

New England Clean Power Link

Converter Station, Ludlow, Vermont

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1.0 Introduction

On behalf of the applicant of the proposed New England Clean Power Link (“NECPL”) project, Champlain VT, LLC d/b/a TDI New England, this narrative, Notice of Intent (“NOI”) form, site plans, and supporting technical data prepared by VHB, comprise an application for authorization to discharge stormwater pursuant to General Permit 3-9015 (“GP 3-9015”) for the proposed Converter Station north of Nelson Road in Ludlow, VT (see Site Location Map). The project site discharges to two tributaries of Twentymile Stream which is located in the Ottauquechee-Black Rivers Basin. Twentymile Stream is not included on the State of Vermont 303(d) List of Waters, Part A (2012) as impaired for stormwater. Therefore, the proposed stormwater management system has been designed to meet the Stormwater Management Rule for Non-Stormwater Impaired Waters (Chapter 18 of the Environmental Protection Rules) and applicable criteria of the Vermont Stormwater Management Manual (VSMM). The proposed stormwater treatment system includes one stormwater discharge location, with associated stormwater treatment practices (STPs) including three grass channels and two dry ponds.

The following application materials prepared by VHB are provided on the enclosed CD ROM and include site plan and detail sheets, maps, calculation sheets, and other technical data:

- Pre and Post Development Watershed Plans
- Site Map
- Site Plan & Details
- Worksheets & Calculations
 - Schedule A Form
 - Water Quality Volume Calculation
 - Groundwater Recharge Calculation
 - Extreme Flood Protection Standard Waiver
 - Grass Channel STP Design Sheet
 - Dry Pond STP Design Sheet
 - HydroCAD Computations
 - CN Design Memorandum



2.0 Project Site

The project site for the proposed converter station is located north of Nelson Road in Ludlow, Vermont and includes approximately 10 acres. Existing conditions consist of undeveloped woods which slope generally west to east. The proposed project consists of a 1.2 acre converter station building, associated outbuildings, and an access drive. Within the 5.7 acre fenced area associated with the converter station, the ground will be completely covered with a 6-inch thick section of yard stone, composed of a 50/50 mix of clean 1 ½-inch and ¾-inch stone underlain by an 18-inch base course. VHB assigned the yard stone a curve number of 60 based on the curve number computations provided by the collaborating Project Engineer, TRC (see Appendix H). The curve number is similar to that which could be anticipated for pervious open space (e.g., lawns, parks, etc.) in good condition with greater than 75 percent grass cover per the Soil Conservation Service (“SCS”), now Natural Resources Conservation Service (“NRCS”) TR-55 table for runoff curve numbers, revised 1986. The proposed project will include approximately 2.0 acres of impervious cover. The project is proposed to discharge to an unnamed tributary to Twentymile Stream, identified on the Site Map include as Figure 1.

Existing Topography, Land Cover and Hydrology

Based on the U.S. Geological Survey (USGS) topographic maps and the topographic survey of the site, the project area includes average slopes of around 7 percent, with an elevation range of approximately 1360 to 1430 feet above sea level (NAVD88). Existing land is undeveloped woods.

Existing soils and existing topographic contours are shown on the pre-development watershed plan included as Figure 2 in the attachment. The existing site condition is analyzed as two subwatersheds. Existing subwatershed 1, referred to as EX1, includes the area to be developed with the proposed access driveway which drains to the south under Nelson Road to an unnamed tributary to Twentymile Stream (POI 002) and has an area of 1.2 acres. This subwatershed area will drain to a “point of interest” (“POI”) as opposed to a “design point” since stormwater flows to this area will be eliminated under proposed conditions. EX1 is separated from the unnamed tributary by approximately 370 feet of undeveloped land. Existing subwatershed 2, referred to as EX2, includes nearly the entire proposed converter station yard area and drains to the east through undeveloped land prior to discharge to a different unnamed tributary to Twentymile Stream (S/N 001) and has an area of 9.1 acres. EX2 is



separated from the unnamed tributary by approximately 1,700 feet of undeveloped land. Receiving streams, points of interest and discharge points are shown on the Site Map, included as Figure 1.

Soils

Underlying soils have been mapped by the Natural Resources Conservation Service ("NRCS") as Tunbridge Lyman complex, very rocky, 8 to 15 percent slopes categorized as Hydrologic Soil Group (HSG) D, designation 12C and 15 to 35 percent slopes categorized as HSG C, designation 12D (See NRCS Soils mapping on the Site Map).



3.0 Proposed Development

The proposed development is analyzed as five subwatersheds discharging to three points of interest. Flow to POI 002 from the existing conditions has been eliminated under proposed development due to the proposed grass swale which will redirect flow to POI 001A.

Subwatershed 1, referred to as S1, includes the proposed impervious driveway and associated adjacent stormwater features which discharge to POI 001A. Subwatershed 2.1, referred to as S2.1, includes approximately two-thirds of the proposed yard which includes roof runoff and overland flow from equipment pads which is conveyed to a dry pond via a grass channel, ultimately discharging to POI 001A. Subwatershed 2.2, referred to as S2.2, includes the remaining third of the yard where stormwater runoff is conveyed via another grass channel to the same dry pond. Subwatershed 3, referred to as S3, includes the roof of the auxiliary building located west of the main converter station building and the associated stormwater features discharging to POI 001B. Subwatershed 4, referred to as S4, includes a proposed grass slope required for the proposed grading of the site. Runoff from all three points of interest (POI 001A, POI 001B and POI 001C) will flow toward the east to the unnamed tributary to Twentymile Stream at discharge point S/N 001.

Construction of the Converter Station requires grading outside of S1, S2 and S3. Areas outside of S1, S2, and S3 will remain pervious and with the exception of areas designated for stormwater management, flow patterns will remain unchanged under proposed conditions. Two upgradient channels are proposed west of the site. One directs off-site flows north around the converter station site, bypassing the proposed stormwater treatment practice. The second directs off-site flows south around a portion of the site driveway. Because cover and slope remain unchanged under proposed conditions, the areas diverted by the upgradient channels are not modeled as part of this analysis. See Site Plan for location of upgradient channels.

Watershed characteristics are summarized in Table 1 below. In general, the site driveway, building roofs and concrete foundations will drain either via roof drains or sheet flow to grass channels on the perimeter of the site, which ultimately discharge to dry ponds. The stone yard will consist of highly permeable gravel and is anticipated to infiltrate excess runoff. However, because the yard stone will be placed on HSG C and D soils, VHB anticipates that runoff may travel along the yard stone/soil



interface and exit the pad as shallow groundwater. Therefore the site has been graded to direct runoff towards the perimeter of the yard pad and will be bounded by a grass channel to provide stormwater treatment and conveyance. Together, the proposed grass channels and dry ponds meet the treatment and detention requirements of the Vermont Stormwater Management Manual, described below.

Table 1: Watershed Characteristics Summary

	Watershed S1	Watershed S2.1	Watershed S2.2	Watershed S3	Watershed S4
Total Area (acres)	1.18	4.56	2.10	0.90	1.56
Proposed Impervious Area (acres)	0.27	1.44	0.21	0.09	0
Weighted Curve Number (CN)	83	76	67	79	73
Time of Concentration (TC, minutes) ¹	15.8	7.5	7.9	5	5

¹Minimum modeled time of concentration is 5 minutes

The proposed grass channels have been designed to meet the Water Quality (WQv), and Recharge (Re) criteria of the VSMM. The proposed dry ponds have been designed to meet the Channel Protection (CPv), and Overbank Flood Protection (Qp10) criteria of the VSMM as described in the following paragraphs.

Discharge Location POI 001A

Discharge location POI 001A is located on the southeast corner of the site as shown on Figure 3. Discharge location POI 001A captures flows from subwatersheds S1, S2.1 and S2.2. Stormwater runoff in this area is captured in three grass channels which provide water quality treatment, and convey flow to dry pond P1 prior to discharge. The first grass channel, referred to as GC1, captures flows from S1 and runs along the south side of the proposed gravel driveway and into a second grass channel. The second grass channel, referred to as GC2.1, captures flow from S2.1, which includes the majority of the converter station yard and runs along the south side of the proposed yard and into a dry pond, referred to as P1. Runoff from the remaining portion of the converter station yard flows to a third grass channel, referred to as GC2.2, which also discharges to P1. POI 001A is located at the outlet of P1 and flows overland east through an undeveloped area eventually discharging to an unnamed tributary to Twentymile Stream, S/N 001. Supporting computations for the grass channels are included in Appendix E and G. Supporting computations for the dry pond are included in Appendix F and G.



The manner of discharge is described as follows:

POI 001A Manner of Discharge

Stormwater from 7.8 acres of the Converter Station site flows via roof drains and/or overland to grass channels to a dry pond for stormwater treatment and control prior to draining via an outlet control structure to POI 001A, which then discharges east overland to an unnamed tributary to Twentymile Stream, S/N 001.

VHB sized P1 to meet the freeboard and geometry requirements for stormwater treatment ponds outlined in Section 2.7.1 of the VSMM. Pond pretreatment is provided by the grass channels. A barrier with an access opening for maintenance will be provided around the perimeter of the pond. The barrier will consist of landscaping elements (e.g., plantings), boulders, and/or a chain link fence. Pond side slopes are 3 horizontal to 1 vertical. A 12-foot maintenance road with an average slope of 6-percent is provided for access to the pond and outlet control structure. The pond will not contain a permanent pool therefore no pond benches are included. Details of P1 geometry are included in the Site Plans and Details, as well as in Appendix G.

Water Quality Volume Standard

GC1, GC2.1 and GC2.2 meet the design requirements outlined in the VSMM for providing water quality treatment, including an average flow rate of 1 foot per second (ft/s) and an average depth no greater than 4-inches during the water quality event using an adjusted runoff curve number as computed in Appendix B, non-erosive peak velocity during the 1-year storm event, and greater than 6-inches of freeboard during the 10-year storm event. A summary of GC1, GC2.1 and GC2.2 geometry is provided in Table 2 below.



Table 2: Grass Channel 1, 2.1 and 2.2 Geometry

Grass Channel	GC1	GC2.1	GC2.2
Bottom Width (ft)	3	3	3
Side Slope (ft:ft)	2:1	2:1	2:1
Length (ft)	400	610	250
Depth (ft)	2	2	2
Invert Upstream (ft NAVD88)	1418	1398	1398
Invert Downstream (ft NAVD88)	1398	1396	1396

Recharge Standard

The three grass channels (GC1, GC2.1 and GC2.2) are located in HSG D soils and therefore no groundwater recharge is anticipated. Recharge on the site is met within the area discharging to POI 001B and is addressed below.

Channel Protection Volume Standard

The CPv for subcatchments S1, S2.1 and S2.2 combined is 0.36 acre-feet (af). Because the site discharges to a cold water fish habitat, the required CPv detention time is 12-hours. P1 has been designed to provide a release rate lower than the maximum average CPv release rate during the 1-year storm event and greater than 12-hours through the use of a 2-inch low flow orifice. Supporting computations are included in Appendix F and supporting modeling is included in Appendix G.

Overbank Flood Protection Standard

For stormwater discharges to POI 001A, the Overbank Flood Protection Standard (Qp10) will be met by attenuation in P1. The peak 10-year flow rate from the site to the design point under existing conditions is 13.6 cubic feet per second (cfs). Under post-development conditions the peak flow rate from P1 is 3.1 cfs, which combines with the flow from the second dry pond and the vegetated slope (Watershed S4) for a peak flow rate of 3.9 cfs at S/N 001.

Extreme Storm Protection Standard

The Extreme Flood Protection Treatment Standard (Qp100) is waived since the expanded impervious area is less than 10 acres (see Waiver Worksheet in Appendix D). P1 meets the hydrologic criteria for Structure Class "a" and will provide 1-foot of freeboard above the emergency spillway and the top of



berm during the 100-year, 24-hour event. P1 storage volumes and elevations are summarized in Table 3 below.

Table 3: P1 Peak Storage Volume and Elevation

Storm Event	Peak Storage Volume (af)	Peak Elevation (ft)
1-year	0.23	1381.7
10-year	0.38	1382.7
100-year	0.72	1384.5

Cold Climate Considerations

Grass channels GC1, GC2.1 and GC2.2 will be inspected after the spring melt. Residual sand will be removed and damaged vegetation replaced. The overflow pipe from P1 is designed as a 24-inch pipe to minimize freezing. Dry pond P1 will be protected from road sand build up by the presence of a grass channel between the driveway and the pond.

Discharge Location POI 001B

Discharge location POI 001B is located on the north east corner of the site as shown on Figure 3. Discharge location POI 001B captures flows from subwatershed S3, which includes the roof of the auxiliary building located west of the main converter station building and the pervious area between the converter station pad and the stormwater features associated with subwatershed S3. Stormwater runoff from the auxiliary building is captured in a roof drain which flows to a grass channel, referred to as GC-3, which provides water quality treatment and recharge and conveys flow to a second dry pond, P2, located north of the site, prior to discharge.

POI 001B leaves the site at the outlet of P2 and flows overland east through an undeveloped area eventually discharging to the unnamed tributary to Twentymile Stream at S/N 001. Supporting computations for the grass channel is included in Appendix E and G. Supporting computations for the dry pond are included in Appendix F and G.

The manner of discharge is described as follows:



POI 001B Manner of Discharge

Stormwater from 0.90 acres of the Converter Station flows via roof drains and/or overland to grass channels to a dry pond for stormwater treatment and control prior to draining via an outlet control structure to POI 001B, which then discharges east overland to an unnamed tributary to Twentymile Stream, S/N 001.

Similar to P1, VHB sized the P2 to meet the freeboard and geometry requirements for stormwater treatment ponds outlined in Section 2.7.1 of the VSMM. Pond pretreatment is provided by the grass channel. A barrier with access for maintenance will be provided around the perimeter of the pond. The barrier will consist of landscaping elements (e.g., plantings), boulders, and/or a chain link fence. Pond side slopes are 3 horizontal to 1 vertical. A 12-foot maintenance road with an average slope of 1-percent is provided for access to the pond and outlet control structure. The pond will not contain a permanent pool therefore no pond benches are included. Details of P2 geometry are included in the Site Plans and Details, as well as in Appendix G.

Water Quality Volume Standard

GC3 meets the design requirements outlined in the VSMM for providing water quality treatment, including an average flow rate of 1 ft/s and an average depth no greater than 4-inches during the water quality event using an adjusted runoff curve number as computed in Appendix B, non-erosive peak velocity during the 1-year storm event, and greater than 6-inches of freeboard during the 10-year storm event. A summary of GC3 geometry is provided in Table 4 below.

Table 4: Grass Channel 3 Geometry

Grass Channel	GC3
Bottom Width (ft)	3
Side Slope (ft:ft)	2:1
Length (ft)	340
Depth (ft)	2
Invert Upstream (ft NAVD88)	1398
Invert Downstream (ft NAVD88)	1378



Recharge Standard

The required recharge volume for the site is 91 cubic feet (cf), with a tributary area of 1,091 square feet (sf) (see Appendix C). GC3 is located in HSG C soils. The stormwater management manual states that if grass treatment channels meet the water quality treatment standard then they also meet the groundwater recharge standard. The auxiliary building roof is 3,750 sf, greater than the required recharge area; therefore GC3 satisfies the recharge requirements for the site.

Channel Protection Volume Standard

The CPv for discharges to POI 001B is 0.05 af. As noted above, the required CPv detention time is 12-hours. P2 has been designed to provide a release rate lower than the maximum average CPv release rate during the 1-year storm event and as close to 12-hours as possible through the use of a 1-inch low flow orifice. Supporting computations are included in Appendix F and supporting modeling is included in Appendix G.

Overbank Flood Protection Standard

For stormwater discharges to POI 001B, the Overbank Flood Protection Standard (Qp10) will be met by attenuation in P2. The peak 10-year flow rate from the site towards the east under existing conditions is 13.6 cubic feet per second (cfs), while the peak flow rate from P2 under proposed conditions is 1.7 cfs, which combines with the flows from the first dry pond and the vegetated slope (Watershed S4) for a peak flow rate of 3.9 cfs at S/N 001.

Extreme Storm Protection Standard

The Extreme Flood Protection Treatment Standard (Qp100) is waived since the expanded impervious area is less than 10 acres (see Waiver Worksheet in Appendix D). P2 meets the hydrologic criteria for Structure Class "a" and will provide 1-foot of freeboard above the emergency spillway and the top of berm during the 100-year 24-hour event. P2 storage volumes and elevations are summarized in Table 5 below.

Table 5: P2 Peak Storage Volume and Elevation

Storm Event	Peak Storage Volume (af)	Peak Elevation (ft)
1-year	0.03	1374.1
10-year	0.04	1374.8
100-year	0.05	1375.4



Cold Climate Considerations

Grass channel GC3 will be inspected after the spring melt. Residual sand will be removed and damaged vegetation replaced. The overflow pipe from P2 is designed as a 24-inch pipe to minimize freezing. No road sand is anticipated to flow towards P2.

Discharge Location POI 001C

Discharge location POI 001C is located on the east of the site as shown on Figure 3. Discharge location POI 001C captures flows from subwatershed S4. Stormwater runoff in this area consists of only flow from pervious surfaces therefore no treatment is necessary prior to discharge and supporting treatment computations are not provided for POI 001C. Stormwater runoff flows overland across the proposed 3:1 vegetated slope prior to discharge into the undeveloped area east of the site.



4.0 Planting and Landscaping Plan

A planting and landscaping plan has been prepared by T. J. Boyle and Associates for the New England Clean Power Link project and includes a mitigation planting plan for the Converter Station. Per the plan, mitigation planting combined with retention of existing vegetation buffers will provide screening of the Converter Station and the stormwater management system from the surrounding area. In general, planting and landscaping will assist in providing long term erosion control as well as a visual buffer from the road. The planting plan and landscaping plan for the stormwater treatment practices will conform to the guidance provided in Appendix A2 Landscaping Guidance and Plant Lists of the VSMM Volume II Technical Guidance. Hydrologic zones within the dry ponds, including riparian fringe, floodplain terrace and upland slopes will have plant species specified that are suited to each hydrologic zone. Native plant species have been specified for the stormwater treatment practices. Grass channels will be planted with grass species appropriate for frequent inundation.



5.0 Operation and Maintenance Plan

The operational stormwater discharge General Permit requires that the permittee properly operate and maintain all stormwater systems, and that the permittee submit an annual inspection report on the operation, maintenance, and condition of the stormwater system. In general, operation and maintenance of the stormwater management system will involve the following activities (as needed and/or per the site's routine maintenance schedule), as well as any additional activities that are specific requirements of applicable permits:

- Removal of debris (i.e., trash and fallen branches) from roadways and landscaped areas.
- Cleaning swales of collected debris (i.e., trash and fallen branches).
- Removal of sediment from bottom of grass channels when 25-percent of the original WQv has been exceeded
- Mowing of grass channels as required during the growing season to maintain grass heights in the 4 to 6 inch range.
- Mowing or planting in dry ponds to ensure capacity is maintained and erosion is prevented
- Inspection and cleaning of outlet control structures at least annually or as necessary

In conjunction with all maintenance activities, the permittee will submit an annual inspection report that provides the following documentation, in accordance with section 22-307(c)(2) of the Rule:

- Date and locations of maintenance activity
- Detailed description of maintenance activity
- Description of any problems or issues that are encountered while maintenance activity is occurring
- Description of schedule of maintenance activities for problems encountered
- Photographs that are taken before and after maintenance activity has occurred (to extent feasible)

Snow Management

Snow removal will be conducted to ensure that the stormwater management system and nearby natural resources are not impeded by the placement of snow. Snow removed from the roads and parking areas shall be plowed to areas away from inlets to the stormwater system and away from the



systems themselves. Snow storage areas will be inspected each spring and during the annual inspection, and any identified maintenance issues will be resolved.



6.0 Conclusion

The stormwater treatment system designed for the New England Clean Power Link Converter Station in Ludlow, Vermont meets the applicable stormwater management criteria of the VSMM, and is therefore eligible for coverage under GP 3-9015. Water quality and quantity control will be provided through proposed stormwater treatment practices that include grass channels and dry ponds.