMP	Best Management Practice
BMS	Battery Management System
CATL	Contemporary Amperex Technology Co., Limited
Conn. Gen. Stat.	Connecticut General Statutes
Council	Connecticut Siting Council
CSC	Connecticut Siting Council
CTDEEP	Connecticut Department of Energy and Environmental Protection
D&M Plan	Development and Management Plan
dB	decibel
dBA	A-weighted decibel
DC	Direct Current
Eversource substation	Substation to interconnect to the existing Eversource electrical grid, to be designed, permitted, constructed, and owned by Eversource
FSS	Fire Suppression System
HVAC	Heating, Ventilation, and Air Conditioning
IPaC	Information for Planning and Consultation
kV	Kilovolt
MBMU	Main Battery Management Unit
MW	Megawatt
MWh	Megawatt-hour
NDDB	Natural Diversity Database
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
Project	Windham Energy Center, a 320-MW/640-Mhr battery energy storage system project
Project Area	an approximately 20-acre portion of a 62-acre property located off Lake Road proposed for development and operation of the Windham Energy Center
Project Substation	substation to transfer and provide step-up/step-down of energy between the Eversource substation and the BESS
PUESA	Public Utilities Environmental Standards Act
ROW	Right-of-Way
RSP17&19	2017 and 2019 ISO New England Regional System Plans
SBMU	Slave Battery Management Unit
SHPO	State Historic Preservation Office
SWPPP	Stormwater Pollution Prevention Plan
TMS	Thermal Management System
UL	Underwriter's Laboratory
USFWS	United States Fish and Wildlife Service
WEC	Windham Energy Center, LLC

1. Introduction

This Technical Report is submitted by Windham Energy Center, LLC (WEC or Applicant) pursuant to Connecticut General Statutes (Conn. Gen. Stat.) §16-50l(e), which establishes local input requirements for the siting of an electric storage facility under the jurisdiction of the Connecticut Siting Council (Council or CSC). This statutory provision requires the submission of technical information to officials of the municipality where a proposed facility may be located, and any municipality within 2,500 feet of the proposed facility location. In addition to officials in the Town of Killingly, copies of this Technical Report have been provided to officials in the Towns of Pomfret and Putnam, Connecticut, based on information shown in Figures 1 and 2.

WEC is proposing the development and operation of the Windham Energy Center (the Project) on an approximately 20-acre property that is part of a larger, 62-acre parcel located west of Lake Road in the Town of Killingly, Connecticut (the Project Area). The Project consists of an approximately 320-megawatt (MW)/640 MW-hour (MWh) battery energy storage system (BESS) and related substation (Project Substation), called collectively “Project,” which will interconnect to the existing Eversource 345-kilovolt (kV) overhead electric transmission line within a right-of-way (ROW) located to the north and east of the Project Area (Eversource ROW). The interconnection will require an electrical substation which will be designed, permitted, constructed, owned, and operated by Eversource (Eversource substation). Eversource will provide a separate filing to address the Eversource substation and interconnection once design details have been confirmed. It is assumed that the Eversource substation will be located within a 300-foot by 300-foot area adjacent to the existing Eversource electric transmission line and that no material activities would occur outside of the Project Area. Best available information will be provided in the application to characterize the anticipated impacts associated with the Project, including assumptions for the Eversource substation.

1.1 APPLICANT INFORMATION

WEC is owned solely by SV Renewables LLC, which is owned and controlled by Sunflower US L.P. Sunflower US L.P. has successfully developed, financed, constructed, and operated renewable energy projects in Italy, Spain, Poland, and Israel. In addition, senior members of the Sunflower US L.P. team have over 5 years of previous experience developing renewable energy projects in the United States. Upon approval, the Project will be owned and controlled by WEC.

Vitis Energy is engaged in providing development services for SV Renewable LLC and is doing so for this project. In addition to WEC, Vitis Energy is actively developing more than two gigawatts of clean energy power generation assets, with around 800 MW (solar and battery storage) expected to begin construction this year. The company prides itself on its robust community partnerships, focusing on renewable energy initiatives to ensure sustainable and impactful development. The team at Vitis Energy boasts a combined total of over 100 years of experience in the development, construction, and operations of infrastructure and clean energy projects, underscoring their commitment to excellence in the renewable energy sector.

1.2 PROJECT PURPOSE AND INTENT

WEC is proposing the development and operation of the Project, an approximately 320-MW/640 MWh BESS and Project Substation to respond to the need for modernization and reliability enhancements in the region's electric infrastructure. These enhancements will provide the ability to store electricity generated during non-peak conditions for use to meet peak energy needs. BESS facilities have become increasingly important as the region's electric generation portfolio integrates increasing numbers of intermittent energy sources, such as wind and/or solar facilities. The Project is well suited to meet these growing energy needs while satisfying Connecticut customers and public policy requirements in a reliable, low-cost, and environmentally friendly manner.

The Project will interconnect with the existing 345-kV Eversource overhead electric transmission line via the proposed Eversource substation, which will be designed, permitted, constructed, owned, and operated by Eversource within the Project Area.

1.3 PROJECT SELECTION PROCESS

Alternative technology evaluation has not been undertaken, as the purpose of the Project is to provide a BESS facility to meet specific regional needs. In addition, no fuel is required for the Project. The following sections discuss the review of alternatives associated with Project size and location.

1.3.1 Consideration of Alternative Project Sizes

Identifying an appropriate size for the Project included engineering studies and consultation with local utilities to maximize efficiency and effectiveness. To appropriately size a BESS, a balance must be found between existing capacity to support network load and other limiting factors so that system reliability is not negatively impacted. Most BESS facilities within Connecticut intended to support ISO-New England¹ range between 4.9 MW and 7.0 MW. Based on economies of scale, it is sensible to propose the largest size BESS a given location can support.

1.3.2 Consideration of Alternative Project Sites

The 2017 and 2019 ISO New England Regional System Plans (RSP17 & 19) cited energy security and renewable resource integration as key issues that needed to be addressed. In response, the Applicant team and its advisors began searching for a viable energy storage site within the ISO-New England operating area. RSP17 & 19 identified that energy storage assets would be very beneficial in addressing the reliability issues caused by "just-in-time" fuel sources (i.e., natural gas) and intermittent generation, such as wind and solar. Therefore, beginning in 2019, WEC has made a concerted effort to search for a best-fit location to develop an ISO-New England energy storage resource.

WEC's initial site search prioritized locations with nearby electric transmission infrastructure, adequately sized parcels with nearby existing or planned industrial areas, and those with network infrastructure that would benefit from a reliable BESS solution.

WEC then weighed initial siting prospects on a set of criteria which narrowed viable site locations. The criteria included proximity to required infrastructure, community long-term plans and interest,

¹ The independent, non-profit Regional Transmission Organization that serves Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

probability of permitting, and consideration for financial and transmission planning modeling. Figure 3 illustrates Connecticut's existing electric transmission system and areas of renewable energy development within the state, which were used to evaluate potential Project locations.

As can be seen on Figure 3, one location where a convergence of electrical infrastructure and renewable development occurs is Windham County. Other locations of interest evaluated were determined to require more extensive infrastructure updates (such as the construction of lengthy transmission lines or more extensive system upgrades to transport the power).

Research identified the Town of Killingly's Plan of Conservation and Development: 2020 - 2030, which detailed Killingly's interest to continue to support growth of its designated commercial and industrial areas. WEC has conducted due diligence and met with stakeholders to discuss their general interest level, prospective site locations within the region, and existing infrastructure capabilities. WEC's development of the Project will provide critical support to the transmission network, further enabling growth within the current industrial and commercial development space. In addition, Killingly's experience with industrial and energy facilities in the area and the region has helped increase the Town's awareness that clean energy projects can be "good neighbors" that offer economic and community benefits.

Based on these discussions, several specific parcels were identified as potential alternative locations for the Project within Killingly, as shown in Figure 4. Each of the potential locations is located proximate to both the existing Eversource 345-kV overhead electric transmission line and the Killingly Industrial Park. Option A reflected an approximately 20-acre portion of property on the northwest side of Lake Road that had previously been approved as the location of an energy project (189 Lake Road). Option B focused on an approximately 11-acre area consisting of 3 parcels bounded to the west by existing natural gas pipeline infrastructure, located on the northwest side of Lake Road. Option C reflected an approximately 15-acre parcel further south, north of Cottons Bridge Road and northwest of Lake Road. Option D comprised approximately 14 acres and 4 parcels southeast of Lake Road.

All four siting options have potential access to existing electric transmission lines, with Option A reflecting the closest point of interconnection (adjacent to the existing Eversource ROW), and B and D reflecting other locations that are relatively close to the point of interconnection (approximately 1,000 feet and approximately 780 feet, respectively) than Option C (1,900 feet). Local distribution class networks are also important to support temporary power during construction and auxiliary power for Project operations, and are available for each of the four siting options. Options A, B and C reflect more level terrain, with Option D comprised of steeper slopes over much of the property. Three of the four options currently are the location of residential properties that would be demolished to support the Project; all site options are generally similar in character.

Table 1. Summary of Characteristics for Optional Sites

Attribute	Option A	Option B	Option C	Option D
Adequate Size/Configuration	Adequate size/compact site	Adequate size/compact site	Adequate size/compact site	Adequate size/less compact site
Distance from Point of Electrical Interconnection	Adjacent to interconnection	Slightly longer than Option D, but no crossing of Lake Road needed	Longer than both Options B and C	Short distance, but requiring Lake Road crossing
Land Use	Wooded, with 1 residence. Within an area designated for industrial growth. Within a site previously approved for an energy project.	Wooded, with 3 residences. Proximate to area designated for industrial growth.	Wooded. Closer to a denser residential area.	Wooded, with multiple residences.
Terrain	Relatively gentle, with steeper side slopes	Relatively gentle, but steeper surrounding slopes	Slightly steeper than Option B	Relatively gentle, but knoll-like

Option B was initially selected, based upon availability and more favorable attributes. WEC’s preliminary design and due diligence activities, at this point, included—but were not limited to—easement assessments, legal review of prior development activity in the region, review of permitting efforts regarding energy generation projects in the region and statewide, revenue forecasting, review of natural resource conditions, and preliminary engineering. In 2021, WEC determined that the Project had a high probability for success and officially created Windham Energy Center, LLC for all efforts regarding the Project going forward.

The more detailed evaluation of Option B identified that significant retaining walls would be required to design the Project in this location. In addition, while a Lake Road crossing would not be required, the electrical lines would be required to extend across an access owned by the Wyndham Land Trust. Therefore, WEC reached out to property representatives with interest in Option A. This would allow for even greater proximity to the electrical interconnection and would move the Project to a property previously considered suitable for energy development and operation.

Activities have continued to refine engineering design, coordinate with Eversource, and engage in activities evaluating the Project at the proposed location (Option A).

2. Windham Energy Center – Project Description

The Project is a planned 320-MW/640-megawatt-hour (MWh) BESS installation, designed to work as a stand-alone facility that can store energy during off-peak times to hold in reserve and meet peak energy demands when needed. The Project will consist of lithium-ion batteries installed in racks within prefabricated containers; inverters; medium-voltage transformers; control equipment; switchgear; and a Project Substation that will collect and transfer voltage between 34.5 kV and 345 kV and connect to the Eversource substation. The Eversource substation will be designed, permitted constructed, owned, and operated by Eversource. The Eversource substation is proposed within an approximately 2-acre area adjacent to the existing Eversource ROW. The Project layout, including assumptions for the Eversource substation, is shown in Figures 5 and 6.

While the specific battery technology could change, FlexGen technology (represented by the materials provided in Appendix A), is reflected in this document as the likely design module. The batteries will be installed in pre-engineered containers with battery storage racks including relay and communications systems for automated monitoring and managing of the batteries to facilitate design performance. A battery management system (BMS) will be provided to control the charging/discharging of the batteries along with temperature monitoring and control of the individual battery cell temperature with an integrated cooling system. Batteries operate with direct current (DC) electricity that must be converted to alternative current (AC) for compatibility with the existing electric grid. Power inverters to convert between AC and DC, as well as transformers to step up the voltage, will be included in the layout. It is assumed that height of the BESS will be limited to approximately 10 feet.

Note that the layout indicates locations for future augmentation units. Because batteries operate less efficiently over time, it is anticipated that these smaller DC augmentation units will be added to supplement storage. These will be phased installations over the life of the Project, with the first augmentation targeted after approximately 3 years of operation, and additional augmentation every 5 years thereafter. The locations of the augmentation are shown to demonstrate the full build-out planned for the Project over time.

The Project will be located within the approximately 20-acre Project Area, as shown in Figures 5 and 6. Approximately 20-foot-wide gravel access roads will provide for movement throughout the Project Area, and the areas between equipment will also be gravel or grass-covered. The construction area designated on the plan will be used for operational and maintenance parking once construction is complete. All parking, including for construction, is anticipated to be accommodated within the Project Area. As shown in Figure 5, the Project will be set back from Lake Road by a minimum of approximately 75 feet, with a majority of the existing vegetation remaining in-place for visual screening, except in the location of the access drive. The Project will also be surrounded by a security fence and gate.

The Project will not require a water supply. The BESS incorporates integrated Underwriters Laboratory (UL)-certified fire suppression and a liquid-cooled thermal management system, which should limit external firefighting needs. No wastewater discharge is anticipated. No process water requirements are associated with a BESS installation, and no operations building that would require domestic utilities is planned. Stormwater management will be necessary in association with the Project, as discussed further in Section 4.5.

3. Regulatory Review Process

The following sections provide an overview of the regulatory review processes anticipated to apply to pre-construction approval of the Project.

3.1 CONNECTICUT SITING COUNCIL

Municipal jurisdiction over the siting of the proposed BESS described in this report is pre-empted by provisions of the Public Utilities Environmental Standards Act (PUESA), Conn. Gen. Stat. §16-50g et seq. The PUESA gives exclusive jurisdiction over the location, type, and modification of electric storage facilities to the Council (Conn. Gen. Stat. §§16-50i(a)(3); 16-50x(a); and 16-50x(d)). Accordingly, the Project described in this report is exempt from the Town of Killingly's land use (zoning and wetlands) regulations.

Upon receipt of an application, the Council will assign a docket number, and following a completeness review, set a docket schedule, including a hearing date. At that time, the Towns of Killingly, Putnam, and Pomfret may choose to participate in the Council's proceeding. Other procedures followed by the Council include serving WEC and other participants with interrogatories, holding a pre-hearing conference, and conducting a public hearing. Following the public hearing, the Council will issue findings of fact, an opinion, and a decision and order.

Prior to construction, the Council will also require WEC to submit a development and management plan (D&M Plan), which is in essence, a final site development plan showing the details of the facility incorporating any conditions imposed by the Council. These procedures are also outside the scope of the Town's jurisdiction, and are governed by the Conn. Gen. Stat., the Regulations of Connecticut State Agencies, and the Council's Rules of Practice. If the Council approves the electric generating facility described in this Technical Report, WEC or its contractor will submit an application for approval of building and electrical permits, as required, to the Building Official. Under Section 16-50x of the Conn. Gen. Stat., which provides for the exclusive jurisdiction of the Council, the Building Official must honor the Council's decision.

3.2 OTHER STATE AND FEDERAL PROGRAMS

Table 2 provides a list of potential environmental permits required prior to construction for the Project. As Project details are further developed, additional review may be required at the state and federal level, and additional pre-construction permits could be required.

Table 2. Potential Environmental Permitting Requirements – Pre-Construction

Agency	Permit/Approval	Comments
<i>State Permits, Reviews, and Approvals</i>		
Connecticut Siting Council	Certificate of Environmental Compatibility and Public Need	Required prior to Project construction.
Connecticut Department of Energy and Environmental Protection (CTDEEP)	Natural Diversity Database (NDDDB) – endangered species program	Review request submitted on 28 September 2023; response received 11 October 2023. To be updated to reflect adjusted property.

Agency	Permit/Approval	Comments
	National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater – Construction Activity General Permit	Required prior to Project construction that disturbs greater than 1 acre of ground area.
Connecticut Commission on Culture and Tourism – History Division	Historic and archaeological resource review	Correspondence on 6 September 2016 confirmed no additional archaeological investigations are warranted and no historic properties will be affected at 189 Lake Road.
<i>Federal Permits, Reviews, and Approvals</i>		
None known to be required.		

3.3 MUNICIPAL CONSULTATION PROCESS

Pursuant to Conn. Gen. Stat. §16-50l of the General Statutes, Town officials are entitled to receive technical information regarding the proposed electric storage facility at least 60 days prior to the filing of an application with the Council. In accordance with these provisions, this Technical Report is provided to the Town of Killingly (the host municipality) and the Towns of Pomfret and Putnam (municipalities within 2,500 feet of the Project Area) and includes: information on the public need and benefit of the Project; details of the Project; a description of the site selection process; and a discussion of potential environmental effects associated with the Project.

Each municipality may conduct public information hearings or meetings, as it deems necessary, to develop and advise WEC of its recommendations concerning the Project. Notice of any public information meeting or hearing will be sent to abutting landowners and will be published in a newspaper of general circulation in the municipality, at least 15 days prior to the hearing.

Within 60 days of the initial consultation, the municipalities are required to issue recommendations on the Project to WEC. Within 15 days of the filing of the application, WEC must provide the Council with copies of all materials provided to the municipality, a summary of the consultation effort, and all recommendations issued by the Town(s).

In addition, Conn. Gen. Stat. §16-50x(d) states that the Town’s Planning and Zoning Commission and Inland Wetlands Agency may issue orders to “regulate and restrict” the Project’s proposed location. All such orders must be in writing and recorded in the records of the respective community. Notice of the issuance of such orders must also be provided to WEC or other parties affected by the orders. The “regulate and restrict” orders must be filed with the Council not more than 65 days after the filing of the facility application. These orders are subject to appeal to the Council within 30 days after the giving of the notice by the municipality.

4. Environmental Considerations

The following narrative provides preliminary information describing consideration of key environmental factors that will be evaluated by the Council for the Project. Preliminary details have been provided if available; otherwise, a discussion of pending studies to be completed has been provided. Topics addressed in the following sections are: air quality; wetlands and watercourses; wildlife and endangered species; water use and discharge; stormwater management; visual impacts; cultural resources; noise; traffic; solid waste disposal; emergency response; and electric and magnetic field effect.

4.1 AIR QUALITY

The Project will have no air emissions during normal operation, and no air permitting would be required. Because construction activities are minimal, it is not expected that dust or other emissions associated with the construction phase will have a significant adverse environmental effect. Best management practices (BMPs) will be used, and state guidance followed, to minimize the potential for such temporary impacts.

4.2 WETLANDS AND WATERCOURSES

The Project Area has been evaluated to identify wetlands and watercourses within its boundaries and on adjacent parcels, and none have been identified. The majority of the wooded areas within the Project Area are evergreen woods dominated by white pine. Smaller areas of less homogenous tree cover extend into the Project Area. Mixed hardwood and old field habitats are present in more eastern portions of the Project Area; this includes the mowed/maintained yard associated with the residence located within the Project Area.

The Project Area was previously evaluated in 2016 to identify where wetlands and watercourses were located within a larger property. A confirmatory review of the Project Area was conducted in September 2023 and February 2024 to affirm that conditions had not changed (Appendix B). All Project activities are proposed within upland forest. Wetlands known to be proximate to the Project-related features are shown on Figure 7. None of these wetland areas are located within 100 feet of any proposed Project improvements.

4.3 WILDLIFE AND SPECIES EVALUATION

Detailed avian, amphibian, and reptile surveys were completed in 2016 for an area that encompassed the Project Area. The Project Area reflects residential use and upland forest; no wetland impact is proposed.

The potential for the Project to impact species, particularly protected species, has been considered in order to incorporate appropriate species protection measures. An Information for Planning and Consultation (IPaC) was completed in February 2024 for the Project Area. According to the United States Fish and Wildlife Service (USFWS), the Project Area is located within the range of the northern long-eared bat (*Myotis septentrionalis*) and the monarch butterfly (*Danaus plexippus*). WEC plans to restrict tree clearing such that no mature tree clearing would occur during the bat pupping season (June and July); therefore, no impact to this species is expected. The monarch butterfly relies on milkweed plants

to lay their eggs and feed. Due to the Project Area being mainly forested, the monarch butterfly is not likely to be present within the Project Area.

The Project Area is within a property that was the subject of review by the CTDEEP in 2016. A submittal was made to the CTDEEP NDDb (filed on 27 September 2023) for a location that includes much of the Project Area to update that review and confirm whether additional species measures or studies would be warranted. A response was provided by CTDEEP on 11 October 2023, that was consistent with prior reviews for the area. Updated correspondence to CTDEEP will be provided to adjust to the current Project Area, with the outcome expected to be consistent with the below discussion.

CTDEEP correspondence on 11 October 2023 concurred with providing the following measures to avoid impacts to listed bats and turtle species:

- For any construction work done during the eastern box turtles' active period of 1 April through 1 November, the following precautionary measures will be employed:
 - Prior to construction, silt fencing will be installed around the work area. The area within the perimeter of the silt fence will be canvassed for the presence of turtles by a qualified individual one day prior to installation of the silt fencing and for five consecutive days following installation. Any turtles found within the bounds of the silt fence shall be relocated.
 - During construction, work crews will be apprised of the species description and possible presence. Work crews will search the work area for turtles prior to the start of each construction day. Any turtle encountered in the work area will be moved unharmed to an area immediately outside the fenced area and oriented in the same direction it was walking when found.
 - All precautionary measures will be taken to avoid degradation to wetland habitats, including any wet meadows and seasonal pools. No work is proposed in such areas for the Project Area.
 - Precautions will be taken to avoid turtles when heavy machinery or vehicles are traveling to the work area.
 - All silt fencing will be removed after work is completed when soils are stable so that reptile and amphibian movement is not restricted.
- Restriction of tree clearing such that none will occur during the months of June and July to avoid the pup season for bat species. Once construction is complete, no further impact is anticipated, with species continuing to use the remaining forested areas.

CTDEEP also requested, in the 11 October 2023 correspondence, consideration of potential lepidoptera habitat enhancements. A prior project had set aside a small area for such purposes that was within the old field habitat within the Project Area, and WEC will work with CTDEEP to determine how best to respond to this habitat recommendation.

No wetlands or vernal pools have been identified within the Project Area. The closest known and mapped vernal pool to the Project Area is over 500 feet to the northwest of the Project Area (as shown on Figure 7). Adequate Critical Terrestrial Habitat Area will remain to accommodate the lifecycle of vernal pool species.

Agency correspondence is provided in Appendix C.

4.4 WATER USE AND DISCHARGE

The Project will not require water use or discharge in association with its operation and function. Stormwater, addressed in Section 4.5, will be the only water discharge associated with the Project.

4.5 STORMWATER MANAGEMENT

WEC will incorporate careful consideration of stormwater management into its Project design and will develop a Stormwater Pollution Prevention Plan (SWPPP) to detail its BMPs. Calculations to determine the volumes and direction of stormwater flows across the Project Area will be undertaken to mimic this existing flow in the post-development design scenario. This will include the incorporation of BMPs consistent with state requirements, as outlined in the 2023 Connecticut Stormwater Quality Manual, which will include appropriate stormwater management design to prevent the potential for off-site impact.

4.6 VISUAL IMPACTS

The BESS consists of structures that will have a maximum height of 10 feet, with the exception of certain electrical equipment in the Project Substation that could be approximately 75 feet tall. The BESS structures will be set back a minimum of 75 feet from Lake Road, with most of the existing mature trees being retained along the Lake Road frontage, except where the site access drive is proposed. Given the limited height of the structures and the vegetative screening, the Project is not expected to be visually intrusive. A rendering of the Project is provided in Figure 8.

Similarly, the Eversource substation will be set back from Lake Road by approximately 75 feet, with vegetation remaining in the intervening area. Structure heights are anticipated to range from 75 to 120 feet within the limited Eversource substation footprint.

4.7 CULTURAL RESOURCES

The Connecticut Department of Economic & Community Development, Offices of Culture and Tourism acts as the State Historic Preservation Office (SHPO) for review of historic and cultural resource issues in Connecticut. Archaeological investigations were completed at the Project Area in accordance with SHPO requirements in 2016. No evidence of prehistoric occupations was identified during Phase 1B shovel testing, and SHPO concurrence was received on 6 September 2016 (Appendix D). It is not anticipated that further consideration or review of historic or archaeological features will be warranted.

4.8 NOISE

The Project will meet all applicable noise requirements at both the state and local level. The stringent standards define acceptable sound levels generated by an industrial facility at its property boundary. The acceptable levels vary depending upon the abutting land use; CTDEEP noise limits are summarized in Table 3, with typical sound levels profiled in Table 4.

Table 3. CTDEEP Noise Limits (A-Weighted Decibels [dBA])

Emitter	Receptor			
	Class C	Class B	Class A Daytime (7 a.m. – 10 p.m.)	Class A Nighttime (10 p.m. – 7 a.m.)
Class C – Industrial	70	66	61	51
Class B – Commercial and Retail Trade	62	62	55	45
Class A – Residential Areas and other sensitive areas	62	55	55	45

Table 4. Typical Noise Sources and Acoustic Environments

Noise Source or Activity	Sound Level (A-Weighted Decibels)	Subjective Impression
Vacuum cleaner (10 feet)	70	Moderate
Passenger car at 65 mph (25 feet)	65	
Large store air-conditioning unit (20 feet)	60	
Light auto traffic (100 feet)	50	Quiet
Quiet rural residential area with no activity	45	
Bedroom or quiet living room	40	Faint
Bird calls	40	
Typical wilderness area	35	
Quiet library, soft whisper (15 feet)	30	Very quiet
Wilderness with no wind or animal activity	25	Extremely quiet
High-quality recording studio	20	
Acoustic test chamber	10	Just audible
	0	Threshold of hearing

Adapted from: Kurze and Beranek (1988) and USEPA (1971).

CTDEEP regulations also prescribe provisions for impulse noise, prohibiting impulse noise in excess of 80 decibels (dB) (peak) during nighttime hours in any Class A zone, and 100 dB (peak) at any time in any zone. Audible discrete tones also require special consideration. A limit of 100 dB pertains to infrasonic and ultrasonic noise. Construction noise is exempt from CTDEEP noise regulations.

The Town of Killingly provides noise level standards applicable to the Project under Chapter 12.5, Article VI (Sections 120-131) of the Code of Ordinances. The Town standards are consistent with those prescribed by the CTDEEP, although the definition of daytime varies. The Town of Killingly considers daytime to be 7 a.m. to 9 p.m., Monday through Saturday, and 9 a.m. to 9 p.m. on Sundays. If measured background levels exceed the noise standard, a proposed source can contribute an additional 5 dBA over ambient levels; however, in no event can the proposed source exceed 80 dBA. No impulse sound greater than 80 dBA at night, or greater than 100 dBA at any time is allowed. Construction during daytime hours is exempt from the noise level standards, as is blasting between 8 a.m. and 5 p.m. (with proper permits).

WEC has focused on integrating mitigation elements into the design and layout of the Project. For example, the BESS facility will incorporate sound attenuation of its fans, and placement of the Project within the Project Area will provide setbacks from surrounding property boundaries. A noise modeling

study will be completed, the results of which will influence the final Project design and will be included in the Project's full application to the Council.

4.9 TRAFFIC

The Project Area is located approximately 1.2 miles to the west of I-395, a major transportation corridor. Temporary impacts to current traffic levels are anticipated to occur during the construction phase of the Project. Truck traffic delivering equipment and construction materials to the Project Area, as well as increased traffic associated with construction workers traveling to and from the Project Area, will occur at varying levels over the approximately 14-month construction process. There will be approximately 8 to 10 flatbed trucks per day and 30 to 40 workers during peak construction of around 2 months. The Eversource substation may require additional workers and would be expected to be completed within a similar time frame.

Traffic will occur along the segment of Lake Road that extends from I-395 to the Project Area. Much of this is within the current or planned industrial and commercial development area of Killingly. Coordination will occur with the Town to address scheduling to avoid peak commuter periods along that road, and to identify periods when manual control or other measures will be useful to minimize impact to existing users of that local road.

No permanent staff will be located at the Project; limited regular access for maintenance and monitoring will occur. Traffic levels would only increase during major maintenance periods, these instances are expected to be very minimal due to the nature of the technology employed.

It is not expected that traffic studies will be needed, although details will be provided to describe anticipated construction traffic levels in the application to the Council.

4.10 SOLID WASTE DISPOSAL

The Project will not result in unusual demand to local solid waste disposal infrastructure or systems. During construction, demolition debris, worker-related daily wastes (i.e., food wastes), packaging materials, and other debris typical of BESS construction would be expected. Once the Project is completed, no substantial solid waste generation is anticipated in association with normal operations.

4.11 EMERGENCY RESPONSE

Safety is of paramount importance in locating, designing, and operating energy projects, including BESS facilities, because BESS are most efficiently used when placed near the communities they serve. While grid-scale BESS have been in operation since at least 1996, adoption of lithium-ion chemistry BESS technology has been advancing since 2011 due to technological innovations and increased manufacturing capacity.² These technologies are continually evolving. Safety incidents that have occurred during early adoption of BESS have been drivers toward use of different material composition, as well as configuration and design. As BESS technologies have matured, test methods have been established to subject BESS technologies to rigorous conditions to allow for safety certifications and availability of safer BESS modules with more effective layout options.

² National Renewable Energy Laboratory, 2019. "Greening the Grid FAQs." Accessed September 2023 at <https://www.nrel.gov/docs/fy19osti/74426.pdf>.

WEC is committed to providing this Project as an energy solution that integrates well with its host community. One key design goal has been the selection of equipment with minimal safety risk.

4.11.1 Equipment Characteristics

The selected battery containers are EnerC+ units, shown in Figure 9, manufactured by Contemporary Amperex Technology Co., Limited (CATL). Each battery container (a rectangular box approximately 20 feet long, 8 feet wide, and 9.5 feet high) is designed to be fully enclosed as an independent operating system. The EnerC+ is a modular fully integrated product, consisting of rechargeable lithium-ion batteries with the characteristics of high-energy density, long service life, and high efficiency. The primary components of the safety and control system consists of the BMS, the Thermal Management System (TMS), and the Fire Suppression System (FSS).

Each storage container represents approximately 4 MWh of energy storage capability. Within each container, a racking system holds the individual battery modules. There are five battery racks in each container. Each rack holds eight individual battery modules, and each module contains 52 battery cells. The batteries are designed both separately and together to meet several relevant safety standards (UN38.3, UL1973, IEC62619, and UL9540A). Key safety systems are described in the sections below.

4.11.1.1 Battery Management System

The BMS monitors the battery voltage, current, and temperature. It uses the detected information to manage energy absorption and release, thermal management, low-voltage power supply, high-voltage security monitoring, and fault diagnosis and management.

The BMS architecture includes three primary levels of electrical controls. The first is the Main Battery Management Unit (MBMU), which is the core electronic control unit of the container. The MBMU oversees five Slave Battery Management Units (SBMUs) that each regulate a main compartment. Each cell is also equipped with a Cell Supervision Circuit that monitors the activity of each cell. The BMS, through its three-level distributed scheme (Cell Supervision Circuit, SBMU, and MBMU), controls the BESS unit to ensure the stable operation of the energy storage system.

Once operational, the internal sensors and communications system will allow a remote operations team to continuously monitor the systems, maintain battery performance, and control the BESS facility. Should any of the monitored factors indicate non-standard operation, remote shutdown can be initiated for a technician to identify and correct for any issues before they become a safety concern. In the event of a more significant failure or emergency, programmed alarms will alert the operations team to any faults with the batteries and the team is able to remotely shut down the facility. The operations team is also in charge of gauging the need for battery replacement and/or augmentation based upon facility performance.

4.11.1.2 Thermal Management System

The TMS provides liquid cooling to maintain the temperature of the BESS within an allowable operating temperature range. To maintain a stable temperature, each container includes a chiller and heater with a liquid cooling pipe distributed inside each battery module.

In addition to preventing heat buildup, this allows batteries to operate at ideal conditions for energy management. If unsafe temperatures are detected, an internal high-speed fuse is included that provides a switch that can cut off the high-voltage connection as needed, allowing individual modules to be remotely shut down and electrically isolated if an anomaly is detected.

4.11.1.3 Fire Suppression System

As an outdoor non-walk-in BESS, the EnerC+ provides a complete FSS with detection, explosion control, and fire extinguishing functions. Independent from the TMS, the FSS has its own detectors for heat, smoke, and hydrogen. The FSS is also electronically isolated with its own fire control panel. In total, the FSS consists of smoke detectors, temperature detectors, hydrogen detectors, the fire control panel, the aerosol, the explosion-proof fan, and an independent power supply. The control panel will also control and record information for the FSS during all events. The location of the detectors for each EnerC+ unit are depicted in Figure 9.

An extraction fan system is included which meets the National Fire Protection Association (NFPA) 855 and 69 standards. Should a thermal runaway event be detected in the container, the combustible gas can be pumped to the outside of the container to prevent dangerous concentrations of combustible gases from accumulating.

4.11.2 Current Safety Standards

The Connecticut Fire Code is based on NFPA-1 fire code and incorporates the Standard for the Installation of Stationary Energy Storage Systems, NFPA 855. This standard was first introduced in 2020, but the most current version of NFPA 855 was issued in 2023.

The most straightforward demonstration for a BESS project would be demonstration of compliance by using pre-engineered battery storage systems listed under UL9540. UL9540 serves as the system certification and does so by incorporating and making references to many other codes. It references over 60 other rules, which include UL1973 (batteries), UL1741 (inverters), American Society of Mechanical Engineers (ASME) B31 (power piping), ASME B & PV (boiler & pressure vessel), American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 62.1 (ventilation), and NFPA 70 (electrical). With the new UL9540 requirements in place, systems larger than 50 kilowatt-hours or with separations less than 3 feet cannot be listed to the second edition of UL9540 without complying with appropriate UL9540A fire test performance requirements. The local fire authority may approve installations with larger energy capacities and smaller separation distances based on large-scale fire testing conducted in accordance with UL9540A, the Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems Standard.

UL9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage, can be used by technology developers to evaluate battery performance under a variety of adverse conditions to determine if a thermal runaway event (e.g., the risk of a fire in one location to spread) would occur at the cell, unit, enclosure, and installation level. Depending on the results, recommendations may be derived for that particular technology in terms of space or enclosure design, etc.

The results from the UL9540A Test Method can be requested from the manufacturer and presented to the local fire code official to address or waive building code and fire safety concerns involving BESS installation, ventilation requirements, effectiveness of protection, and fire response methods.

The CATL EnerC+ has completed UL9540A testing as discussed below.

4.11.3 Project Technology Testing

The battery cells, battery modules, and EnerC+ containers have been certified in accordance with the UL9540A test method. In order to satisfy the requirements of NFPA 855, the testing must indicate:

- No fire spread to surrounding equipment
- No array-to-array propagation
- No fire spread through fire resistance-rated barrier
- Explosion containment
- Explosions cannot injure occupants/first responders
- Toxic gases do not exceed Immediately Dangerous to Life or Health Levels
- Gas released will not exceed 25% of Lower Flammable Limit in their installed environment

4.11.4 Failure Modes and Effects Analysis

The NFPA 855 Standard for the Installation of Stationary Energy Storage Systems requires a hazard mitigation analysis for energy storage systems. This analysis is provided to the licensing fire authority and will evaluate the consequences of the following failure modes:

- A thermal runaway or mechanical failure condition in a single BESS unit
- Failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis
- Failure of a required protection system including, but not limited to, ventilation (heating, ventilation, and air conditioning [HVAC]), exhaust ventilation, smoke detection, fire detection, fire suppression, or gas detection.

Under the NFPA 855 standard, the Project will only be approved if the consequences of the analysis demonstrate the following:

- Fire will be contained within unoccupied energy storage rooms for the minimum duration of the fire resistance rating specified in NFPA 855
- Fire and products of combustion will not prevent occupants from evacuating to a safe location
- Deflagration hazards will be addressed by an explosion control or other system.

The EnerC+ units are uniquely designed to satisfy these requirements, as the units are outdoor containers located in a secure facility and not within any occupied areas. The Project is also well spaced, allowing adequate access for emergency personnel. Additionally, as previously described, if a thermal

runaway event is detected in the container, the combustible gas can be pumped to the outside of the container to prevent dangerous concentrations of combustible gases from accumulating.

4.11.5 Additional Safety Precautions

Safety has been a primary metric in the selection of the technology used, the vendor design selected, and the layout proposed. The safety measures inherent in each container are intended to quench fires internally such that impacts would be limited to one specific container, or at most, a group of containers, allowing the damaged units to readily be replaced.

Highly stable chemistry is used in each battery. Electrical safety controls include an emergency-stop design, multiple fuse protection design, electrical and thermal monitors, multi-channel isolation design, and lightning protection design.

The fire protection design includes alarms, ventilation, and aerosol extinguishers to prevent fire spread.

Even with low anticipated levels of risk, it is important to plan for unanticipated events. The following reflect some measures planned in order to provide the community, first responders, and the Project team with assurances that appropriate actions are being taken and continuous improvement in safety performance is achieved.

- Although the containers will be monitored in real time such that any out-of-specification operation will be noted and both automated and manual responses initiated, signs will be posted on the fencing with a contact number in the event anyone in the local community were to observe something requiring action or investigation. The contact (telephone and email) will be monitored for immediate response.
- As noted above, the containers are designed to self-control and typical measures involve remaining at a safe distance as the incident is internally controlled and burns itself out. In addition, quick-connect piping will be available on the outside of the containers in the event that additional water is deemed beneficial to incident control.
- Training opportunities will be facilitated for local firefighters to review current state of the science and risk management procedures for actions, including when special respirator measures may be warranted during either a fire incident or during decommissioning of a damaged container. An outline of safety measures is provided in Appendix E.
- When an unanticipated event occurs, whether at this facility or in the industry more broadly, a continual review of safety procedures will occur that will update for any lessons learned.

4.12 ELECTRIC AND MAGNETIC FIELD EFFECT

Potential changes in electric and magnetic field effects would be entirely located on private property associated with the Project. Therefore, it is not anticipated that an assessment of electric and magnetic field effects will be warranted in the application.

5. Public Benefits

The Project will provide considerable benefits by bringing a cost-effective, highly efficient, and flexible resource that will increase grid reliability and support efficient generation resources. The Project will also contribute to the local community by providing tax payments.

During the expected 14-month construction period, 40 to 50 construction jobs will be required for the BESS, with additional workers associated with the Eversource substation. During this time, workers will be contributing to the local economy through the use of local restaurants, hotels, retailers, etc. The Project is not expected to be staffed once operational. WEC plans to use local labor, local service providers, and local subcontractors whenever possible during the construction of the Project.

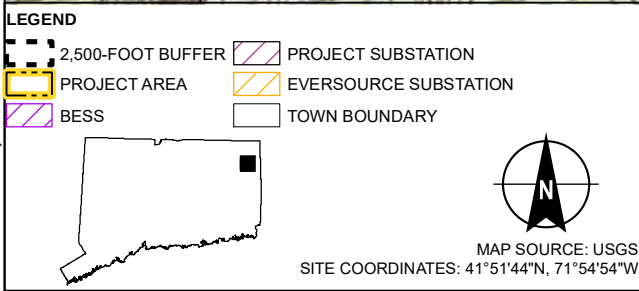
6. Project Schedule

An anticipated schedule is shown in Figure 10. WEC is currently working to complete studies to support the CSC application filing and anticipates that this filing will be made during the spring of 2024. Agency review and public participation will be ongoing throughout 2024, with a goal of having major permits issued for the Project in the first quarter of 2025.

The Applicant expects to commence construction during the first quarter of 2025 and will require approximately 14 months to complete site preparation, construction, and testing for the BESS to support operation by the early 2026. The detailed schedule for permitting and construction of the Eversource substation is unknown at this time but must be completed timely to support testing of the Project.

FIGURES

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PROJECT LOCATION (TOPOGRAPHIC MAP)

APPROXIMATE SCALE 1" = 2 MILES

FIGURE 1

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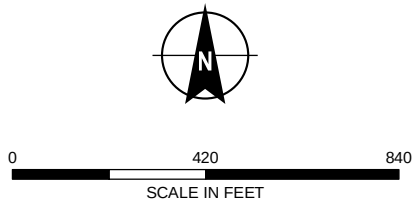


LEGEND

-  BESS
-  PROJECT SUBSTATION
-  EVERSOURCE SUBSTATION
-  PROJECT AREA
-  PARCEL BOUNDARY
-  WYNDHAM LAND TRUST PARCEL

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. ASSESSOR PARCEL DATA SOURCE: CONNECTICUT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
3. AERIAL IMAGERY SOURCE: NEARMAP, 14 SEPTEMBER 2022



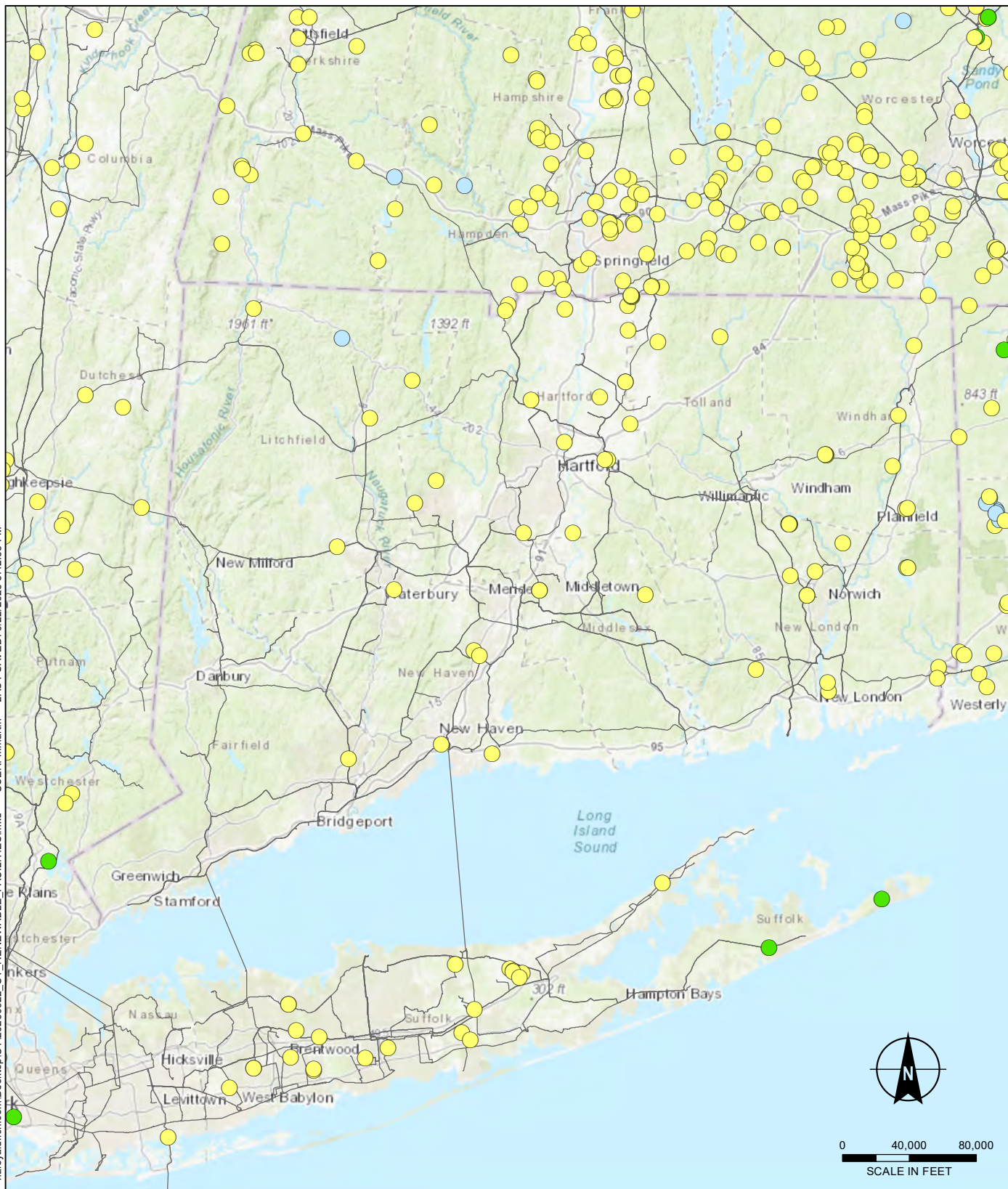
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PROJECT LOCATION
(AERIAL IMAGERY)

FIGURE 2

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LEGEND

- ELECTRIC TRANSMISSION LINE
- BATTERY ENERGY FACILITY
- SOLAR ENERGY FACILITY
- WIND ENERGY FACILITY

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ELECTRIC TRANSMISSION AND
RENEWABLE ENERGY
DEVELOPMENT

FIGURE 3

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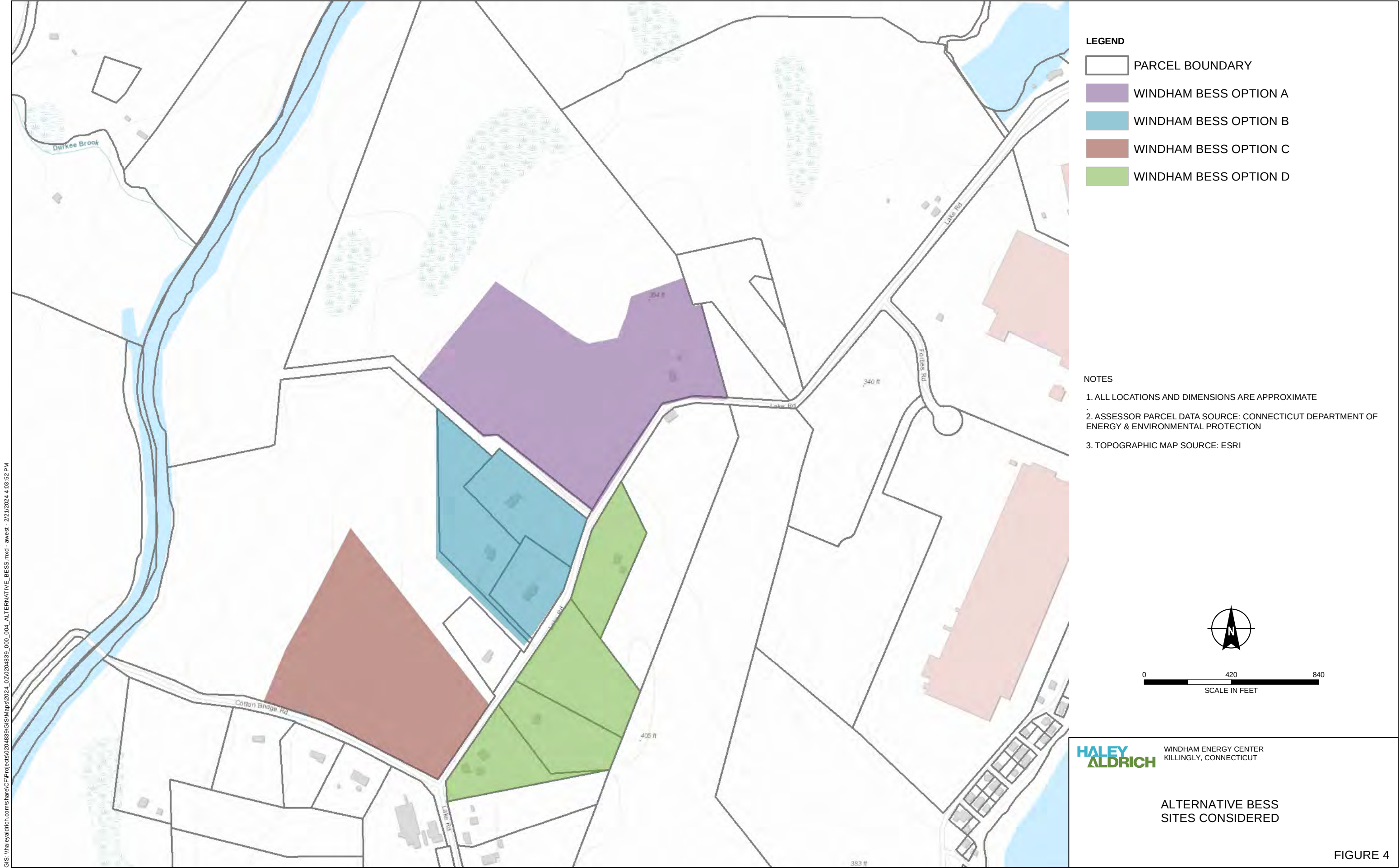
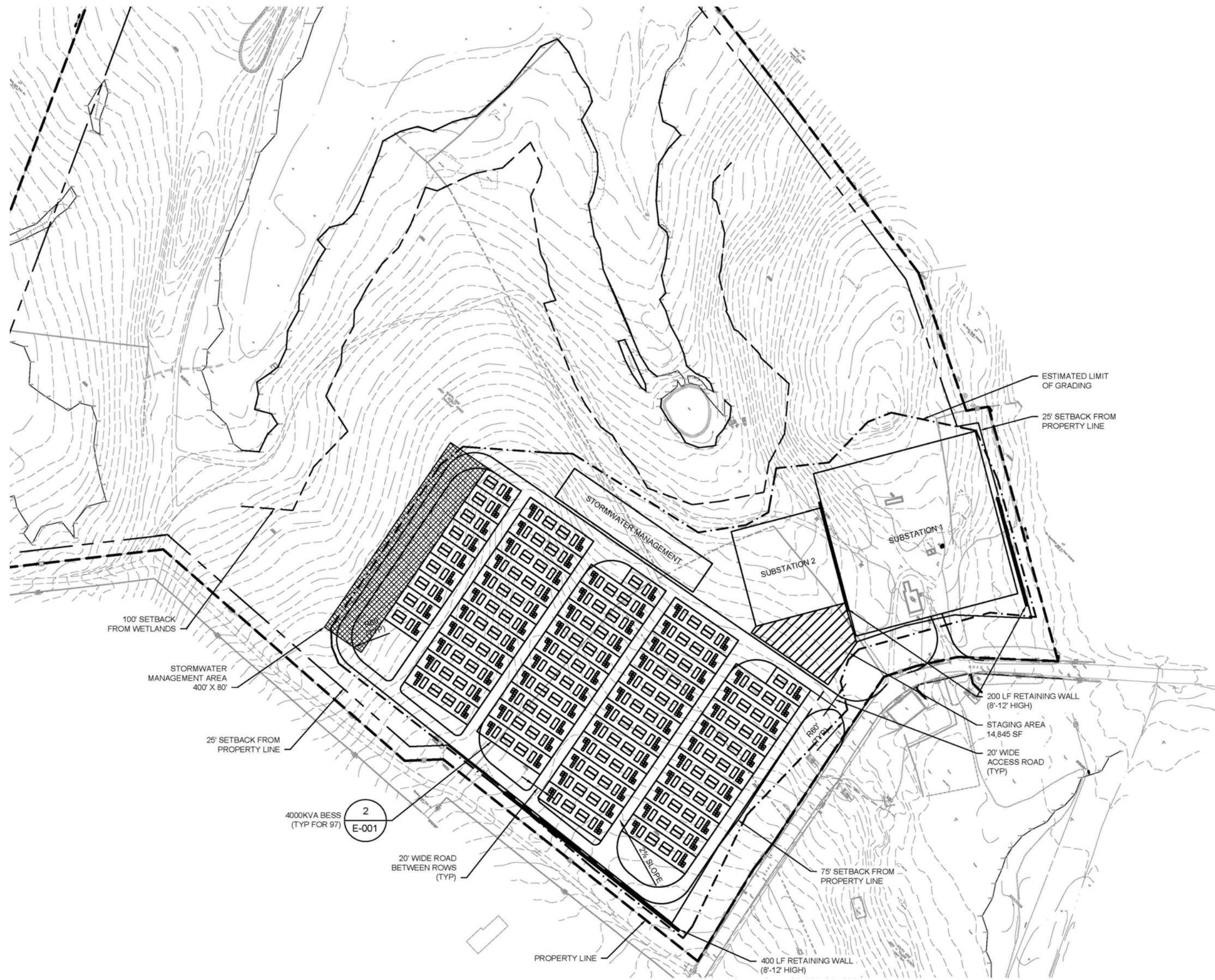


FIGURE 4



1 ELECTRICAL LAYOUT
E-001 1" = 100'

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BESS ENGINEERING LAYOUT

FIGURE 5

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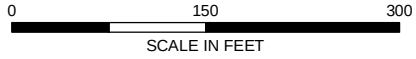


LEGEND

-  BESS
-  PROJECT SUBSTATION
-  EVERSOURCE SUBSTATION
-  PROJECT AREA
-  ACCESS ROAD
-  SUBSTATION
-  BESS LAYOUT

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. ASSESSOR PARCEL DATA SOURCE: CONNECTICUT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
3. AERIAL IMAGERY SOURCE: NEARMAP, 14 SEPTEMBER 2022

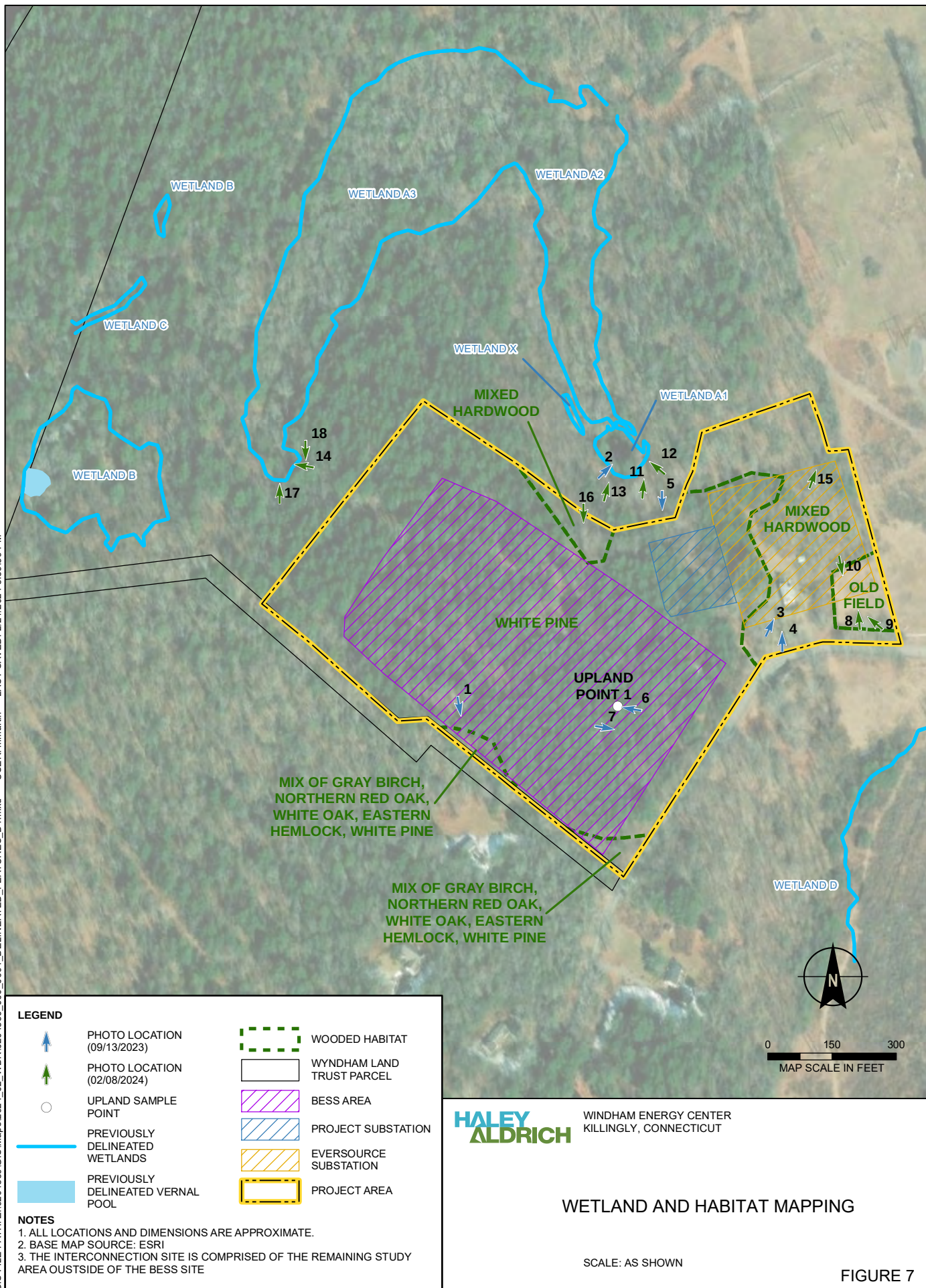


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PROJECT AND
INTERCONNECTION LAYOUT

FIGURE 6

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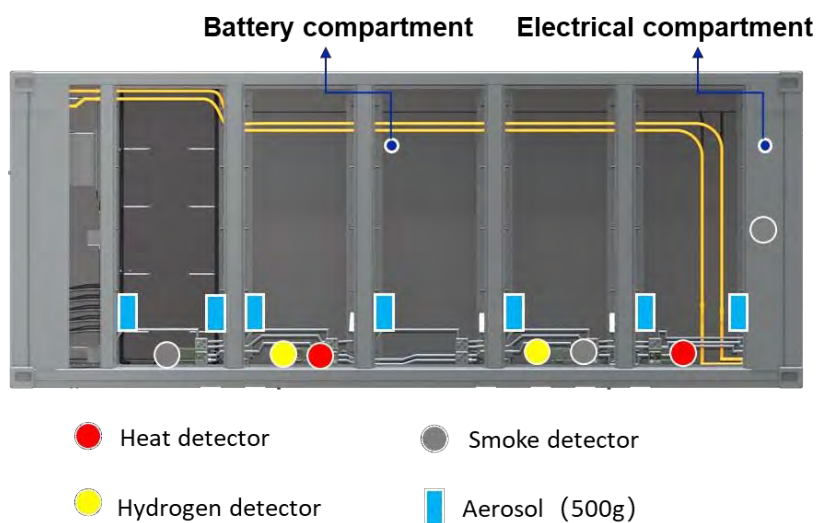
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PROJECT RENDERING

FIGURE 8



EnerC+ Liquid Cooling Energy Storage Container – Side View*

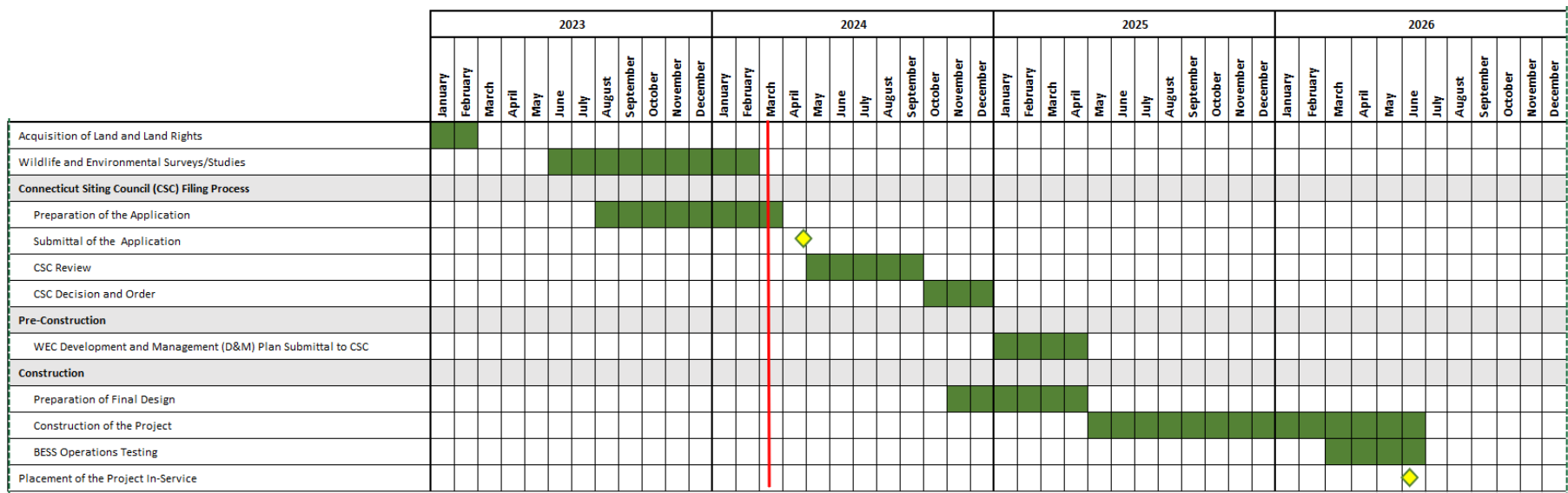


Type and Location of Detectors**

FIGURE 9
EQUIPMENT DETAILS

*CATL, November 2022. EnerG+306 Container Product Specification.

** CATL, July 2023. Hazard Mitigation Analysis for EnerC+.



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PROJECT SCHEDULE

FIGURE 10

APPENDIX A

Vendor Specifications



EnerC+ 306 Container Product Specification

Version	Date	Changes
1.0	Nov. 30, 2022	First Release

Contents

Tables	I
Figures	II
1 General Introduction	1
1.1 Confidentiality	1
1.2 Purpose of Document	1
1.3 Definitions and Abbreviations.....	1
1.3.1 Definitions.....	1
1.3.2 Abbreviations.....	2
2 System Description	4
2.1 Application	4
2.2 Overview	4
2.2.1 Battery	5
2.2.2 BMS.....	5
2.2.3 FSS.....	6
2.2.4 TMS.....	6
2.3 Advantages.....	6
3 System Specifications	8
3.1 Power and Energy	8
3.2 Electrical Specifications.....	8
3.3 Mechanical Specifications.....	9
3.4 Environmental Specifications.....	9
3.5 Certification Standard	9
4 Battery Management System(BMS)	11
4.1 BMS Overview	11
4.2 BMS Architecture	11
4.3 BMS Function	12
4.3.1 Battery Status Monitoring	13
4.3.2 Charging/Discharging Management.....	13
4.3.3 Thermal Management	14
4.3.4 Program Refreshing	14
4.3.5 High Voltage Safety Monitoring.....	14

4.3.6 Peripheral Monitoring and Control Management	14
4.3.7 Fault Diagnosis Management	14
5 Fire Suppression System(FSS)	15
5.1 FSS Overview	15
5.2 FSS Function	15
5.2.1 Detection System	16
5.2.2 Explosion-Proof System	16
5.2.3 Fire Extinguishing System	18
6 Thermal Management System(TMS)	20
6.1 TMS Overview	20
6.2 TMS architecture	20
6.3 TMS Specification	22
7 User Interface	23
7.1 PCS Requirements	23
7.2 Fuse Matching	23
7.3 Common Mode Voltage	24
7.4 Communication	26
8 Appendix	27

Tables

Table 1 Power and Energy of EnerC+	8
Table 2 Electrical specifications of EnerC+.....	8
Table 3 Mechanical Data of EnerC+	9
Table 4 Environmental Specifications of EnerC+	9
Table 5 Certification Standard	10
Table 6 Detailed Performance Parameters of BMS.....	12
Table 7 Detector Type and Position Description.....	16
Table 8 The Parameters of the Inlet.....	17
Table 9 The Parameters of the Exhaust Port.....	18
Table 10 The Paraments of The Flange	19
Table 11 The Parameters of the Nozzle	19
Table 12 Main Feature of Thermal Management System	22
Table 13 Power Consumption of Thermal Management System	22

Figures

Figure 1 EnerC+ Liquid Cooling Energy Storage Container – Sideview	4
Figure 2 EnerC+ Liquid Cooling Energy Storage Container – Sideview Without Door.....	5
Figure 3 Three-Level BMS Architecture for One Container in Parallel.....	11
Figure 4 Three-level BMS Architecture for Two Containers in Parallel.....	12
Figure 5 The Interactive Interface of FSS	15
Figure 6 Type and Location of Detectors	16
Figure 7 Explosion-Proof Fan System.....	17
Figure 8 Dry Pipe System	18
Figure 9 Overview of the cooling unit of EnerC+	20
Figure 10 Architecture of Thermal Management System.....	21
Figure 11 PCS Matching	23
Figure 12 Fuse Matching.....	24
Figure 13 One PCS for One Transformer.....	25
Figure 14 Multiple PCSs for One Transformer	25
Figure 15 The Communication Architecture of the System.....	26
Figure 16 The Front View and Dimensions of EnerC+	27
Figure 17 The Side View and Dimensions of EnerC+	27
Figure 18 The Top View and Dimensions of EnerC+	28

1 General Introduction

1.1 Confidentiality

This product specification is intended to be seen only by persons directly involved in this project. Transfer to other parties, especially to partners without the approval of CATL, has to be coordinated by the person in charge of this project in CATL and is governed by declarations relating confidentiality in the development contract.

1.2 Purpose of Document

This document is a product specification formulated by Contemporary Amperex Technology Company Limited (CATL) for Battery Energy Storage System developed by CATL. It describes and stipulates the performance index, basic functions, interface and communication, key parameters, safety characteristics, this product, as well as matters needing attention of users and relevant legal statements.

The specifications and parameters of the products are provided in this document. If the contract parties find any inadequacies, they shall inform us so as to develop better products.

CATL possesses the right to update and clarify this document.

1.3 Definitions and Abbreviations

1.3.1 Definitions

BESS: Battery Energy Storage System, using electrochemical cells to storage electrical energy.

Frequency Modulation: The grid should work under stable frequency while other uncontrol events will disturb the frequency. So, the active power shall be supplied to modulate the frequency of grid. The BESS shall provide the active power for the grid.

Voltage Modulation: The grid should work under stable voltage while other uncontrol events, especially the inductive load and capacitive load will disturb the voltage. So, the reactive power shall be supplied to modulate the voltage of grid. The BESS shall provide the reactive power for the grid.

Peak shaving and Valley filling: When the power plants generate more energy than the demand, the containers shall absorb the excess energy which called peak shaving. When the power plants generate less energy than the demand, the containers shall release the lack of energy which called Valley filling.

PV: Photovoltaic power generation.

Wind power: Power get from the rotation blade driven by wind.

Modbus TCP: The Modbus protocol including three kinds of messages: ASCII, RTU, TCP. Modbus TCP is a kind of communication protocol which is widely used in the industrial field.

Container: The container for the battery energy storage system.

Module: A mechanically integrated arrangement of cells connected in series and/or parallel, complete with packaging, thermal management, output DC connections, and associated cell sensing.

Cell: The smallest non-divisible component of the EnerC+ System, assembled into a battery module in series and parallel arrays.

RTE: Round-trip Efficiency, defined as discharging of the system from 100% SOC to 0% SOC at kWp immediately followed by charging the system from 0% SOC to 100% SOC at kWp. The Round-trip DC-DC energy efficiency shall be measured at the DC terminals of the container.

1.3.2 Abbreviations

BMS: Battery Management System.

TMS: Thermal Management System.

CAN: Controller Area Communication.

FSS: Fire Suppression System.

PCS: Power Conversion System.

BOL: Beginning of Life.

EOL: End of Life.

SOC: State of Charge.

SOH: State of Health.

CSC: Cell Supervision Circuit, the base unit of battery management.

SBMU: Slave Battery Management Unit, collects and analyses the data from CSC, and uploads to the MBMU.

MBMU: Main Battery Management Unit. The core control unit of the container.

EMS: Energy Management System. Monitoring and manage the charge and discharge of the BESS.

Sub Control Box: Including the SBMU fuse isolation switch and other components.

Master Control Box: Including the IMM, MBMU ETH fiber conversion module.

Distribution Box: Including auxiliary power system, UPS and other components.

2 System Description

2.1 Application

The EnerC+ container is a modular fully integrated product , consisting of rechargeable lithium-ion batteries, with the characteristics of high energy density, long service life, high efficiency. It can provide over 4MWh energy when the batteries are fully charged. The EnerC+ Energy Storage product is capable of various on-grid applications, such as frequency regulation, voltage regulation, arbitrage, peak shaving and valley filling, and demand response. Furthermore, the EnerC+ container can be used for PV storage integration and Wind storage integration. The system can also operate as a microgrid to support backup and islanded systems.

2.2 Overview

The overview of the container is shown in Figure 1. The detailed information can be found in the following chapters.



Figure 1 EnerC+ Liquid Cooling Energy Storage Container – Sideview



Figure 2 EnerC+ Liquid Cooling Energy Storage Container – Sideview Without Door

The EnerC+ container consists of following parts: batteries, BMS, FSS and TMS, which are integrated together to keep the normal working of the container.

2.2.1 Battery

The capacity of cell is 306Ah, 2P52S cells integrated in one module, 8 modules integrated into one rack, 5 racks integrated into one container. As the core of the energy storage system, the battery releases and stores energy.

2.2.2 BMS

BMS adopts the distributed scheme, through the three-level (CSC--SBMU--MBMU) architecture to control the BESS, to ensure the stable operation of the energy storage system. It can manage energy absorption and release, the thermal management system and low voltage power supply according to the detected information: battery voltage, current and temperature. It can monitor high voltage DC/AC security, diagnosis and analysis faults according information from various detectors and dry-contacts. And it can keep communication with PCS and EMS through CAN. The BMS is the most important control unit of EnerC+ container. The BMS possesses the UPS to keep normal function when facing the temporary out of power.

2.2.3 FSS

FSS consists of smoke detectors, temperature detectors, H2 detectors, the fire control panel, the aerosol, the dry pipe, the explosion-proof fan and the UPS. FSS undertakes functions : monitor the thermal run-away risks of container through the detectors, extinguish the thermal run away, especially the flame fire, control the loss to minimum. The control panel will control and record information for the fire suppression system. The FSS is independent with any other system and it is the security guard of EnerC+ container.

2.2.4 TMS

TMS consists of one powerful chiller, the PTC heater and the liquid cooling pipe distributed in each battery module. The TMS will control and keep the temperature of battery within reasonable range. The battery will work at best state and reach longest life under the thermal management system.

2.3 Advantages

Our EnerC+ container possesses the advantages below:

- 1) **Standard design.** The 20ft design is very convenient for the transportation. The standard design can be installed one-stop.
- 2) **New generation Cell.** EnerC+ container integrates the LFP 306Ah cells from CATL, with more capacity, slow degradation, longer service life and higher efficiency.
- 3) **High integrated.** The cell to pack and modular design will increase significantly the energy density of the same area. The system is highly integrated, and the area energy density is over 270 kWh/m². EnerC+ can support back-to-back arrangement and save more area.
- 4) **Extreme safety.** The system supports three levels of safety:

Firstly, the cell safety, the highly stable lithium iron phosphate is used in the EnerC+ container. LFP is a kind of safety material especially for the BESS.

Secondly, the electrical safety: a) E-Stop design; b) multiple fuse protection design; c) insulation monitor voltage monitor; d) multi-channel isolation design; e) lightning protection design.

Thirdly, the fire protection design, CATL has four-level fire control strategy. The first-level is the alarm. The second-level is ventilation and smoke exhausting to prevent deflagration. The third-level is aerosol to extinguish initial fire, and the fourth-level is the dry pipe sprinkle fire protection to prevent fire spread.

Adaptive thermal management. EnerC+ integrated single-cluster water pump, temperature control

strategy automatically adjusted with battery status, prolonging battery life.

- 5) **Easy extension.** It is very convenient for the augmentation of containers or racks. Furthermore, the EnerC+ support one PCS connected to 2 containers; this will decrease the covered area significantly.
- 6) **Independent UPS.** EnerC+ container have integrated two UPS system, one is for FSS which available capacity is 24 hours, another one is for BMS which available capacity is 10 minutes

3 System Specifications

In this chapter, the systems specifications will be introduced in detail. For the BESS, the system specifications included the power and energy, electrical specifications, the environmental specifications, the mechanical specifications and certification standards. The product model is C02306P05L01.

3.1 Power and Energy

Table 1 Power and Energy of EnerC+

DC Side Data		
Product Model	C02306P05L01	Remark
P-Rate	0.5P	
Cell		
Cell type	LFP	
Cell capacity	306Ah	
Cell Voltage range	2.5-3.65V	
Cell rated Energy	979.2Wh	
System		
Configuration	5P2P416S	
Rated Energy	4073.47kWh	
Rated Voltage	1331.2VDC	
Voltage Range	1164.8~1497.6VDC	
Rated Charging Current	1530A	
Maximum Charging Current	1748A	
Rated Charging Power	2036.73kW	
Rated Discharging Current	1530A	
Maximum Discharging Current	1748A	
Rated Discharging Power	2036.73kW	

3.2 Electrical Specifications

Table 2 Electrical specifications of EnerC+

Auxiliary Power & Communication			
Product Model		C02306P05L01	Remark
P-Rate		0.5P	
Auxiliary Power 1	Voltage Range	3AC+N+PE 380V~480V ±10%, 50/60HZ	
	Power	Max. 36.7kW	
	Inrush Current	≤65A, < 5S	
	Voltage Range	AC+PE 230 V±10%, 50/60HZ	

Auxiliary Power 2	Power	Max. 0.8kW (Continuous)	
	Inrush Current	5A	
UPS	Capacity	DC24V. 7Ah capacity.@25°C	The UPS is only used to supply power to BMS components.
Communication Protocol		CAN, Modbus/TCP	

3.3 Mechanical Specifications

Table 3 Mechanical Data of EnerC+

Mechanical Data		
Product Model	C02306P05L01	Remark
Transportation	Land or sea transportation	
Size	2896mm(H)*2438mm(D)*6058mm(W)	
Weight	~36t	
Color	RAL7042	
IP Level	IP55 (Battery Room)	
	IPX5 (Electrical Room)	
	IPX5(Cooling unit)	

3.4 Environmental Specifications

Table 4 Environmental Specifications of EnerC+

Environment condition		
Charge Temperature Range	-25°C...+55 °C	Remark
Discharge Temperature Range	-25°C...+55 °C	
Storage Temperature Range	-30°C...+60°C	
Application Altitude	≤2000m (no derating)	
Relative Humidity	0 ~ 95 % (non-condensing)	
Degree of Anti-corrosion of Battery Unit	C4, (optional C5)	
Seismic Level	IEEE 693-2018 Moderate design level	

3.5 Certification Standard

Table 5 Certification Standard

Standards & Certificates		
Cell	UN38.3	UN Transportation Testing for Lithium Batteries
	UL1973	Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications
	IEC62619	Safety requirements for secondary lithium cells and batteries, for use in industrial applications
	UL9540A	Energy Storage Systems and Equipment
Container	UL1973	Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications
	NFPA855	Standard for the Installation of Stationary Energy Storage Systems
	UL9540A	Energy Storage Systems and Equipment
	IEC 62477	Safety requirements for power electronic converter systems and equipment – Part 1: General
	IEC 62619	Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications
	IEC 62933-5-2	Electrical energy storage (EES) systems – Part 5-2: Safety requirements for grid-integrated EES systems – Electrochemical-based systems
	IEC 61000-4 IEC 61000-6	Generic standards – Emission standard for industrial environments
	IEC61000-4-6	Electromagnetic compatibility (EMC) –Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields

4 Battery Management System(BMS)

4.1 BMS Overview

BMS is used in energy storage system, which can monitor the battery voltage, current, temperature, managing energy absorption and release, thermal management, low voltage power supply, high voltage security monitoring, fault diagnosis and management, external communication with EMS and ensure the stable operation of the energy storage system.

4.2 BMS Architecture

BMS includes three-level constructure, composed of 1 unit of MBMU, 1 unit of IMM, 1 unit of ETH, 1 unit of media converter, 5 units of SBMUs, 40 units of CSCs. This is the architecture that one PCS connected to one container (Figure 3). What's more, the system can also support one PCS match 2 containers (Figure 4).

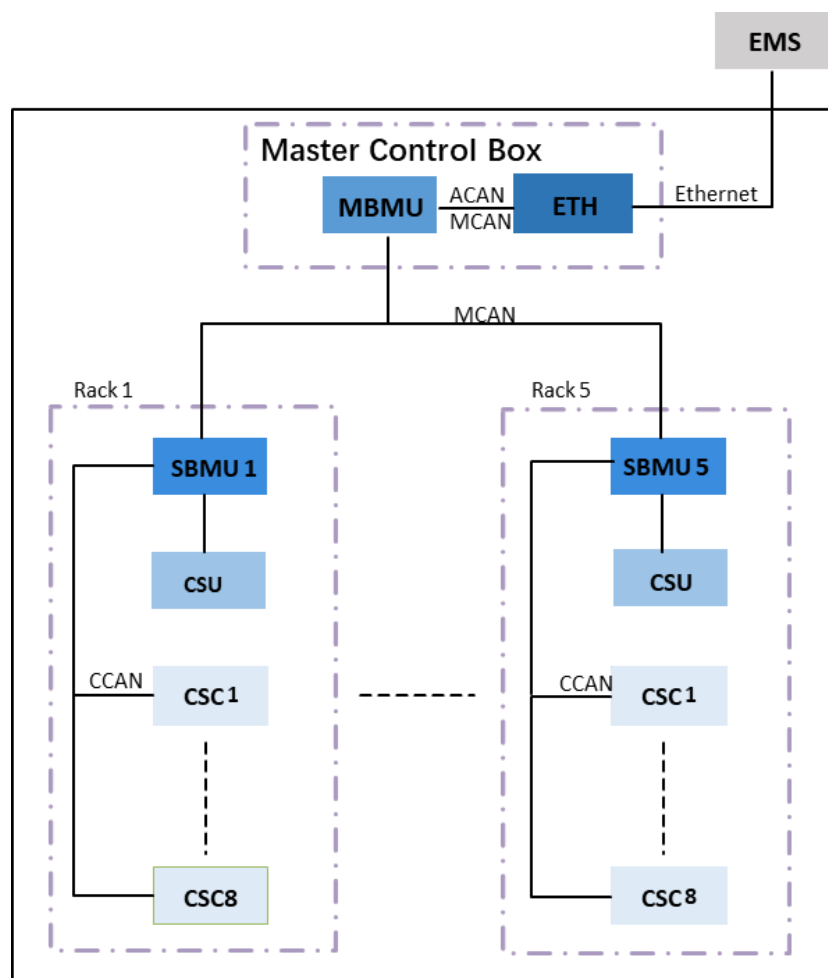


Figure 3 Three-Level BMS Architecture for One Container in Parallel

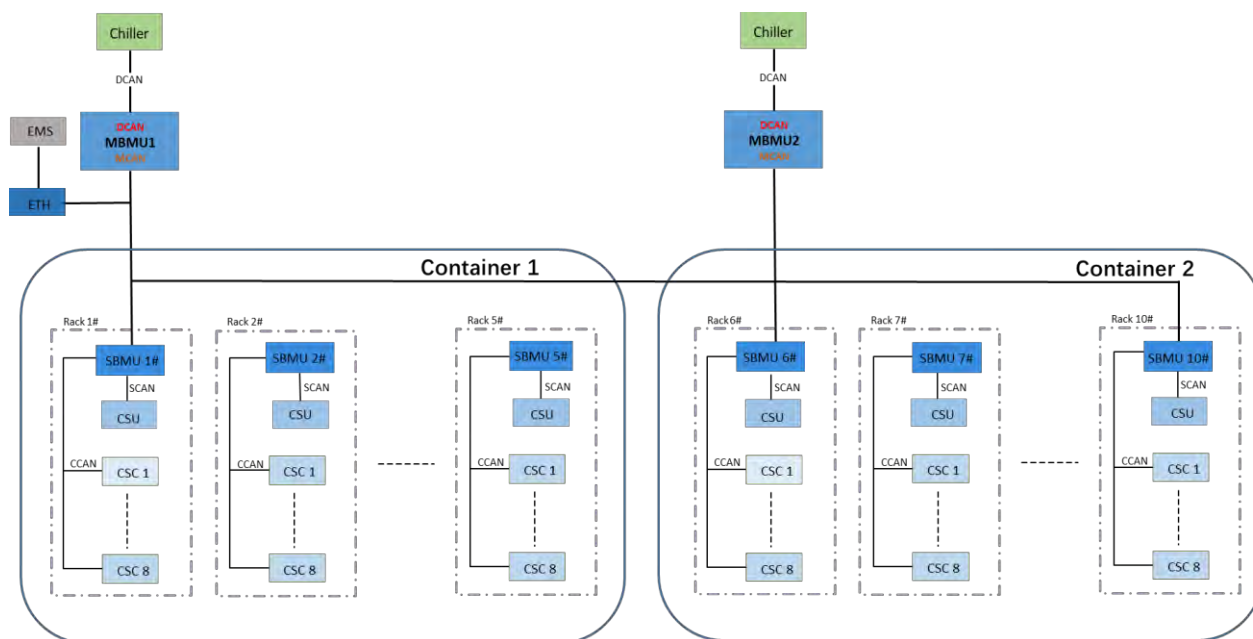


Figure 4 Three-level BMS Architecture for Two Containers in Parallel

4.3 BMS Function

The detailed information of BMS can be seen in Table 6. The parameters including: Cell voltage sampling, Cell temperature sampling, Current sampling, HV sampling, Ambient temperature detection, Insulation detection and other important parameters.

Table 6 Detailed Performance Parameters of BMS

Item	Performance Parameters	Value	Note
Working voltage	Range	20V~26V	
Cell voltage sampling	Range	1V~4.85V	
	Accuracy	±5mV	0℃ ~ +60℃
		±10mV	-40℃ ~ 0℃ or 60℃ ~ 85℃
Cell temperature sampling	Range	-40℃ ~ +125℃	
	Accuracy	±2℃	-20℃ ~ +60℃
		±3℃	-40℃ ~ -20℃ & +60℃ ~ +85℃
Current sampling	Range	± 500A	
	Sampling period	10ms	
	Accuracy	<1%FSR	-40℃ ~ 85℃
HV sampling	Range	0V ~ 1500V	
	Accuracy	1%FSR	
Cell balance	Current	100mA@3.2V	Opened in all channels

SOC	Accuracy	$< \pm 5\%$	LFP, according to specific conditions
SOH	Accuracy	$< \pm 5\%$	
Ambient temperature detection	Range	$-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$	
	Range	$\pm 3^{\circ}\text{C}$	
Insulation detection	Range	$0 \sim 10\text{M}\Omega$	
	Accuracy	$-30\% \sim 0\%$	
	Detection Time	$\leq 10\text{s}$	Y capacitor $< 0.47\mu\text{F}$ (for single side)

4.3.1 Battery Status Monitoring

- 1) BMS monitors the battery's parameters, including cell voltage, module temperature, battery module current and total battery module voltage.
- 2) BMS detects the battery status such as State of Charge (SOC) accurate to within 5%, SOH and the calculation of SOP.
- 3) BMS functions as a safety management system in such cases as under voltage, over discharge, over voltage, over temperature, and over current of the battery. In case of failure, the system will give an alarm to the supervisory equipment, limit the charge and discharge current or power, and control the disconnection of all HV contactors. This can protect the battery while safeguarding the power systems security.
- 4) BMS shall provide battery information (including data recording and fault waveform recording) to EMS.

4.3.2 Charging/Discharging Management

- 1) BMS controls and monitors the high voltage main contactors, auxiliary relays and low voltage coils.
- 2) BMS has pre-charge control within the parallel connection among racks.
- 3) BMS works in the management of charge and discharge. It will calculate the charge and discharge power limit according to the existing status of the battery (temperature, SOC) and actual performance of electrical components and then report to EMS which has the function of controlling to these limits.
- 4) BMS has the function of balance management to extend the reliability of the battery system.

4.3.3 Thermal Management

- 1) BMS has the function of sample collecting of battery cell temperature and chiller operating status.
- 2) BMS controls the liquid cooling TMS system based on cell & coolant's temperature.

4.3.4 Program Refreshing

BMS can flash programs on site, which supports the flashing of MBMU, SBMU, IMM, CSC and ETH by using the host computer through MCAN. BMS has the function of remote software flash, which enables to update BMS from a remote client via Ethernet. Furthermore, the system supports the BMS program refreshing through EMS.

4.3.5 High Voltage Safety Monitoring

- 1) BMS has the function of system insulation detection.
- 2) BMS has the function of high voltage sampling (collecting data of the main positive voltage).
- 3) BMS supports the detection of the dry contact of MSD, Fuse and Switch, as well as the auxiliary contact of the primary loop contactor.

4.3.6 Peripheral Monitoring and Control Management

- 1) BMS has the function of ambient temperature sampling and humidity sampling, which matches according to project requirements
- 2) BMS has multiple high-side drivers and can drive and control peripheral devices according to project requirements.
- 3) BMS has multiple dry contact interfaces and can monitor external signals according to project requirements.

4.3.7 Fault Diagnosis Management

- 1) BMS stores information such as operational parameters and historical alarms that can be viewed by ESS host computer.
- 2) BMS enables storage of latest historical alarms.

5 Fire Suppression System(FSS)

5.1 FSS Overview

As an outdoor non-walk-in battery energy storage system, EnerC + provides a perfect set of fire suppression system solutions with detection, explosion control and fire extinguishing functions. The fire extinguishing control strategy is divided into four levels:

- **First level, alarm warning;**
- **Second level, ventilation and smoke exhaust to prevent deflagration;**
- **Third level, aerosol is released to extinguish the initial fire;**
- **Fourth level, dry pipe spraying to control the spread of fire.**

5.2 FSS Function

The fire suppression system is divided into three parts: detection system, explosion-proof system and fire extinguishing system. The information of the interactive interface is shown in the following Figure 5.

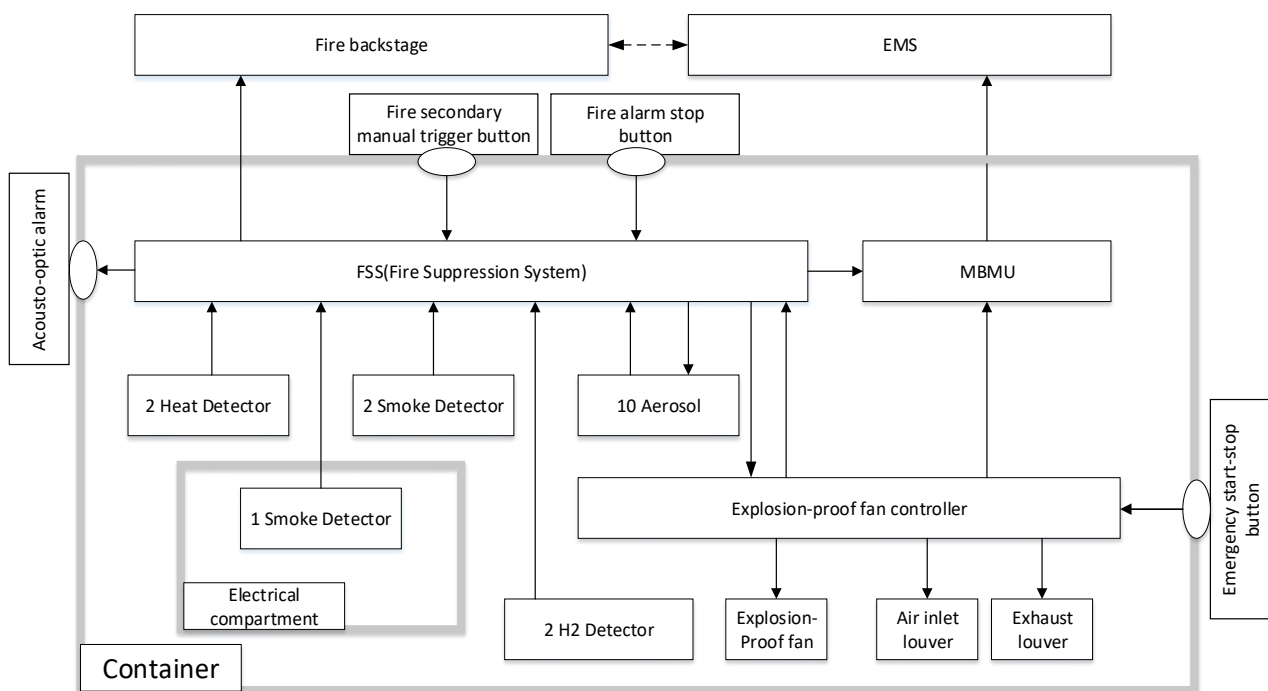


Figure 5 The Interactive Interface of FSS

5.2.1 Detection System

The detection system has three types of detectors, the number and installation position of which are shown in Table 7 and Figure 6. All detection signals are received and processed by the fire control panel, and the hydrogen(H_2) detector can be linked with the explosion-proof fan system.

Table 7 Detector Type and Position Description

No	type	quantity	remarks
1	Heat detector	2	Detection of temperature, in the battery room
2	Smoke detector	2+1	Detection of smoke particles, two in the battery room, and one in the electrical room
3	H_2 detector	2	Detection of H_2 , in the battery room
4	Fire control panel	1	Receive detector signals and control fire extinguishing system and explosion-proof system, in the electrical room

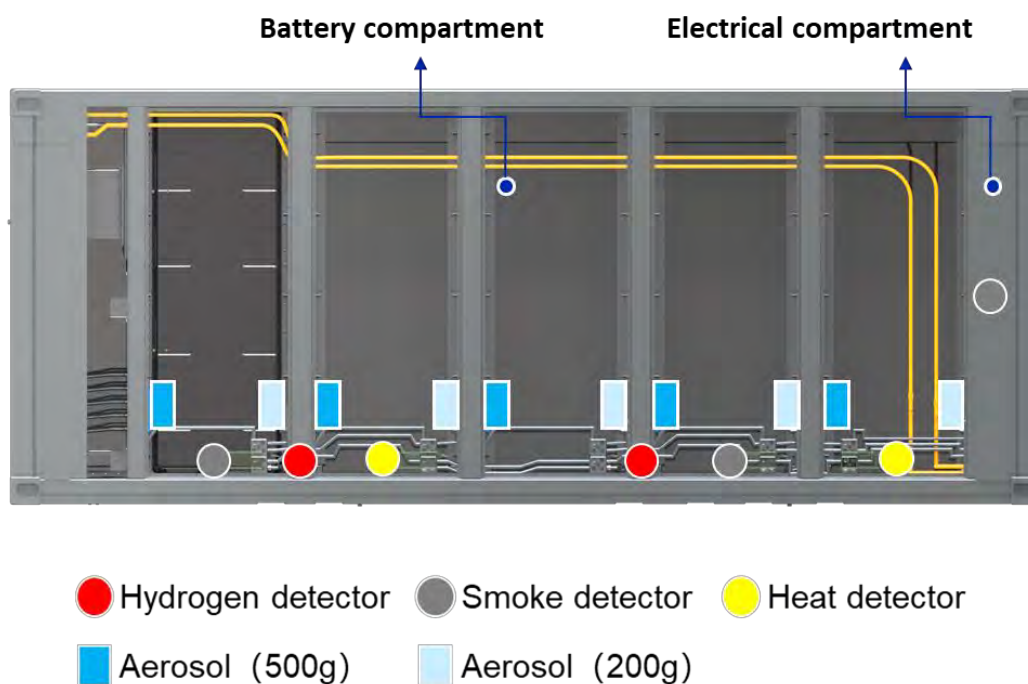


Figure 6 Type and Location of Detectors

5.2.2 Explosion-Proof System

Explosion-proof fan system meets NFPA855 (NFPA 69) standard and has the ATEX certification, which is

shown in Figure 7



Figure 7 Explosion-Proof Fan System

The air inlet electric louver receives the alarm signal sent by the hydrogen(H_2) detector and opens the electric louver. When one of these two signals is received, the air inlet electric louver automatically closes. One signal comes from the hydrogen (H_2) detector, indicating that the combustible gas concentration is within a reasonable threshold range, and the other signal is a secondary alarm signal. The parameters of the Inlet are shown in Table 8.

Table 8 The Parameters of the Inlet

Item	Specification
Supply voltage	24V DC
Rated power	60W
Inrush power	85W
Position	Integrate in Rack
Certification	In the process of ATEX certification

The air outlet electric louver will turn on the explosion-proof fan and releases the combustible gas in the battery room after receives the alarm signal from the hydrogen(H_2) detector. The explosion-proof exhaust fan will automatically turn off when the concentration of combustible gas falls within the reasonable

threshold. The parameters of the exhaust port are shown in Table 9.

Table 9 The Parameters of the Exhaust Port

Item	Specification
Supply voltage	230V AC
Rated power	72W
Inrush power	102W
Position	Integrate in Rack
Maximum air volume	820CFM
Certification	ATEX

5.2.3 Fire Extinguishing System

5.2.3.1 Aerosol

When an initial fire occurs in the battery room, a fire alarm signal will occur, and the fire extinguishing system will automatically control the release of aerosol, which can also be triggered manually. The fixed position of aerosol is shown in Figure 6.

5.2.3.2 Dry pipe

As the last line of defense, the dry pipe system can effectively control the spread of fire, which is shown in Figure 8.

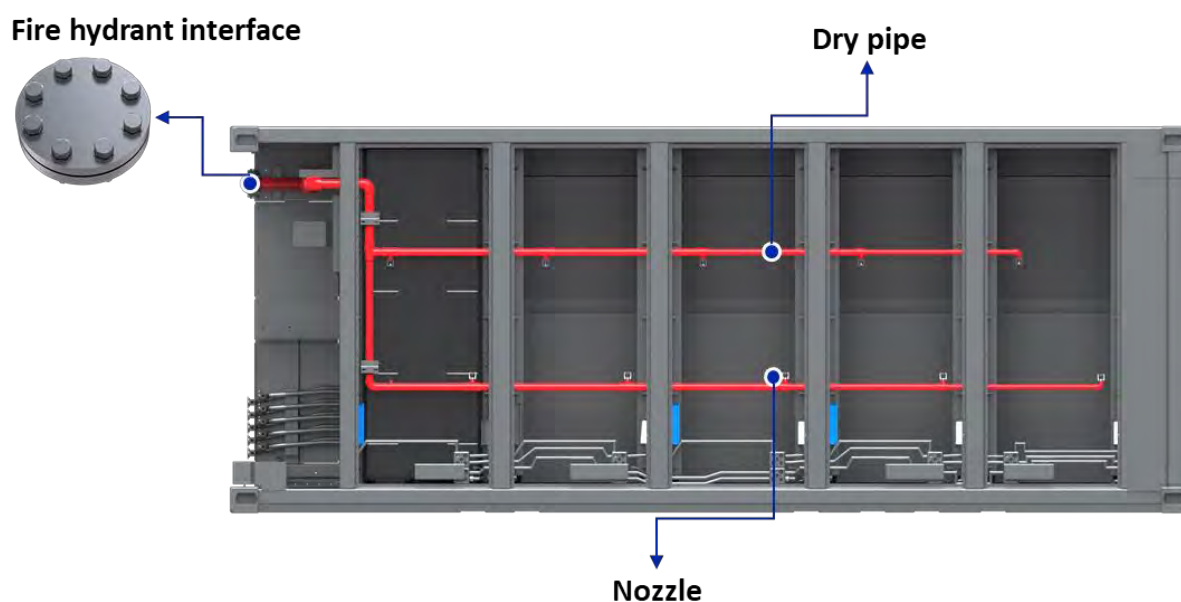


Figure 8 Dry Pipe System

The flange is installed at the entrance of the dry pipe fire protection system, for the connection between the pipes. The parameters of the flange are shown in Table 10.

Table 10 The Parameters of The Flange

Item	Specification
Model	DN65
Standard	EN1092-1
Material	ASTM A105
Class	PN 16
Flange type	TYPE 01 Plate flange for welding TYPE 05 Blind flange
Certificate	PED 4.3 for material
End connection	Integrate in Rack

The HD Medium Velocity Water Spray Nozzles are open type (non-automatic) nozzles with rubber plug, designed for directional spray application in fixed fire protection system. The parameters of the nozzle are shown in Table 11.

Table 11 The Parameters of the Nozzle

Item	Specification
Model	MV-A Brass Material
Type	MV-A
Maximum working pressure	12bar (175 psi)
End connection	½ BSPT
Heat Sensor Position	Integrate in Rack

6 Thermal Management System(TMS)

6.1 TMS Overview

The TMS system of EnerC+ is liquid cooling, which main function is to maintain the temperature of the battery system to an allowable operating temperature range. Thus, the battery shall work at the best conditions, adsorb and release the maximum energy, slow degradation the SOH and maintain the longest life.

The Thermal management system is composed with the high-efficiency liquid cooling unit, the liquid cooling pipe under the bottom of battery and the PTC heater. The TMS works under the control of BMS. BMS sends the start up or shut down signals to the cooling unit, then the cooling unit and the PTC heater will work together to change the temperature of circulating coolant liquid for heat exchange in the cooling pipe. The circulating liquid will exchange the heat with the battery through the pipe. Thus, the temperature of battery will increase or decrease into appropriate range.

For example, the cooling unit will be started if the BMS detect the battery temperature over the setting value. The cooling mode will be activated to decrease the temperature of circulating liquid until reaching the setting value. When the BMS detects the battery temperature less than the setting value, the heat mode will be activated to increase the temperature of circulating liquid until the setting value. Detailed information will be described below.

6.2 TMS architecture



Figure 9 Overview of the cooling unit of EnerC+

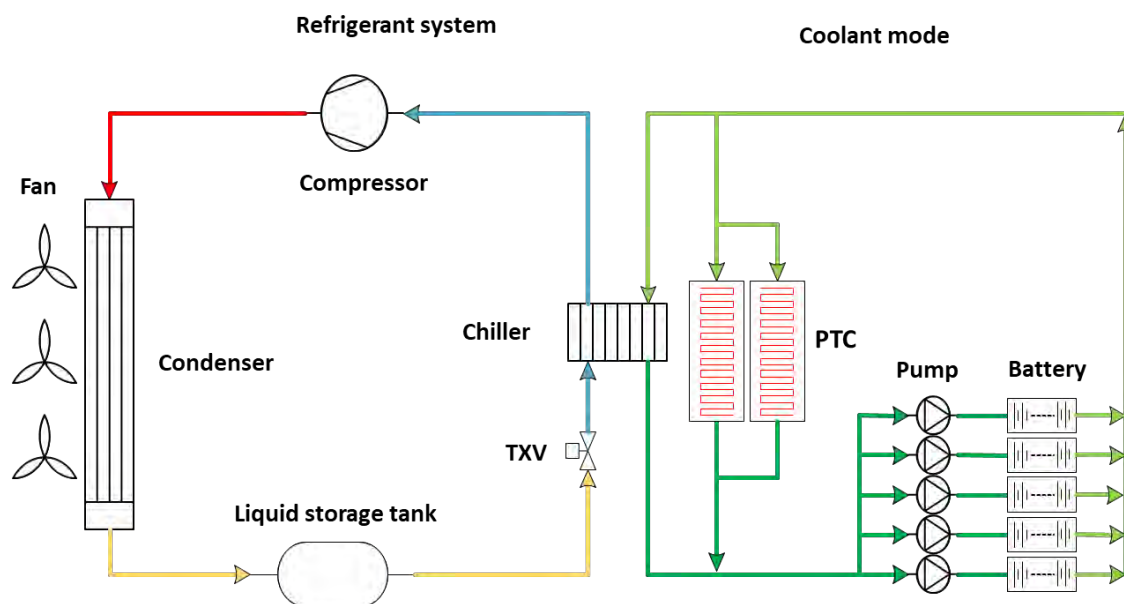


Figure 10 Architecture of Thermal Management System

The overview of cooling unit has been listed in Figure 9. EnerC+ own one high power cooling unit at the side of the container. TMS architecture can be described above (Figure 10). The composites parts are listed below:

- Compressor.** The function of compressor is to compress the low temperature and low pressure refrigerant gas into high temperature and high pressure refrigerant gas. Then the gas flow to the condenser through the pipe.
- Condenser.** The function of condenser is condensing the high temperature and high pressure refrigerant gas into ambient temperature and high pressure refrigerant liquid. Excess liquefaction heat will be taken away by the fan. Then the liquid flow to the chiller through the pipe.
- Chiller.** The function of chiller is to exchange the heat from the refrigerant liquid with the coolant. The ambient temperature and high pressure refrigerant liquid will evaporate into low temperature and low pressure refrigerant gas. The heat will transfer from the coolant to the refrigerant liquid. The low temperature coolant will flow to the cooling plate to cool the batteries while the refrigerant gas return to the compressor. The circle process will continue and the heat of battery will be taken away.
- PTC Heater.** The positive temperature co-efficiency resistance. The PTC will heat the coolant when the TMS get signals that the temperature of coolant is below the setting value. Then the coolant will be heated until the temperature increases to the setting value. The battery will be warmed up by the coolant.

e) **Pump.** The pump will force the coolant into circulating in the pipe.

6.3 TMS Specification

Table 12 Main Feature of Thermal Management System

	Coolant: Basf GLYSANTIN G30
	Max. ambient temperature: 55°C
	Power supply: 3AC 380...480V
	40kW Cooling capacity for 0.5P System
	Cooling capacity is auto-adjustable according to ambient temperature & discharge/charge status

The main features of TMS are listed above, which is shown in Table 12. The TMS will work under the ambient temperature range from -25 °C to 55 °C. The cooling power is auto-adjustable according to ambient temperature & discharge/charge status. There are four operating modes for the TMS, including shutdown mode, cooling mode, heating mode and self-circulation mode.

Table 13 Power Consumption of Thermal Management System

Type of EnerC+	0.5P System
Cooling Capacity	40kW
Maximum Heating Power	18kW
Maximum Cooling Power	31kW
EER	≥2.6(18°C@35°C)

7 User Interface

7.1 PCS Requirements

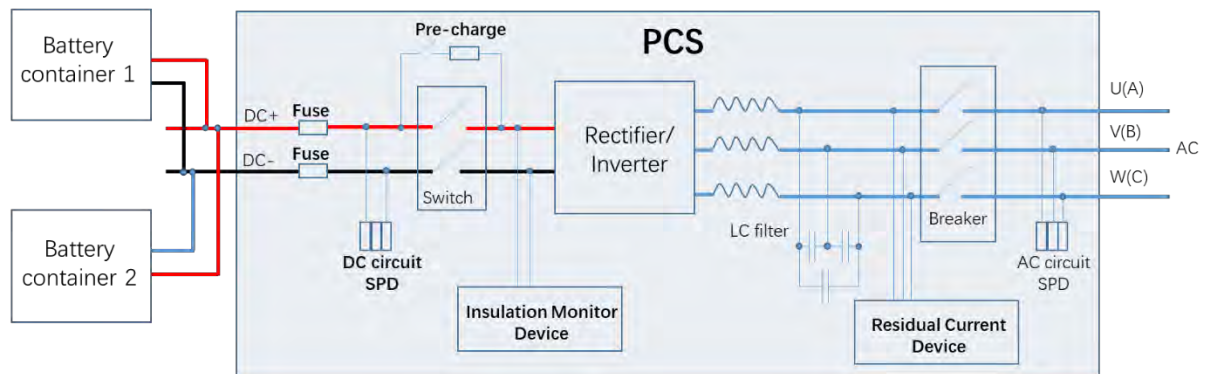


Figure 11 PCS Matching

- Please make sure to use one single copper Busbar for two battery containers cable connection for positive or negative pole in PCS side.
- Please make sure to use Fuse(F) for DC circuit in PCS. The Fuse breaking time in PCS should less than the breaking time of fuse in battery container when short circuit occurs.
- Please make sure PCS have pre-charge circuit.
- Please make sure the PCS has a main circuit switch on the DC side .
- One PCS can match up to 2 battery containers.
- PCS should have SPD in DC high voltage bus.
- PCS should have SPD in AC side.
- PCS should have insulation monitor device. BMS monitor the insulation of DC bus before battery DC relay is closed. PCS monitor the insulation of DC bus after battery DC relay is closed.
- PCS should have residual current device to monitor the leakage current on AC side.
- When the battery is in a low SOC state after discharge, the grid cannot charge the battery in time and needs short-term storage. In this scenario, it is necessary to ensure that PCS is disconnected from the battery to prevent the battery from being over discharged.

7.2 Fuse Matching

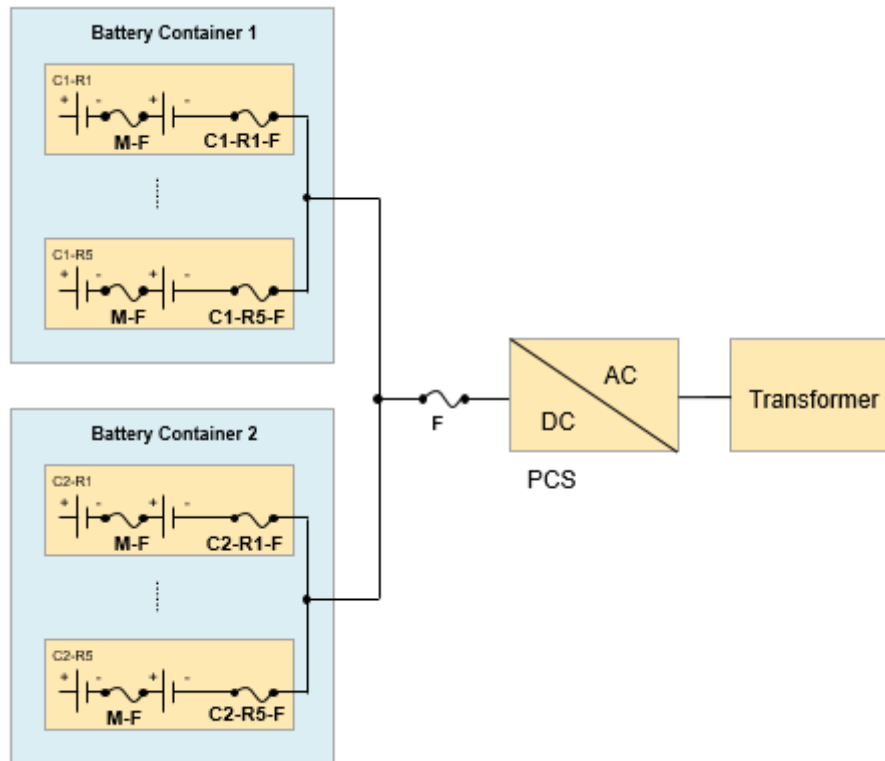


Figure 12 Fuse Matching

- The principle of fuse matching:
- Fuse Breaking Time: $F < C-R-F < M-F$.
- Voltage Level: 1500V
- One Container Fuse F Breaking ability: $> 72.72\text{kA}$
- Two Container Fuse F Breaking ability: $> 145.44\text{kA}$

1. One PCS can connect two battery containers. Every container has 5 racks .
2. One rack short circuit current is 14.544kA.
3. PCS DC side fuse is **Fuse F**.
4. Battery rack fuse is C-R-F.
5. Module fuse is M-F.

7.3 Common Mode Voltage

● One PCS for one transformer

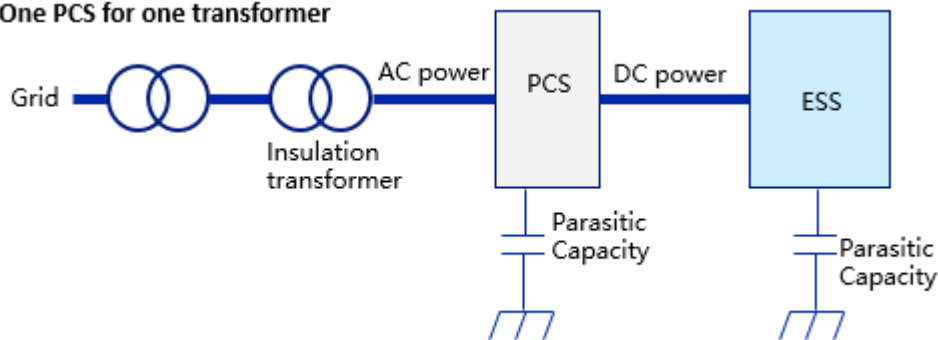


Figure 13 One PCS for One Transformer

● Multiple PCS for one transformer

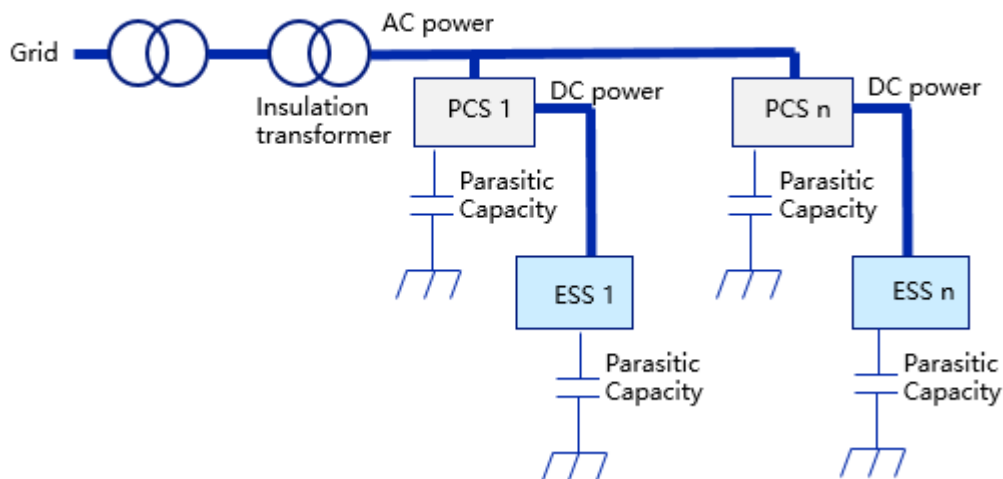
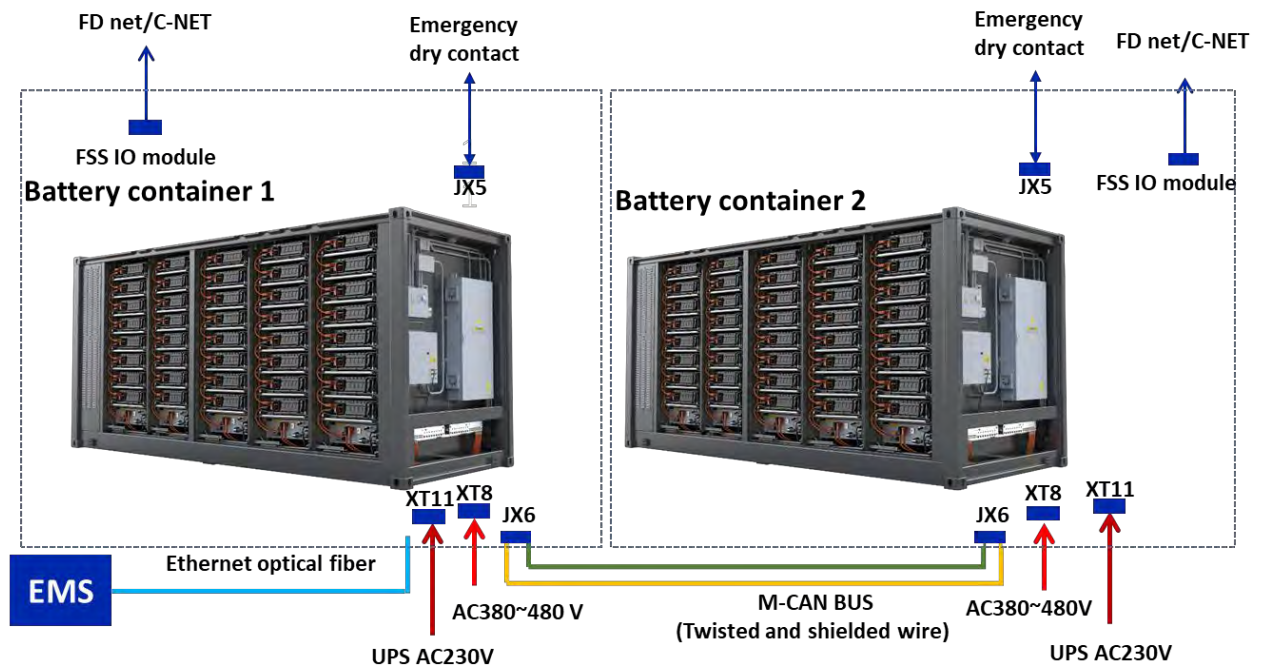


Figure 14 Multiple PCSs for One Transformer

The common mode voltage or current will affect the BESS reliability and personal safety. PCS will generate the common mode voltage and current due to the converter theory. Due to parasitic capacitance, the PCS should improve the insulation resistance isolation. And it is recommended to use insulation transformer. When multiple PCS are parallel connected, make sure that the switching of IGBT inside each PCS will not affect the other PCS to reduce the common mode voltage. The carrier synchronization should be considered in PCS control.

Common mode voltage value in DC side <100VDC, <15kHz

Make sure not to mix the AC and DC power cables, not to mix input and output cables, not to mix power cables and control cables.



8 Appendix

The attached is the triple view and the dimensions of EnerC+. The front view, the side view, the top view. The detailed installation information can be found in the users' manual.

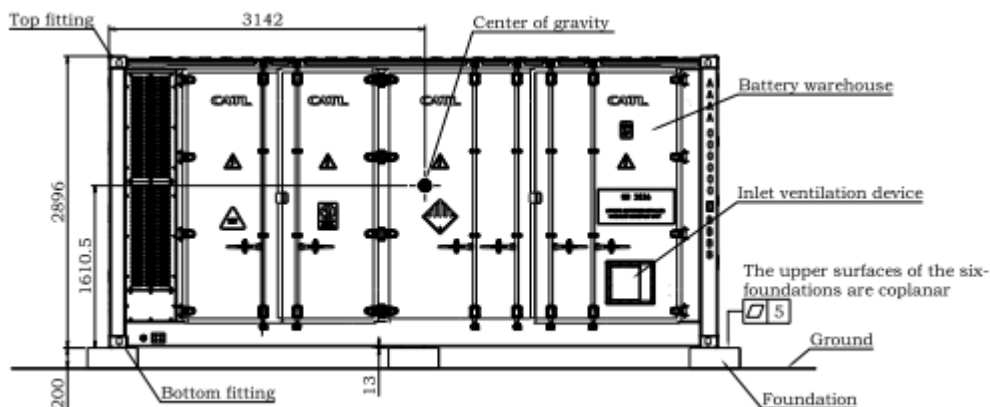


Figure 16 The Front View and Dimensions of EnerC+

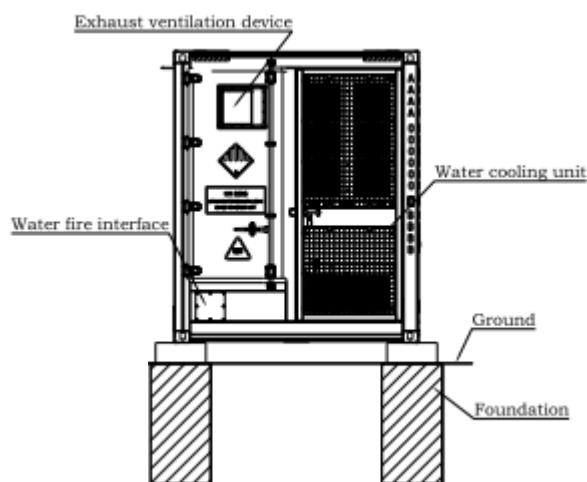


Figure 17 The Side View and Dimensions of EnerC+

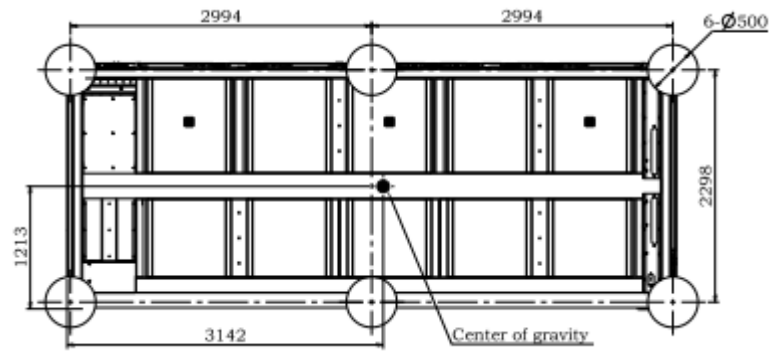


Figure 18 The Top View and Dimensions of EnerC+

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Note

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please refer top our webpage:

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APPENDIX B

Natural Resources Report



HALEY & ALDRICH, INC.
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MEMORANDUM

22 February 2024
File No. 0204839-000

TO: Windham Energy Center, LLC

FROM: Haley & Aldrich, Inc.
James Pippin, Wetland Biologist
Michael Martin, Wetland Biologist
Stephanie Grimaldi, Environmental Scientist

SUBJECT: Wetland and Stream Delineation – No Findings Memo
Windham Energy Center
Town of Killingly, Windham County, Connecticut

On behalf of Vitis Energy, Haley & Aldrich, Inc. (Haley & Aldrich) conducted a field visit to confirm that wetlands and streams are not located within and immediately adjacent to the proposed Windham Energy Center (Project). The Project Area is located adjacent and northwest of Lake Road, Town of Killingly, Windham County, Connecticut (see Figure 1). It consists of a total of approximately 20 acres, within which a proposed a battery energy storage system (BESS) and related infrastructure is proposed.

In June 2016, REMA Ecological Services, LLC (REMA) prepared a *Wetland Report: Existing Conditions* that included a formal wetland and stream delineation for property, a portion of which is now considered the Project Area. None of the delineated wetlands from the 2016 report were located within the current Project Area. Because the information provided in the prior delineation report is somewhat dated, the Haley & Aldrich evaluation is intended to confirm conditions within and near the Project Area.

Methodology

Prior to field investigations, in addition to reviewing the previously prepared report, a desktop review of publicly available data sources was conducted. Data consulted include United States Geological Survey (USGS) topographic quadrangle maps, U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps, the Natural Resources Conservation Service (NRCS) County Soil survey, Federal Emergency Management Agency (FEMA) Flood Insurance maps, the National Hydrography Dataset, and the Connecticut Environmental Conditions Online Maps and Geospatial Data.

The wetland and stream delineation was performed in accordance with criteria set forth in the U.S. Army Corps of Engineers (USACE) *Corps of Engineers Wetland Delineation Manual* (1987) and the 2012 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Supplement* (Version 2.0).

In 1972, the Connecticut state legislature enacted the Inland Wetlands and Watercourses Act (IWWA). This law establishes the regulatory process that protects the state's inland wetlands and watercourses and allows for the municipal regulation of activities affecting these aquatic resources. As a result, every municipality (169 within the state) has established an inland wetlands agency to implement and enforce the law.

Project Setting

The Project Area is bounded by wooded property and the Quinebaug River to the west; residential properties and Lake Road to the south; residential and commercial properties to the northeast; and Lake Road, commercial properties, and Alexander Lake to the east. An existing overhead electric transmission line also extends along the eastern boundary of the Project Area. One residence is located within the Study Area. The majority of the Study Area is wooded. The topography of the Study Area includes a mix of flat and uneven terrain, with a few hills located in the central and eastern portions. A map including topography and soil classifications is shown in Figure 2. USFWS NWI mapping indicates a large palustrine forested wetland and pond located to the north of the Project Area (Figure 3).

Results

Field investigations to delineate wetlands and streams within and adjacent to the Project Area were completed by Haley & Aldrich's wetland biologist, James Pippin, and environmental scientist, Stephanie Grimaldi, on 13 September 2023. A second field investigation was completed by Haley & Aldrich's wetland biologist, Michael Martin, and environmental scientist, Stephanie Grimaldi, on 8 February 2024 following adjustments to the Project Area. There were no wetlands or streams, nor any evidence of surface hydrology observed within the Project Area during either field investigations.

The vegetation cover type of the Project Area consisted primarily of white pine, with an area of mixed hardwood and open field in the easterly area adjoining the existing electric transmission line. Smaller areas of mixed forest also extend into the Project Area. Photographs are provided in Attachment A, with locations shown and habitat types indicated on Figure 4.

Soil sampling was conducted at one location within the Project Area; Upland Point 01 (see Attachment B). The soil sample location (Upland Point 01) was taken at the southern central portion of the Project Area. Silt loam soil was observed at Upland Point 01. According to the associated NRCS Soil Survey, the Soil Map Unit Name is Canton and Charlton fine sandy loams. The color observed at Upland Point 01 was 10YR 3/6 at a depth of 0 to 16 inches. The dominant species of vegetation in the area surrounding Upland Point 01 was white pine. Based on field investigations, no hydrophytic species, hydric soil, or other hydrologic indicators were observed.

The closest locations previously delineated as wetlands were observed during the field investigations. Amphibians (green frogs) were observed on 13 September 2023 in the small pond located northeast of the Project Area, which was confirmed to be outside of the Project Area boundary. The location of this small pond was consistent with the USFWS NWI mapping and the prior delineation. A photo log, including of vegetative cover, soil sample location, and other observations in the Project Area is provided in Attachment A. The location of the photos is also shown in Figure 4, along with delineation of cover types, boundaries of previously delineated off-site areas, and the location of the Upland Point.

Conclusion

Haley & Aldrich performed a wetland and stream delineation assessment on 13 September 2023 and 8 February 2024 and found no wetlands or streams, nor any evidence of surface hydrology observed within or immediately adjacent to the Project Study Area. This memorandum serves to record and document that the Project Area was evaluated for the presence of jurisdictional wetlands and/or streams, and that no jurisdictional wetlands and/or streams were recorded. This memorandum further demonstrates that Windham Energy Center, LLC has completed its due diligence pursuant to Section 401/404 and the Connecticut IWWA.

Enclosures:

- Figure 1 – Study Area Overview
- Figure 2 – Topography and Soils
- Figure 3 – Federal and State Mapped Aquatic Resources
- Figure 4 – Delineated Features

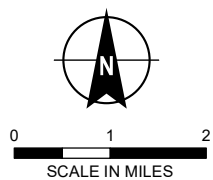
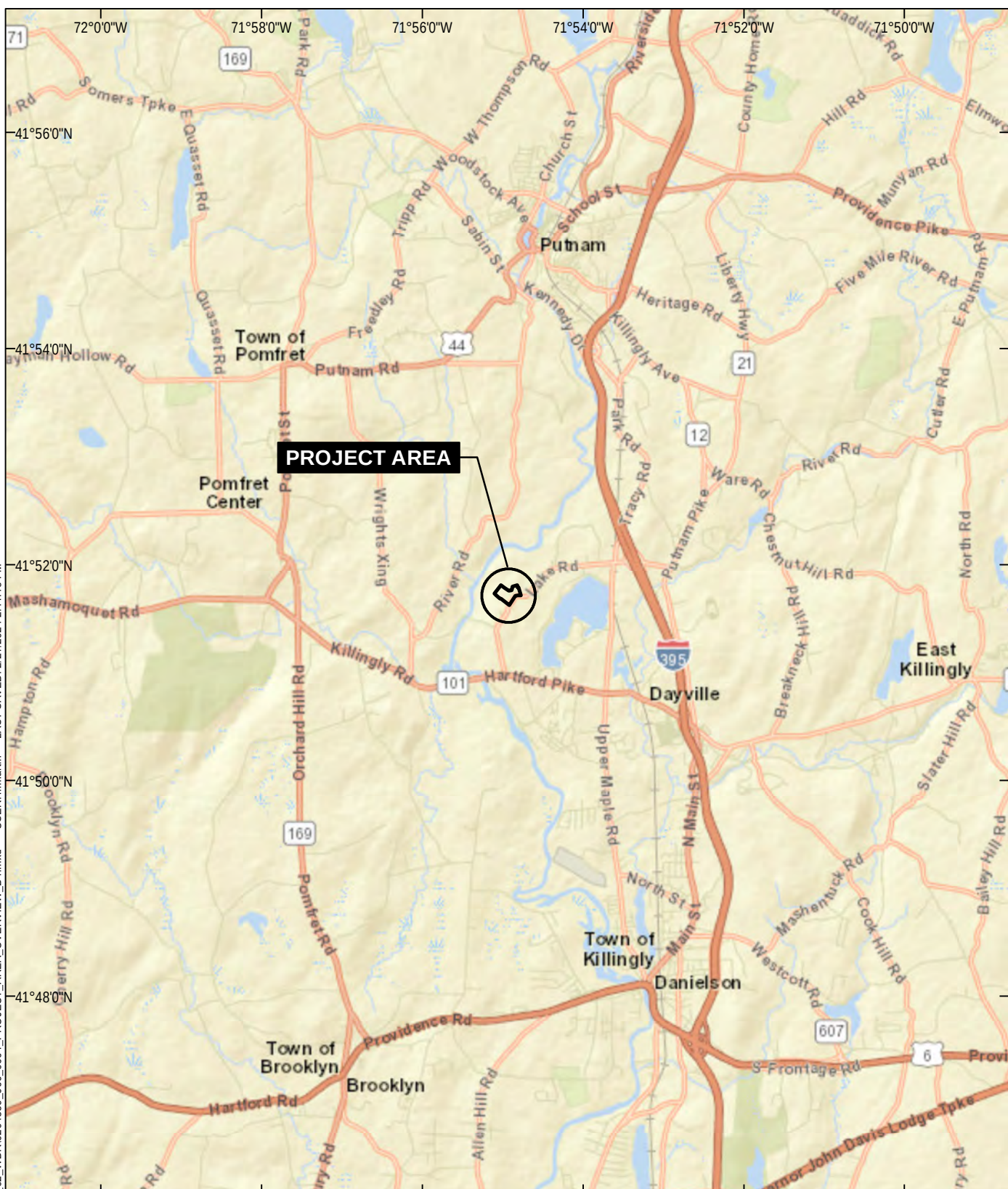
Attachment A – Photo Log

Attachment B – Routine Wetland Determination and Stream Inventory Forms

\\haleyaldrich.com\share\CF\Projects\0204839\Wetlands-Natural Resources\2024-02-08_Site Visit\Memo\2024-0222_WEC - No Findings Memo.docx

FIGURES

GIS FILE PATH: Z:\0204839\GIS\Maps\2024_02_WDR\0204839_000_0001_PROJECT_AREA_OVERVIEW_D1.mxd — USER: mmartin — LAST SAVED: 2/21/2024 2:41:43 PM



MAP SOURCE: ESRI
SITE COORDINATES: 41°51'44"N, 71°54'54"W

**HALEY
ALDRICH**

WINDHAM ENERGY CENTER
KILLINGLY, CONNECTICUT

PROJECT AREA OVERVIEW

APPROXIMATE SCALE: 1 IN = 2 MI
FEBRUARY 2024

FIGURE 1

GIS FILE PATH: Z:\0204839\GIS\Maps\2024_02_WDR\0204839_000_0002_PROJECT_AREA_TOPOGRAPHY_AND_SOILS_D1.mxd — USER: rmartin — LAST SAVED: 2/21/2024 2:45:53 PM



PROJECT AREA SOILS

- 3: RIDGEBURY, LEICESTER, AND WHITMAM SOILS, 0 TO 8 PERCENT SLOPES, EXTREMELY STONY
- 61B: CANTON AND CHARLTON FINE SANDY LOAMS, 0 TO 8 PERCENT SLOPES, VERY STONY
- 62C: CANTON AND CHARLTON FINE SANDY LOAMS, 3 TO 15 PERCENT SLOPES, EXTREMELY STONY
- 73C: CHARLTON-CHATFIELD COMPLEX, 15 TO 45 PERCENT SLOPES, VERY ROCKY

LEGEND

 PROJECT AREA

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. BASE MAP SOURCE: USGS



0 500 1,000
SCALE IN FEET

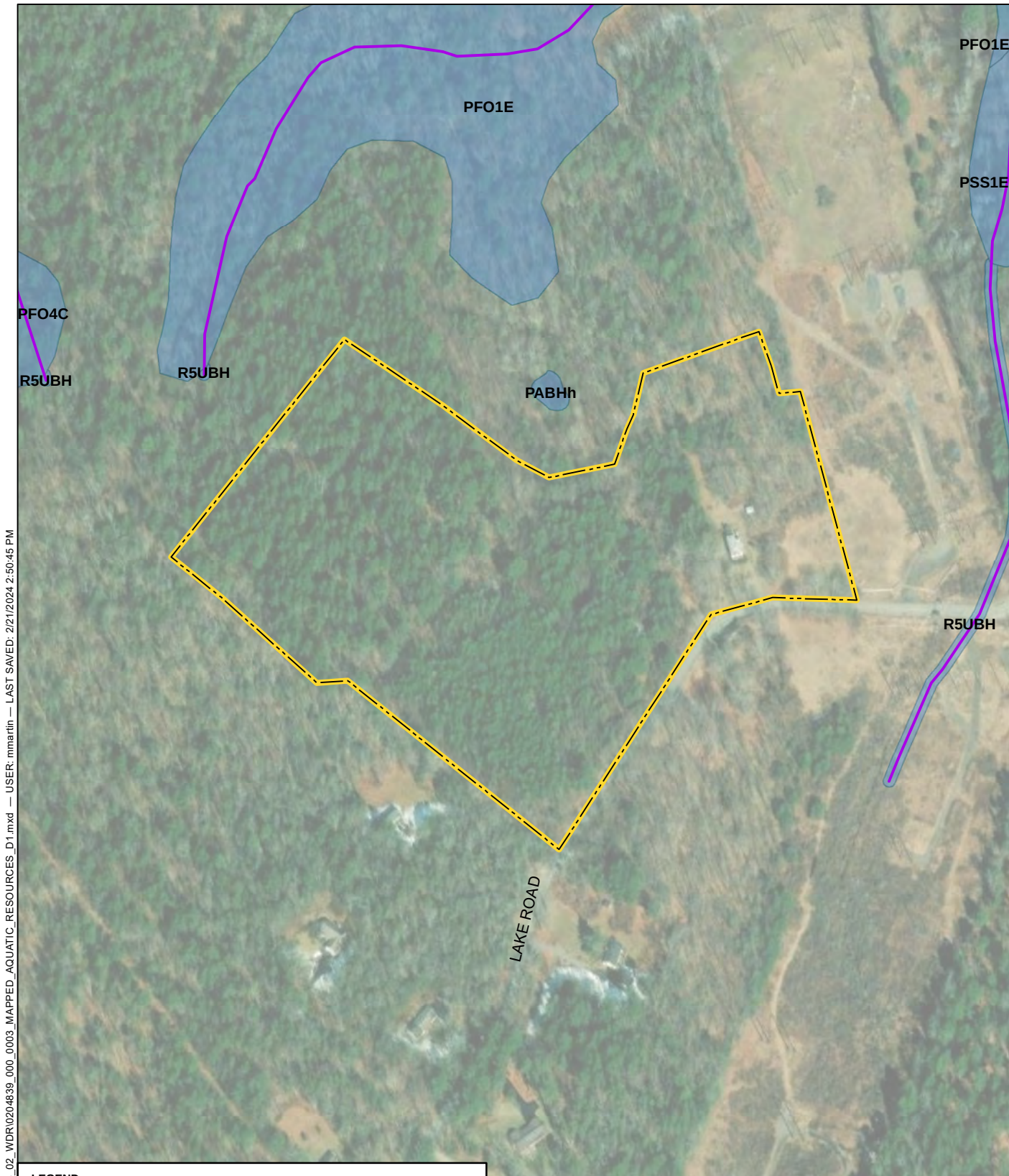
**HALEY
ALDRICH**

WINDHAM ENERGY CENTER
KILLINGLY, CONNECTICUT

**PROJECT AREA TOPOGRAPHY
AND SOILS**

SCALE: AS SHOWN
FEBRUARY 2024

FIGURE 2



GIS FILE PATH: Z:\0204839\GIS\Maps\2024_02_WDR\0204839_000_0003_MAPPED_AQUATIC_RESOURCES_D1.mxd — USER: mmartin — LAST SAVED: 2/21/2024 2:50:45 PM

LEGEND

-  MAPPED NHD
-  NWI MAPPED
-  PROJECT AREA

NOTES

1. NHD STREAM DATA SOURCE: U.S. GEOLOGICAL SURVEY
2. NWI WETLAND DATA SOURCE: U.S. FISH AND WILDLIFE SERVICE
3. AERIAL IMAGERY SOURCE: ESRI



0 150 300
SCALE IN FEET

**HALEY
ALDRICH**

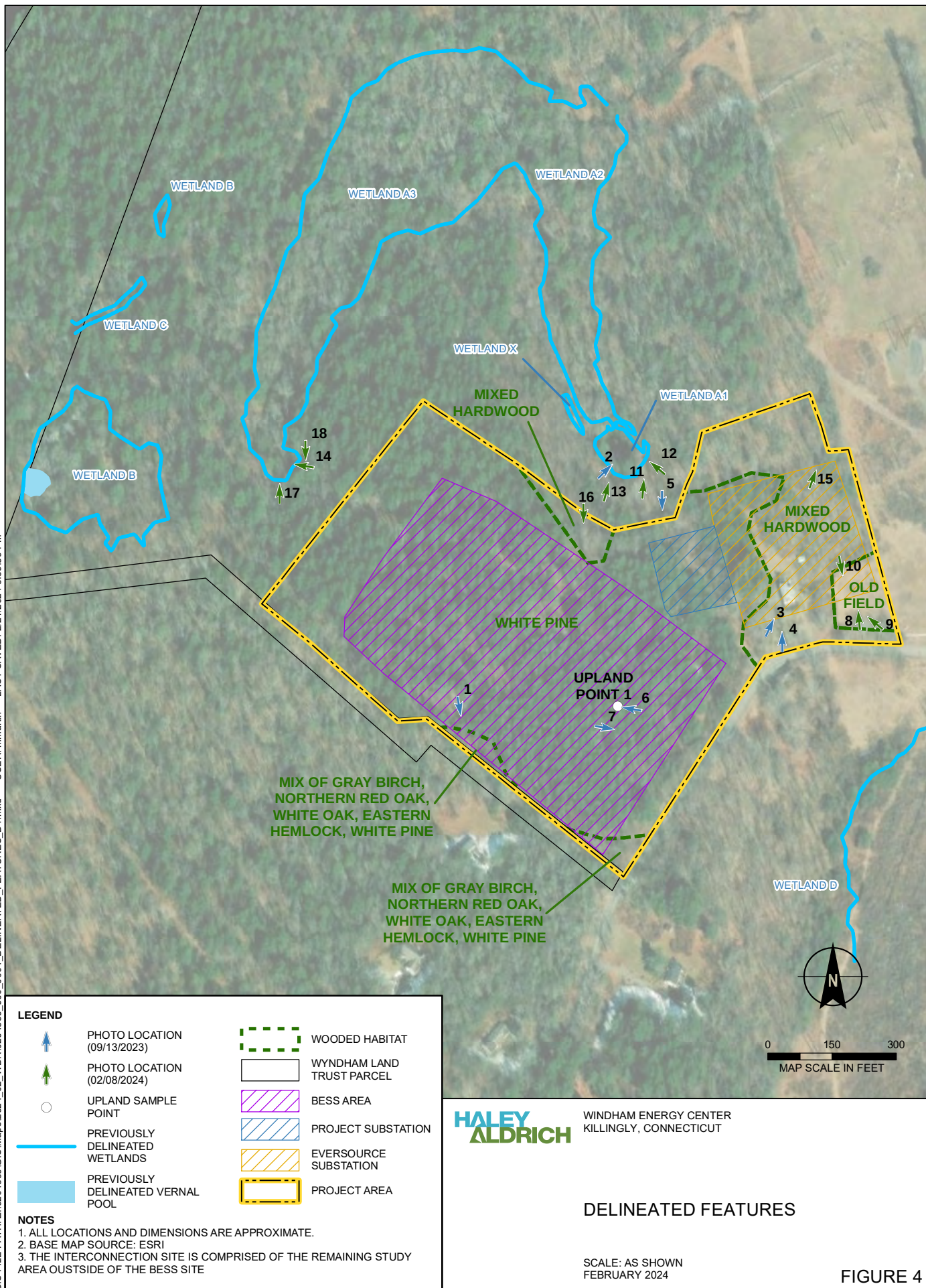
WINDHAM ENERGY CENTER
KILLINGLY, CONNECTICUT

**FEDERAL AND STATE
MAPPED AQUATIC RESOURCES**

SCALE: AS SHOWN
FEBRUARY 2024

FIGURE 3

GIS FILE PATH: Z:\0204839\GIS\Maps\2024_02_WDR\0204839_000_0004_DELINEATED_FEATURES_D1.mxd — USER: mmartin — LAST SAVED: 2/21/2024 3:59:59 PM



ATTACHMENT A

Photo Log



Photo 1: View of typical vegetation cover in the Project Area.



Photo 2: View of a small pond located northeast of the proposed Project Area consistent with NWI mapping and former delineations; confirmed to be outside of the Project Area.



Photo 3: View of the residence located within the Project Area.



Photo 4: View of the herbaceous layer located at the residence within the Project Area.



Photo 5: White pine stand within the Project Area.



Photo 6: View of the soil sample taken at Upland Point 01.



Photo 7: View of white pine surrounding Upland Point 01.



Photo 8: Old field located on the eastern side of the proposed Eversource substation area, facing north.



Photo 9: Old field located on the eastern side of the proposed Eversource substation area, facing northwest.



Photo 10: Old field located on the eastern side of the proposed Eversource substation area, facing south.



Photo 11: Covered spring outside of Study Area, facing north.



Photo 12: Spring entering the pond north of the Project Area, facing northwest. This stream begins at the point of which the photo is taken and is located outside of the Project Area.



Photo 13: Spring fed pond located outside of the Project Area, facing northeast.



Photo 14: View of wetland from the spring located north of the Project Area, facing northwest.



Photo 15: East portion of the Project Area, facing northeast.



Photo 16: Stone wall in the central portion of the Project Area, facing south.



Photo 17: Wetland located north of the Project Area, facing north.



Photo 18: Spring located north of the Project Area.

ATTACHMENT B

Wetland Determination and Stream Inventory Data Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Windham Energy Center City/County: Windham County Sampling Date: 2023-09-13
Applicant/Owner: Vitis Energy State: Connecticut Sampling Point: Upland Point 1
Investigator(s): Pippin/Grimaldi Section, Township, Range: Killingly
Landform (hillslope, terrace, etc.): Hill Local relief (concave, convex, none): Convex Slope (%): 5
Subregion (LRR or MLRA): R 144A Lat: 41.86160892 Long: -71.91530792 Datum: WGS 84
Soil Map Unit Name: Canton and Charlton fine sandy loams NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No ☒	Is the Sampled Area within a Wetland? Yes _____ No ☒ If yes, optional Wetland Site ID: _____
Hydric Soil Present? Yes _____ No ☒	
Wetland Hydrology Present? Yes _____ No ☒	
Remarks: (Explain alternative procedures here or in a separate report.) Not a wetland	

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (minimum of two required)
Primary Indicators (minimum of one is required; check all that apply)		_____ Surface Soil Cracks (B6)
_____ Surface Water (A1)	_____ Water-Stained Leaves (B9)	_____ Drainage Patterns (B10)
_____ High Water Table (A2)	_____ Aquatic Fauna (B13)	_____ Moss Trim Lines (B16)
_____ Saturation (A3)	_____ Marl Deposits (B15)	_____ Dry-Season Water Table (C2)
_____ Water Marks (B1)	_____ Hydrogen Sulfide Odor (C1)	_____ Crayfish Burrows (C8)
_____ Sediment Deposits (B2)	_____ Oxidized Rhizospheres on Living Roots (C3)	_____ Saturation Visible on Aerial Imagery (C9)
_____ Drift Deposits (B3)	_____ Presence of Reduced Iron (C4)	_____ Stunted or Stressed Plants (D1)
_____ Algal Mat or Crust (B4)	_____ Recent Iron Reduction in Tilled Soils (C6)	_____ Geomorphic Position (D2)
_____ Iron Deposits (B5)	_____ Thin Muck Surface (C7)	_____ Shallow Aquitard (D3)
_____ Inundation Visible on Aerial Imagery (B7)	_____ Other (Explain in Remarks)	_____ Microtopographic Relief (D4)
_____ Sparsely Vegetated Concave Surface (B8)		_____ FAC-Neutral Test (D5)
Field Observations:		Wetland Hydrology Present? Yes _____ No ☒
Surface Water Present? Yes _____ No ☒ Depth (inches): _____		
Water Table Present? Yes _____ No ☒ Depth (inches): _____		
Saturation Present? Yes _____ No ☒ Depth (inches): _____ (includes capillary fringe)		
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:		
No hydrologic data supporting this as wet.		
Remarks: No hydrology or indicators of hydrology observed.		

Sampling Point: Upland Point 1

<u>Tree Stratum</u> (Plot size: <u>30 ft r</u>)				Absolute % Cover	Dominant Species?	Indicator Status
1.	<u>Pinus strobus</u>			<u>80</u>	<u>✓</u>	<u>FACU</u>
2.						
3.						
4.						
5.						
6.						
7.						
				<u>80</u>	= Total Cover	
<u>Sapling/Shrub Stratum</u> (Plot size: <u>15 ft r</u>)						
1.						
2.						
3.						
4.						
5.						
6.						
7.						
				<u>0</u>	= Total Cover	
<u>Herb Stratum</u> (Plot size: <u>5 ft r</u>)						
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
				<u>0</u>	= Total Cover	
<u>Woody Vine Stratum</u> (Plot size: <u>30 ft r</u>)						
1.						
2.						
3.						
4.						
				<u>0</u>	= Total Cover	
Remarks: (Include photo numbers here or on a separate sheet.)						
No hydrophytic vegetation observed						

Dominance Test worksheet:	
Number of Dominant Species That Are OBL, FACW, or FAC:	<u>0</u> (A)
Total Number of Dominant Species Across All Strata:	<u>1</u> (B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	<u>0.00</u> (A/B)
Prevalence Index worksheet:	
Total % Cover of:	Multiply by:
OBL species <u>0</u>	x 1 = <u>0</u>
FACW species <u>0</u>	x 2 = <u>0</u>
FAC species <u>0</u>	x 3 = <u>0</u>
FACU species <u>80</u>	x 4 = <u>320</u>
UPL species <u>0</u>	x 5 = <u>0</u>
Column Totals: <u>80</u>	(A) <u>320</u> (B)
Prevalence Index = B/A = <u>4.00</u>	
Hydrophytic Vegetation Indicators:	
<u> </u> 1 - Rapid Test for Hydrophytic Vegetation	
<u> </u> 2 - Dominance Test is >50%	
<u> </u> 3 - Prevalence Index is ≤3.0 ¹	
<u> </u> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)	
<u> </u> Problematic Hydrophytic Vegetation ¹ (Explain)	
¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.	
Definitions of Vegetation Strata:	
Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.	
Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.	
Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.	
Woody vines – All woody vines greater than 3.28 ft in height.	
Hydrophytic Vegetation Present?	Yes <u> </u> No <u>✓</u>

SOIL

Sampling Point: Upland Point 1**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0 - 16	10YR 3/6	100					Silt Loam	Non hydric soil.
-								
-								
-								
-								
-								
-								
-								
-								
-								
-								
-								
-								
-								
-								
-								

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.²Location: PL=Pore Lining, M=Matrix.**Hydric Soil Indicators:**

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

Indicators for Problematic Hydric Soils³:

- ☐ 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**)
☐ 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)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ☒

Remarks:

No hydric soil indicators observed.

APPENDIX C
Species Correspondence



United States Department of the Interior



FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To:
Project Code: 2024-0045731
Project Name: Windham Energy Center

February 06, 2024

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:

Updated 4/12/2023 - Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.

About Official Species Lists

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. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

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 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. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested by returning to an existing project's page in IPaC.

Endangered Species Act Project Review

Please visit the “**New England Field Office Endangered Species Project Review and Consultation**” website for step-by-step instructions on how to consider effects on listed

species and prepare and submit a project review package if necessary:

<https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review>

NOTE Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

Northern Long-eared Bat - (Updated 4/12/2023) The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule went into effect on March 31, 2023. You may utilize the **Northern Long-eared Bat Rangewide Determination Key** available in IPaC. More information about this Determination Key and the Interim Consultation Framework are available on the northern long-eared bat species page:

<https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis>

For projects that previously utilized the 4(d) Determination Key, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective. If your project was not completed by March 31, 2023, and may result in incidental take of NLEB, please reach out to our office at newengland@fws.gov to see if reinitiation is necessary.

Additional Info About Section 7 of the Act

Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines 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 Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. 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:

<https://www.fws.gov/service/section-7-consultations>

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) 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. Please contact NEFO if you would like more information.

Candidate species that appear on the enclosed species list have no current protections under the ESA. The species' occurrence on an official species list does not convey a requirement to

consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

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/program/migratory-bird-permit>

<https://www.fws.gov/library/collections/bald-and-golden-eagle-management>

Please feel free to contact us at **newengland@fws.gov** with your **Project Code** in the subject line if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat.

Attachment(s): Official Species List

Attachment(s):

- Official Species List

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 England Ecological Services Field Office

70 Commercial Street, Suite 300

Concord, NH 03301-5094

(603) 223-2541

PROJECT SUMMARY

Project Code: 2024-0045731

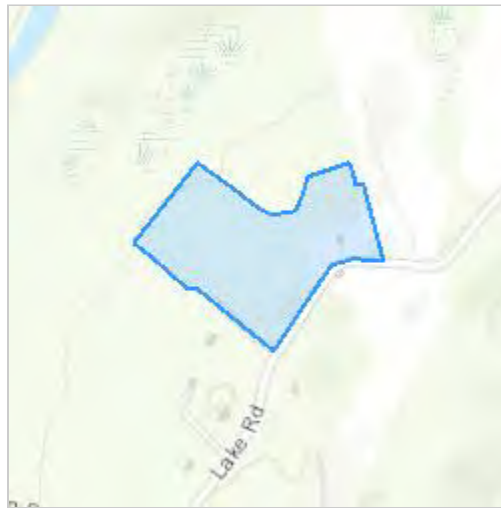
Project Name: Windham Energy Center

Project Type: Power Gen - Other

Project Description: WEC is proposing the development and operation of the Windham Energy Center within an approximately 20-acre property located west of Lake Road in the Town of Killingly, Connecticut (the Project Site).

Project Location:

The approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@41.8620594,-71.91559413096917,14z>



Counties: Windham County, Connecticut

ENDANGERED SPECIES ACT SPECIES

There is a total of 2 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 Fisheries¹, 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.

-
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
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> 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.

IPAC USER CONTACT INFORMATION

Agency: Haley & Aldrich
Name: Audrey West
Address: 8899 Gander Creek Drive
City: Miamisburg
State: OH
Zip: 45342
Email: awest@haleyaldrich.com
Phone: 6033913325



10/10/2023

Lynn Gresock
HALEY & ALDRICH, INC.
3 BEDFORD FARMS DR
BEDFORD, NH 03110
lgresock@haleyaldrich.com

Subject: Windham Energy Center

Filing #: 101310

NDDB - New Determination Number: 202307235

Expiration Date: 10/10/2025

Location: Northwest of Lake Rd, between 345-kv Eversource line and Cotton Bridge, Killingly, CT

I have reviewed Natural Diversity Data Base (NDDB) maps and files regarding this project. According to our records, there are State-listed species (RCSA Sec. 26-306) documented nearby the proposed project area.

Frosted elfin (*Callophrys irus*)- State Threatened

Fragile dagger moth (*Acronicta fragilis*)- State Special Concern

Eastern box turtle (*Terrapene carolina carolina*)- State Special Concern

Wood turtle (*Glyptemys insculpta*)- State Special Concern

Red bat (*Lasiurus borealis*)- State Special Concern

Frosted elfin (*Callophrys irus*)- State Threatened

Populations of frosted elfin (*Callophrys irus*) are declining nationally. The frosted elfin holds the distinction of being the non-federally listed butterfly with the greatest number of state level listings. Its major threats are urban development or agricultural development, vegetation management that results in declines in hostplant populations, and pesticide use. This butterfly in Connecticut is primarily associated with the plant species wild indigo (*Baptisia tinctoria*), and secondarily, wild blue lupine (*Lupinus perennis*). The host plant, *Baptisia tinctoria*, prefers at least 6 hours of direct sun, and well-drained soil. The butterfly lays a single egg on the hostplant, and the caterpillars eat the leaves of the host plant. The butterfly hibernates in a loose cocoon in litter beneath the plant. It is important to retain areas of leaf litter around host plants for overwintering and provide other flowering plants to provide nectar nearby.

Fragile dagger moth (*Acronicta fragilis*)- State Special Concern

Habitat: Woodlands and forests, but anecdotal suggestions that nearby rock outcrops in open areas may be important.

- Do not use pesticides directed at gypsy moth in your project area.
- Maintaining and creating connectivity of frosted elfin colonies is important and is likely to be critical for long term persistence of populations. If suitable habitat exists on your site, you should manage for host plants.
- If supplementing habitat, do not supplement with nursery stocks. Instead, gather seed and spread on soil.

We recommend where suitable habitat exists, you identify and protect suitable habitat and host plants (if applicable) for this state species in your project area. You can benefit this species by seeking help from an invertebrate biologist or plant ecologist to create a management plan to enhance habitat where opportunities exist. Keep the following recommendations in mind as you manage your habitat:

- Minimize ground impact to sensitive habitat, and do not import other types of permanent fill.
- To the extent practicable, conduct construction activities in winter months when plants are dormant and ground may be frozen.
- If sensitive habitats are disturbed, it is best to allow them to revegetate naturally or propagate only locally collected seed. Avoid commercially available seed mixes. They include plant species which are not considered native to Connecticut. Even mixes marketed as 'New England' or 'Northeast' mixes include high percentages of species not native to the Connecticut or the region. Additionally, commercially available seed mixes include plants that are listed as invasive in CT or which include non-local genotypes.
- Minimize the use of pesticides and herbicides in general and consider alternatives. Take precautions that species are not impacted by chemical use including using spot treatment techniques.

Eastern box turtle

In Connecticut, these turtles are found in well-drained forest bottomlands and a matrix of open deciduous forests, early successional habitat, fields, gravel pits, and or powerlines. Turtles are dormant between November 1 and April 1 and hibernate in only a few inches from the surface in forested habitat. The greatest threat to this species is habitat loss, fragmentation, and degradation due to development.

Land disturbance activities need to consider local habitat features and apply fencing and/or time of year restrictions as appropriate. We recommend you consult with a herpetologist familiar with preferred habitats to assist you with proper techniques to ensure the best protection strategies are employed for your site and the scope of your project.

Your project indicates that ground disturbance work will occur in an area that is forested and is potential overwintering habitat for Eastern box turtle. To minimize collision with these species during their breeding season, I recommend you:

- Do not begin ground disturbance work in forested habitat between November 1- March 31.

For construction work conducted between March 16- October 31:

- Exclusionary practices will be used to prevent any herp access into disturbance areas. These measures will need to be installed at the limits of disturbance as shown on the plans, or specifically designated by a herpetologist who can assess the conditions at your site.

Exclusionary fencing be at least 20 in tall and must be secured to and remain in contact with the ground and be regularly maintained (at least bi-weekly and after major weather events) to secure any gaps or openings at ground level that may let animal pass through.

- All staging and storage areas, outside of previously paved locations, regardless of the duration of time they will be utilized, must be reviewed to remove individuals and exclude them from re-entry.
- All construction personnel working within the turtle habitat must be apprised of the species description and the possible presence of a listed species.
- The Contractor search the work area each morning prior to any work being done.
- Any turtles encountered within the immediate work area shall be carefully moved to an adjacent area outside of the excluded area and fencing should be inspected to identify and remove access point. This animal is protected by law and should not be relocated off-site.
- In areas where silt fence is used for exclusion, it shall be removed as soon as the area is stable and disturbance is finished to allow for reptile and amphibian passage to resume.

Red bat (*Lasiurus borealis*)- State Special Concern

Red bats are a migratory “tree bat” species that is found throughout Connecticut between April- October in a variety of forested habitats. They roost out in the foliage of deciduous and coniferous trees, camouflaged as dead leaves or cones. Red bats are primarily solitary roosters. They can be found roosting and feeding around forest edges and clearings. Typically, larger diameter trees (12-inch DBH and larger) are more valuable to these bats. Additionally, trees with loose, rough bark such as maples, hickories, and oaks are more desirable than other tree species due to the increased cover that the loose bark provides. Large trees with cavities are also utilized by this species.

- Do not remove trees between May 15- July 21 to protect the critical period for flightless tree roosting bat pups.

Your submission information indicates that your project requires a state permit, license, registration, or authorization, or utilizes state funding or involves state agency action. This NDDB - New determination may be utilized to fulfill the Endangered and Threatened Species requirements for state-issued permit applications, licenses, registration submissions, and authorizations.

Please be aware of the following limitations and conditions:

Natural Diversity Database information includes all information regarding listed species available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Natural History Survey and cooperating units of DEEP, land owners, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as enhance existing data. Such new information is incorporated into the Database and accessed through the ezFile portal as it becomes available. New information may result in additional review, and new or modified restrictions or conditions may be necessary to remain in compliance with certain state permits.

- During your work listed species may be encountered on site. A report must be submitted by the observer to the Natural Diversity Database promptly and additional review and restrictions or conditions may be necessary to remain in compliance with certain state permits. Please fill out the [appropriate survey form](#) and follow the instructions for submittal.
- Your project involves the state permit application process or other state involvement, including state funding or state agency actions; please note that consultations with your permit analyst or the agency

may result in additional requirements. In this situation, additional evaluation of the proposal by the DEEP Wildlife Division may be necessary and additional information, including but not limited to species-specific site surveys, may be required. Any additional review may result in specific restrictions or conditions relating to listed species that may be found at or in the vicinity of the site.

- If your project involves preparing an Environmental Impact Assessment, this NDDDB consultation and determination should not be substituted for biological field surveys assessing on-site habitat and species presence.
- The NDDDB - New determination for the Windham Energy Center as described in the submitted information and summarized at the end of this document is valid until 10/10/2025. This determination applies only to the project as described in the submission and summarized at the end of this letter. Please re-submit an updated Request for Review if the project's scope of work and/or timeframe changes, including if work has not begun by 10/10/2025.

If you have further questions, please contact me at the following:

Shannon Kearney
CT DEEP Bureau of Natural Resources
Wildlife Division
Natural Diversity Database
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3170
Shannon.Kearney@ct.gov

Please reference the Determination Number 202307235 when you e-mail or write. Thank you for consulting the Natural Diversity Data Base.

Shannon Kearney
Wildlife Division- Natural Diversity Data Base
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3170
Shannon.Kearney@ct.gov

Application Details:

Project involves federal funds or federal permit:	No
Project involves state funds, state agency action, or relates to CEPA request:	Yes
Project requires state permit, license, registration, or authorization:	Yes
DEEP enforcement action related to project:	
Project Type:	Energy and Utility Production Facilities and Distribution Infrastructure
Project Sub-type:	New facility construction
Project Name:	Windham Energy Center
Project Description:	Approximately 11 acres for the proposed BESS facility and approximately 14 acres to encompass Eversource electrical interconnection components. Both properties



Connecticut
**Department of Energy &
 Environmental Protection**
WILDLIFE DIVISION

CPPU USE ONLY

App #: _____
 Doc #: _____
 Check #: No fee required
 Program: Natural Diversity Database
 Endangered Species
 Hardcopy _____ Electronic _____

Request for Natural Diversity Data Base (NDDDB) State Listed Species Review

This form was auto-populated with information provided through the DEEP ezFile portal NDDDB review application.
There are no fees associated with NDDDB Reviews.

Part I: Preliminary Screening & Request Type

Before submitting this request, you must review the most current Natural Diversity Data Base "State and Federal Listed Species and Significant Natural Communities Maps" found on the [DEEP website](#). These maps are updated twice a year, usually in June and December.

This form is being submitted for a:

☒ New NDDDB request ☐ <i>Renewal of a NDDDB Request without modifications and within two years of issued NDDDB determination (no attachments required)</i> [CPPU Use Only - NDDDB-Listed Species Determination # 1736]	☐ New Safe Harbor Determination ; must be associated with an application for a GP for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities (Attachment D of this form is required) ☐ <i>Renewal/Extension of an existing Safe Harbor Determination</i> ☐ With modifications ☐ Without modifications (no attachments required) [CPPU Use Only - NDDDB-Safe Harbor Determination # 1736]
--	---

Enter NDDDB Determination Number for Renewal:

Enter Safe Harbor Determination Number for Renewal/Extension:

1. Does your project utilize federal funds or require a federal permit? ☐ Yes ☒ No

If yes, your project may be subject to Federal rules regarding the Northern long-eared bats or other federally listed species. Information on the Northern long-eared bat and the 4-D rule may be found at:

<http://www.fws.gov/midwest/endangered/mammals/nleb/>

Information on other federally listed species and Section 7 consultations may be found at:

<https://www.fws.gov/newengland/EndangeredSpec-Consultation.htm>

2. Does your project utilize state funding, involve state agency actions, or relate to a CEPA request?

☒ Yes ☐ No

3. Does your project require state permits, licenses, registrations or authorizations? ☒ Yes ☐ No

If yes, list permit type(s): Stormwater Discharge – Construction

If an active enforcement action exists regarding this project, enter number:

If known, enter DEEP analysts reviewing this project: Connecticut Siting Council (not listed above)

II: Requester Information

If the requester is a corporation, limited liability company, limited partnership, limited liability partnership, or a statutory trust, it must be registered with the Secretary of the State. If applicable, the name shall be stated **exactly as it is registered with the Secretary of the State. Please note, for those entities registered with the Secretary of the State, the registered name will be the name used by DEEP. This information can be accessed at the Secretary of the State's Business Records Search. (<https://service.ct.gov/business/s/onlinebusinesssearch>)*

If the requester is an individual, provide the legal name (include suffix) in the following format: First Name; Middle Initial; Last Name; Suffix (Jr, Sr., II, III, etc.).

If there are any changes or corrections to your company/facility or individual mailing or billing address or contact information, please complete and submit the [Request to Change company/Individual Information](#) to the address indicated on the form.

1. Requester*

Company Name: HALEY & ALDRICH, INC.

Contact Name: Lynn Gresock

Address: 3 BEDFORD FARMS DR

City/Town: BEDFORD

State: NH

Zip Code: 03110

Business Phone: 16033913325 Ext:

**E-mail: lgresock@haleyaldrich.com

****By providing this email address you are agreeing to receive official correspondence from the department, at this electronic address, concerning this request. Please remember to check your security settings to be sure you can receive emails from "ct.gov" addresses. Also, please notify the department if your e-mail address changes**

a) Requester can best be described as:

☐ Individual ☐ Federal Agency ☐ State agency

☐ Municipality ☐ Tribal ☒ *business entity (* if a business entity complete i through iii):

i) Check type ☐ corporation

☐ limited liability company

☐ limited partnership

☐ limited liability partnership

☐ statutory trust

☐ Other:

- ii) Provide Secretary of the State Business ID #: 0168234 This information can be accessed at the Secretary of the State's Business Records Search (<https://service.ct.gov/business/s/onlinebusinesssearch>)
- iii) ☐ Check here if your business is **NOT** registered with the Secretary of the State's office.

b) Acting as (Affiliation), pick one:

☐ Property owner

☐ Consultant

☐ Engineer

☐ Facility owner

☒ Applicant

☐ Biologist

☐ Pesticide Applicator

☐ Other representative:

Part III: Site Information

This request can only be completed for one site. A separate request must be filed for each additional site.

SITE NAME AND LOCATION

Project Name (for use in correspondence): Windham Energy Center

If your Project site has a street address, please enter below:

Street Address:

Town(s):

If your Project has no street address, please enter a description of the site location:

Location Description: Northwest of Lake Road, between the 345-kV Eversource transmission lines and Cotton Bridge Road.

Town(s): Killingly

Size in acres, or site dimensions: 24.79

Describe existing land conditions:

he WEC Study Area consists of approximately 25 acres. Approximately 11 acres is the location of the proposed battery energy storage system project (the Project Site); this portion of the Study Area includes residences and residential yards (structures, maintained lawns, and formal landscaping), as well as upland forested land, including oak and birch/locust dominated deciduous woods, white pine and Eastern hemlock dominated evergreen woods, and mixed deciduous/evergreen woods.

This request also includes approximately 14 acres of the Study Area, portions of which are intended for use for an Eversource substation and electric transmission corridor (the

Interconnection Site) to reach the existing 345-kilovolt electric transmission infrastructure. This portion of the Study Area consists of upland forested land.

Of the total Study Area, approximately 6.5% is residential, and 93.5% is upland forest of varying kinds, as show on the attached materials.

Part IV: Project Information

1. **Project Type:**

Choose Project Category: Construction, Development

Choose Project Type: Energy and Utility Production Facilities and Distribution Infrastructure

Choose Project Subtype: New facility construction

2. Brief Project Description: Approximately 11 acres for the proposed BESS facility and approximately 14 acres to encompass Eversource electrical interconnection components. Both properties consist of residences and residential yards as well as upland forest.

3. Provide a schedule for all phases of the project including the year, the month that the proposed activity will be initiated and the duration of the activity.

Construction start is planned for Q4 2024, with an approximately 14-month construction schedule; operation is planned by the end of 2025.

4. Is the subject activity limited to the maintenance, repair, or improvement of an existing structure within the existing footprint? ☐ Yes ☒ No If yes, add explanation in No. 4 below.

5. Give a detailed description of the activity which is the subject of this request and describe the methods and equipment that will be used. Include a description of steps that will be taken to minimize impacts to any known listed species.

Approximately 11 acres of the Study Area will be developed as a BESS facility and associated switchyard. In addition to the BESS facility, review is requested for an approximately 14 acres area, a smaller portion of which is planned for use by Eversource for the utility substation and electrical corridor. All work will be on the northwest side of Lake Road, no impacts to wetlands or streams are proposed. An unrelated project was previously reviewed and received NDDB determinations (NDDB Determination Numbers 201601996, 201614263, 201903145, and 202102808). The following steps will be taken to minimize impact to species:

- For any construction work done during the eastern box turtles' active period of April 1 through November 1, the following precautionary measures will be employed:

- Prior to construction, silt fencing will be installed around the work area. The area within the perimeter of the silt fence shall be canvassed by a qualified individual one day prior to installation of the silt fencing, and for five consecutive days following installation for the presence of turtles. Any turtles found within the bounds of the silt fence shall be relocated outside the bounds of the silt fence.

- During construction, work crews will be apprised of the species description and possible presence. Work crews shall search the work area for turtles prior to the start of each construction day. Any turtle encountered in the work area shall be moved unharmed to an area immediately outside the fenced area and oriented in the same direction it was walking when found. All precautionary measures will be taken to avoid degradation to wetland habitats, including any wet meadows and seasonal pools. No work is proposed in such areas for the preparation of the construction laydown area. Precautions shall be taken to avoid turtles when heavy machinery or vehicles are traveling to the work area. All silt fencing shall be removed after work is completed when soils are stable so that reptile and amphibian movement between uplands and wetlands is not restricted.

- Restriction of tree clearing such that none will occur during the months of June and July in order to avoid the pup season for bat species. Once construction is complete, no further impact is anticipated, with species continuing to use the remaining forested areas.

6. If this is a renewal or extension of an existing Safe Harbor request *with* modifications, explain what about the project has changed.

Part VI: Supporting Documents

Check each attachment submitted as verification that *all* applicable attachments have been supplied with this request form. Label each attachment as indicated in this part (e.g., Attachment A, etc.) and be sure to include the requester's name, site name and the date. **Please note that Attachments A and B are required for all new requests. Attachment C is required for requests associated with: new state or federal permit applications, modifications of existing permits, permit enforcement actions, site management/planning that requires details species recommendations, and state funded projects, state agency activities, and CEPA requests.** Renewals/Extensions with no modifications do not need to submit any attachments. Attachments C and D are supplied at the end of this form.

☒ Attachment A:	Project Detail Map: an 8 1/2" X 11" print/copy of the relevant portion of a USGS Topographic Quadrangle Map clearly indicating the exact location of the site.
☒ Attachment B:	GIS file (for uploaded GIS polygons): fine scaled map showing site boundary and area of work details on aerial imagery with relevant landmarks labeled. (Site and work boundaries in GIS [ESRI ArcView shapefile, in NAD83, State Plane, feet] format can be substituted for detailed maps, see instruction document)
☒ Attachment C:	Supplemental Information (attached, DEEP-APP-007C): Site plans, photographs and biological reports
☐ Attachment D:	Safe Harbor Report Requirements (attached, DEEP-APP-007D)

Part VII: Requester Certification

The requester *and* the individual(s) responsible for actually preparing the request must sign this part. A request will be considered incomplete unless all required signatures are provided.

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of the individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief."	
Gresock Lynn	9/28/2023
Signature of Preparer (a typed name will substitute for a handwritten signature)	Date
Gresock Lynn	
Name of Preparer (print or type)	Title (if applicable)
Signature of Preparer (if different than above)	Date
Name of Preparer (print or type)	Title (if applicable)

Note: Please submit the completed Request Form and all Supporting Documents to:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Or email request to: deep.nddbrequest@ct.gov

Attachment C: Supplemental Information and Attachments

1. Existing & Proposed Conditions

If available provide site plans, drawings or imagery showing existing conditions and proposed changes. If not available, describe all natural and man-made features including wetlands, watercourses with direction of flow, fish and wildlife habitat, floodplains and any existing structures potentially affected by the subject activity. Such features should be depicted and labeled on the site plan.

☐ **Annotated Site Plan(s) attached**

2. **Photographs** depicting site conditions can be helpful to reviewers. Provide and label photographs, if available.

☐ **Site Photographs (optional) attached**

3. Biological Surveys

Has a biologist visited the site and conducted a biological survey to determine the presence of any endangered, threatened or special concern species ☐ Yes ☐ No

If yes, submit any reports of biological surveys, documentation of the biologist's qualifications, and any NDDB survey forms. Reports should include biologist(s) name, habitat and/or species targeted by survey, plant and animal species observed, dates when surveys were conducted.

☐ **Reports of biological surveys attached**

☐ **Documentation of biologist's qualifications attached**

☐ **[NDDB Survey forms](#) for any listed species observations attached**

Attachment D: Safe Harbor Report Requirements

Submit a report, as Attachment D, that synthesizes and analyzes the information listed below. Those providing synthesis and analysis need appropriate qualifications and experience. A request for a safe harbor determination shall include:

1. **Habitat Description and Map(s), including GIS mapping overlays, of a scale appropriate for the site, identifying:**

- wetlands, including wetland cover types;
- plant community types;

- topography;
 - soils;
 - bedrock geology;
 - floodplains, if any;
 - land use history; and
 - water quality classifications/criteria.
2. **Photographs** - The report should include photographs of the site taken from the ground and also all reasonably available aerial or satellite photographs and an analysis of such photographs.
 3. **Inspection** - A visual inspection(s) of the site should be conducted, preferably when the ground is visible, and described in the report. This inspection can be helpful in confirming or further evaluating the items noted above.
 4. **Biological Surveys** - The report should include all biological surveys of the site where construction activity will take place that are reasonably available to a registrant. A registrant shall notify the Department's Wildlife Division of biological studies of the site where construction activity will take place that a registrant is aware of but are not reasonably available to the registrant.
 5. **Based on items #1 through 4 above, the report shall include a Natural Resources Inventory of the site of the construction activity.** This inventory should also include a review of reasonably available scientific literature and any recommendations for minimizing adverse impacts from the proposed construction activity on listed species or their associated habitat.
 6. **In addition, to the extent the following is available at the time a safe harbor determination is requested, a request for a safe harbor determination shall include and assess:**
 - Information on Site Disturbance Estimates/Site Alteration information
 - Vehicular Use
 - Construction Activity Phasing Schedules, if any; and
 - Alteration of Drainage Patterns

APPENDIX D
Cultural Resources Correspondence



Department of Economic and
Community Development

Connecticut
still revolutionary

September 6, 2016

Ms. Lynn Gresock
Tetra Tech
2 Lan Drive, Suite 210
Westford, MA 01886

Subject: Killingly Energy Center
180 and 189 Lake Road
Killingly, Connecticut.

Dear Ms. Gresock:

The State Historic Preservation Office (SHPO) has reviewed the Phase I Cultural Resources Reconnaissance Survey Report and National Register of Historic Places (NRHP) Eligibility Evaluation Report prepared by Tetra Tech for the referenced energy facility. SHPO understands that the proposed project area is comprised two lots designated as 180 and 189 Lake Road. The electric generating facility will be constructed within a 63 acre parcel on the western side of Lake Road (#189) and an associated switchyard will be constructed across the street within a 10 acre parcel (#180). The context and background research in the reports demonstrates knowledge of the project area and the fieldwork appears to meet the standards set forth in the *Environmental Review Primer for Connecticut's Archaeological Resources*.

The project areas currently contain a number of above ground features including a historic farmstead, a family cemetery, several building foundations, and stone walls. SHPO understands that construction will avoid the Lippitt Family Cemetery. SHPO recommends that a 50 ft buffer be established around the cemetery to prevent construction related impacts and that this area be marked as a sensitive resource on construction maps. A comprehensive assessment of the historic farmstead included a consideration of the residence, a barn, 3 utilitarian sheds, and dry-laid stone walls. SHPO understands that the farmstead will be demolished to accommodate new construction. This office concurs with the findings of the NRHP Eligibility Evaluation Report that the farmstead does not possess the qualities of significance for individual listing on the NRHP nor is it a contributing element to a potential historic district. The remaining ruinous features also do not possess the qualities of significance for listing on the NRHP.

The proposed project areas are characterized by a variety of environmental conditions with variable archeological sensitivity. As a result, SHPO accepts the stratified systematic subsurface testing methodology employed to comprehensively examine those areas delineated as having a high or moderate archeological sensitivity that may be impacted by the proposed construction. During the archeological reconnaissance survey, shovel tests were excavated systematically at 15 meter intervals within testing blocks. A total of 245 shovel test pits were completed throughout

State Historic Preservation Office

One Constitution Plaza | Hartford, CT 06103 | P: 860.256.2800 | Cultureandtourism.org

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Department of Economic and
Community Development



the project areas; of which 74 shovel test pits contained historic period artifacts. A concentration of artifacts was identified in association with the no longer extant Lippitt house on the eastern side of Lake Road. This cluster of artifacts has been designated State of Connecticut Site 69-103. Please include this site number in copies of the final report for future research. SHPO does not consider this small and common artifact assemblage to possess research potential. As a result, this office concurs that Site 69-103 is not eligible for listing on the NRHP. Scatters of historic and modern materials were also identified throughout the project areas, but they did not merit archeological site status. Based on the information provided to our office, SHPO concurs with the findings of the report that no additional archeological investigations are warranted and that no historic properties will be affected by the proposed energy facility project. This comment is conditional upon the submission of two bound copies of the final reports to our office for permanent curation and public accessibility, as well as an unbound copy of the site form for Site 69-103.

This office appreciates the opportunity to review and comment upon this project. These comments are provided in accordance with the Connecticut Environmental Policy Act and Section 106 of the National Historic Preservation Act. For additional information, please contact me at (860) 256-2764 or catherine.labadia@ct.gov.

Sincerely,

Catherine Labadia
Deputy State Historic Preservation Officer

State Historic Preservation Office

One Constitution Plaza | Hartford, CT 06103 | P: 860.256.2800 | Cultureandtourism.org

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APPENDIX E

Safety Procedures



Hazard Mitigation Analysis for EenrC Plus

Version	Date	Changes
1.0	JUL. 18, 2023	First Release

Contents

1 General Introduction	1
1.1 Purpose of Document	1
1.2 Applicable Standard	1
1.3 Abbreviations	1
2 Introduction to EnerC Plus System	1
2.1 Battery Mangement System (BMS).....	1
2.2 Thermal Management System (TMS)	2
2.3 Electrical Protect Devices	2
2.4 Fire Suppression System (FSS).....	3
2.4.1 Detection System	3
2.4.2 Explosion-Proof System	4
2.4.3 Fire Extinguishing System	4
3 Safety Standard Test and Certification.....	6
3.1 Battery Safety Certification	6
3.2 Module/System Safety Certification	7
4 Failure Mode and Solution	8
5 Conclusion	15

1 General Introduction

1.1 Purpose of Document

This document mainly analyzes the relevant failure modes of EnerC plus battery energy storage system, and gives corresponding solutions to mitigate the hazard of energy storage system.

1.2 Applicable Standard

NFPA 855 Standard for the Installation of Stationary Energy Storage Systems, section 4.4 requires hazard mitigation analysis for energy storage systems. The analysis shall evaluate the consequences of the following failure modes:

- 1) A thermal runaway or mechanical failure condition in a single ESS unit
- 2) Failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis (FMEA)
- 3) Failure of a required protection system including, but not limited to, ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, fire suppression, or gas detection

The AHJ shall be permitted to approve the hazard mitigation analysis as documentation of the safety of the ESS installation if the consequences of the analysis demonstrate the following:

- 1) Fire will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating specified in 9.6.4
- 2) Fire and products of combustion will not prevent occupants from evacuating to a safe location
- 3) Deflagration hazards will be addressed by an explosion control or other system

1.3 Abbreviations

BEES: Battery Energy Storage System.

HMA: Hazard Mitigation Analysis.

BMS: Battery Management System.

TMS: Thermal Management System.

FSS: Fire Suppression System.

FCP: Fire Control Panel.

BOL: Beginning of Life.

EOL: End of Life.

CSC: Cell Supervision Circuit, the base unit of battery management.

SBMU: Slave Battery Management Unit, collects and analyses the data from CSC, and uploads to the MBMU.

MBMU: Main Battery Management Unit. The core control unit of the container.

EMS: Energy Management System. Monitoring and manage the charge and discharge of the BESS.

Sub Control Box: Including the SBMU fuse isolation switch and other components.

Master Control Box: Including the IMM, MBMU ETH fiber conversion module.

2 Introduction to EnerC Plus System

The EnerC plus is a modular fully integrated product, consisting of rechargeable lithium-ion batteries, with the characteristics of high energy density, long service life, high efficiency. The overview of EnerC plus is shown in Figure 1, which consists of batteries, BMS, TMS and FSS.

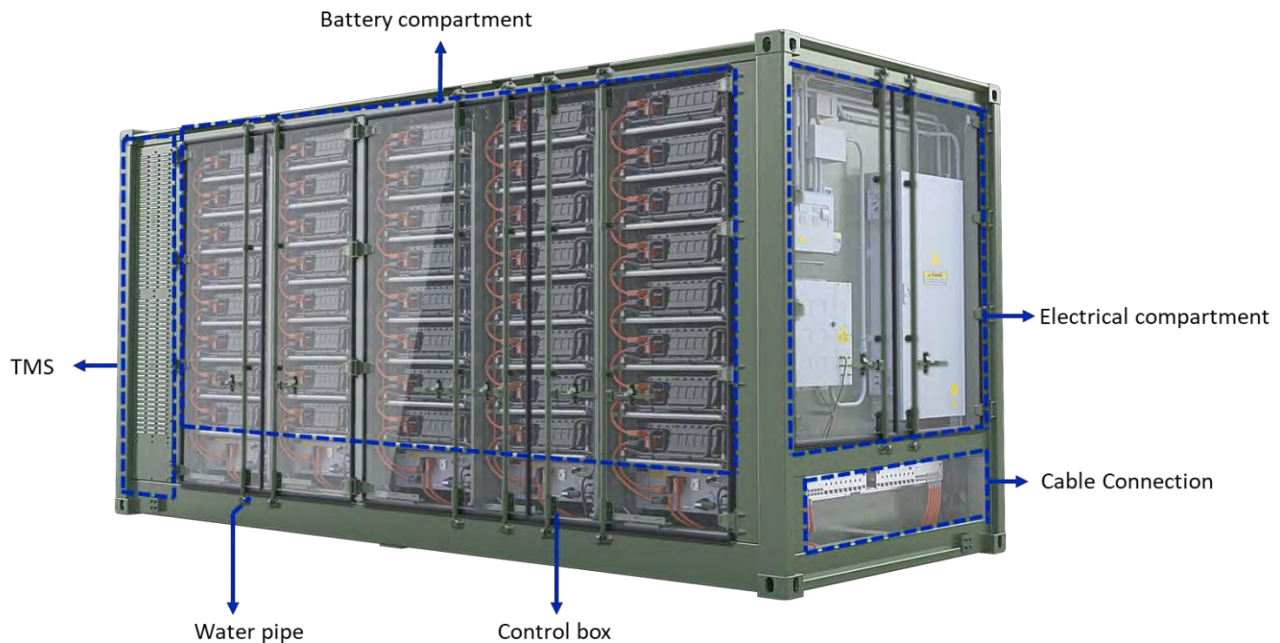


Figure 1 EnerC Plus Liquid Cooling Energy Storage Container

2.1 Battery Management System (BMS)

BMS is used in energy storage system, which can monitor the battery voltage, current, temperature, managing energy absorption and release, thermal management, low voltage power supply, high voltage security monitoring, fault diagnosis and management, external communication with EMS and ensure the stable operation of the energy storage system.

BMS includes three-level constructure, composed of 1 unit of MBMU, 1 unit of IMM, 1 unit of ETH, 1 unit of media converter, 5 units of SBMUs, 40 units of CSCs. This is the architecture that one PCS match 2 containers (Figure 2).

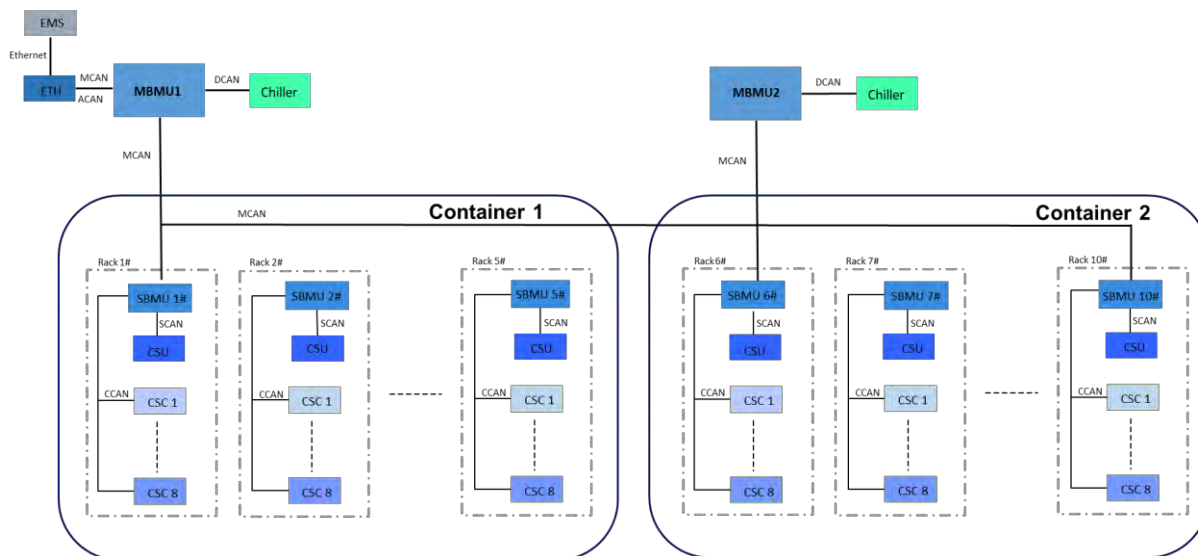


Figure 2 Three-level BMS Architecture for Two Containers in Parallel

2.2 Thermal Management System (TMS)

The TMS system of EnerC plus is liquid cooling, which main function is to maintain the temperature of the battery system to an allowable operating temperature range. Thus, the battery shall work at the best conditions, aerosol and release the maximum energy, slow degradation the SOH and maintain the longest life.



Figure 3 Overview of the cooling unit of EnerC plus

2.3 Electrical Protect Devices

EnerC plus is equipped with double level protection devices, such as module fuse, manual maintenance

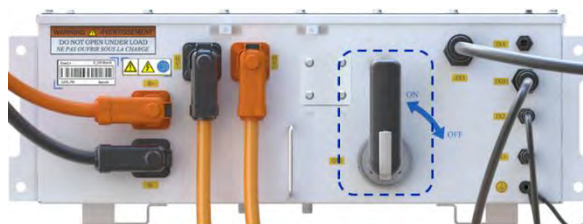
地址：福建省宁德市蕉城区漳湾镇新港路 2 号 ADD: No.2 Xin'gang Road, Zhangwan Town, Jiaocheng District, Ningde City, Fujian, PRC 352100

<http://www.CATL.com>

switch(MSD), sub control box fuse, sub control box relay and isolating switch. When the system fails in external short circuit, the fuse can be fusing quickly to avoid fire .



a) MSD of module



b) isolating switch of sub control box

Figure 4 Electrical Protection Devices

2.4 Fire Suppression System (FSS)

As an outdoor non-walk-in BESS, EnerC plus provides a perfect set of fire suppression system solutions with detection, explosion control and fire extinguishing functions.

2.4.1 Detection System

The detection system has three types of detectors, the number and installation position of which are shown in Table 1 and Figure 5. All detection signals are received and processed by the fire control panel, and the hydrogen(H_2) detector can be linked with the Extraction Fan system.

Table 1 Detector Type and Position Description

No	type	quantity	remarks
1	Heat detector	2	Detection of temperature, in the battery room
2	Smoke detector	2+1	Detection of smoke particles, two in the battery room, and one in the electrical room
3	Hydrogen detector	2	Detection of H_2 , in the battery room
4	Fire control panel	1	Receive detector signals and control fire extinguishing system and explosion-proof system, in the electrical room

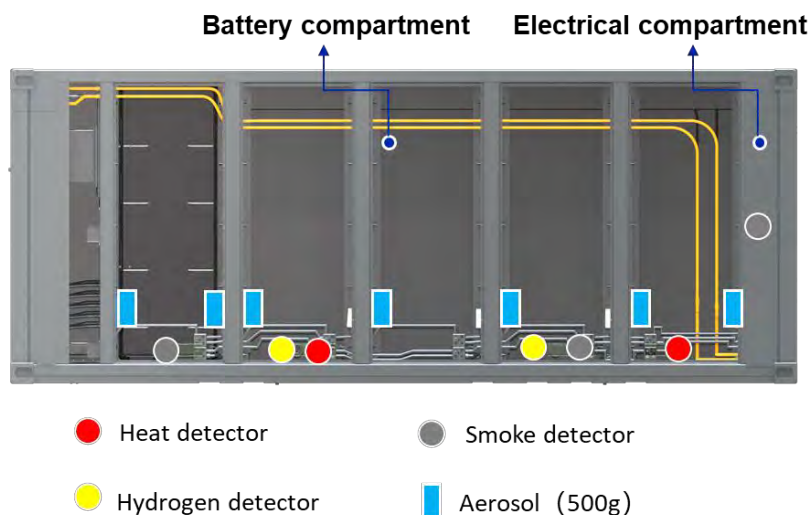


Figure 5 Type and Location of Detectors

2.4.2 Extraction Fan System

Extraction Fan system meets NFPA855 (NFPA 69) standard and has the ATEX certification, which is shown in Figure 6. When the battery thermal runaway in EnerC plus, the combustible gas can be pump to the outside of the container in time to prevent the combustible gas from gathering and deflagration.



Figure 6 Extraction Fan System

When the concentration of combustible gas in container reaches the threshold, the hydrogen detector will give an alarm to FCP. At the same time, the inlet and outlet electrical louver will open and the exhaust fan will turn on, and the combustible gas inside the container will be pumped out. The parameters of the louver and the exhaust fan are shown in Table2.

2.4.3 Fire Extinguishing System

As the last line of defense, the dry pipe system can effectively control the spread of fire, which is shown in

Figure 7.

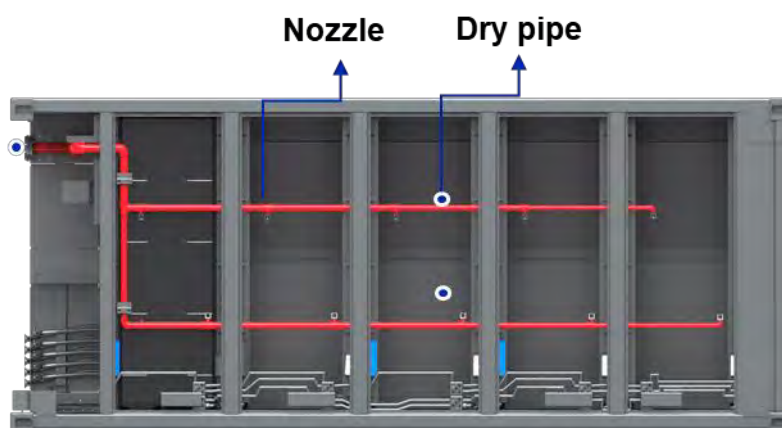


Figure 7 Dry Pipe System

3 Safety Standard Test and Certification

Battery, system/sub-system and Battery Management System (BMS) meet the following standards:

Table 2 Safety standard

Item	Safety standards
Battery	UN38.3, UL1973, IEC62619, UL9540A
System/Sub-system	UL1973, IEC62619, IEC63056, UL9540A
BMS	IEC60730, UL1973

3.1 Battery Safety Certification

For battery safety testing, the test items included in each safety standard are as follows:

Table3 Safety test items for battery

No.	Item	Safety Standards		
		IEC62619	UL1973	UN38.3
1	Overdischarge	✓	✓	✓
2	Overcharge	✓	✓	n.a
3	External short circuit	✓	✓	✓
4	Internal short circuit	✓	n.a	n.a
5	Heating	✓	✓	n.a
6	Thermal runaway	n.a	n.a	n.a
7	Thermal test	n.a	n.a	✓

8	Crush	n.a	n.a	✓
9	Impact	✓	✓	n.a
10	Drop	✓	✓	n.a
11	Altitude simulation	n.a	n.a	✓

Remark: n.a represents that this test is not in the standard

3.2 Module/System Safety Certification

For system or subsystem safety testing, the test items included in each safety standard are as follows:

Table 4 Safety test items for a system or subsystem

No.	Item	Safety Standard	
		IEC62619	UL1973
1	External short	✓	✓
2	Reverse connection protection	✓	n.a
3	Overdischarge protection	✓	✓
4	Overcharge protection	✓	✓
5	Overcurrent protection	✓	n.a
6	Overheating protection	✓	n.a
7	Insulation detect	✓	n.a
8	Drop	✓	✓
9	Thermal propagation	✓	✓

Remark: n.a represents that this test is not in the standard

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4 Failure Mode and Solution

A4.4.1 of Appendix A of NFPA 855 explicitly states that one form of hazard mitigation analysis (HMA) is a failure mode and effects analysis (FMEA), which is a systematic technique for failure analysis. In this chapter, the potential failure modes and corresponding solutions of battery, BMS and FSS are mainly analyzed.

No.	Failure mode	Failure consequences	Action
1	The battery temperature exceeds the upper limit of use	May induce battery thermal runaway	1) BMS alarm 2) Thermal management system cooling 3) Power-off protection
2	Single battery undervoltage	Accelerates battery aging and reduces capacity	1) Battery meets IEC62619/UL1973 undervoltage requirement 2) BMS has undervoltage protection function
3	Single battery overvoltage	May induce battery thermal runaway	1) Battery meets IEC62619/UL1973 overcharge requirement 2) BMS has overvoltage protection function
4	Battery bears vibration and impact conditions during transportation	May cause battery leakage	UN 38.3 test
5	Insufficient design of creepage distance or electrical	System insulation fault alarm, and	1) According to the energy storage system DC1500V

No.	Failure mode	Failure consequences	Action
	clearance	abnormally work	voltage, electrical clearance>10.4mm, creepage distance> 15mm (4000m) 2) Check the creepage distance and clearances of the system
6	Corrosion of container enclosure	The insulation withstand voltage performance of the system is reduced, and personnel have the risk of electric shock	1) Design and test of C5 standard 2) Periodic inspection/maintenance of products
7	Coolant leakage	System insulation failure may induce short circuit fire risk	1) 100% airtight detection 2) Pressure monitoring of cooling system under working condition 3) System insulation withstand voltage detection 4) The water cooling connector is outside the battery pack 5) The wiring harness adopts IP67 design to prevent coolant infiltration
8	No Voltage/Temperature/Current data.	CSC or current sensor are	1) CSC test.

No.	Failure mode	Failure consequences	Action
		damaged.	2) EoL testing.
9	Insulation detection failure	IMM is damaged. The insulation of HV circuit is aging.	1) Design review 2) IMM test.
10	SOC/SOH too low	Software failure	BMS software testing
11	SOC/SOH too high	Software failure	BMS software testing
12	No protection	Software failure. The protection value is improper.	BMS software testing
13	No diagnosis function	Software failure	BMS software testing
14	Emergency function failure	Software failure. Emergency wire is loosen.	Emergency function testing
15	Misoperation during installation and debugging, resulting in short circuit of the positive and negative terminals	Short circuit fire, may endanger the safety of operators	1) Design foolproof 2) On-site training for operators
16	Short circuit at the module level	Battery temperature is too high,	Pack is designed with fuse protection

No.	Failure mode	Failure consequences	Action
		may induce thermal runaway	
17	Short circuit at the cabinet level	Battery temperature is too high, may induce thermal runaway	Electric cabinet is designed with fuse protection
18	Protection device can not break the circuit	Improper fuse selection	1) Design review 2) Short circuit test
19	The bus bar can not withstand a maximum short-circuit current	The bus bar cross-sectional area is too small, the fixed torque is insufficient	1) Design review 2) Short circuit test
20	DC cables cannot withstand the maximum short-circuit current	DC cables have a too small cross-sectional area	1) Design review 2) Short circuit test
21	Wirings does not meet rated voltage requirements	Improper selection	1) Design review 2) Short circuit test
22	Wirings does not meet constant current requirements	Improper selection	1) Design review 2) power testing
23	Wirings does not meet max.pusle current requirements	Improper selection	3) Short circuit test

No.	Failure mode	Failure consequences	Action
24	Relay is damaged when short circuit	Improper selection	1) Design review 2) Short circuit test
25	Busbar is damaged when short circuit	Improper selection	1) Design review 2) Short circuit test
26	Battery thermal runaway, and generates combustible gas	Fire and deflagration, and may cause personal safety	1) BMS alarm 2) FSS detection system alarm 3) Exhausting smoke by the Extraction Fan and pumping out combustible gas inside the container
27	A fire broke out inside the container	Product failure, causing property loss or personal safety	1) FSS alarm 2) Aerosol fire extinguishing 3) Dry pipe fire extinguishing
28	The fire spread to adjacent containers	Causing great property damage or personal safety	1) The flame retardant grade of container materials meets the requirements of UL 94-V0 2) The container enclosure is sandwich structure, and the internal rock wool meets EI60 fire resistance rating 3) Dry pipe fire extinguishing, and controls the

No.	Failure mode	Failure consequences	Action
			spread of fire
29	The smoke detector failed	May affect aerosol release	1) Design of two smoke detectors 2) Two heat detectors can also trigger the secondary fire alarm and release aerosol 3) Regular maintenance
30	The heat detector failed	May affect aerosol release	1) Design of two heat detectors 2) One smoke detector and one heat detector can also trigger the secondary fire alarm and release aerosol 3) Regular maintenance
31	The hydrogen detector failed	Extraction Fan system may not open properly to exhaust smoke	1) Design of two hydrogen detectors 2) The Extraction Fan is designed with manual switch, which can be started manually 3) Regular maintenance
32	Failure of automatic starting function of Extraction Fan	The combustible gas inside the container cannot be discharged in	1) The Extraction Fan is designed with manual switch, which can be started manually

No.	Failure mode	Failure consequences	Action
		time, resulting in deflagration hazard	2) Regular maintenance
33	Aerosol loop failure	The aerosol cannot be released and the fire cannot be extinguished in time	1) The aerosol loop has automatic detection function 2) Regular maintenance

5 Conclusion

According to hazardous mitigation analysis, conclusion as below:

Compliance Requirement	Comments
NFPA 855 chapter 4.4.3 The AHJ shall be permitted to approve the hazard mitigation analysis as documentation of the safety of the ESS installation if the consequences of the analysis demonstrate the following:	
1) Fire will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating specified in 9.6.4	Not applicable. The EnerC plus outdoor containers are located in a remote outdoor location and not within any ESS rooms.
2) Fire and products of combustion will not prevent occupants from evacuating to a safe location	Not applicable. CATL only provides EnerC plus containers, and the design of emergency access is not CATL's responsibility
3) Deflagration hazards will be addressed by an explosion control or other system	EnerC plus is equipped with Extraction Fan system. When battery thermal runaway, the combustible gas is pumped to the outside of the container through the fan system to prevent deflagration