CHARACTERIZATION OF THE LITTORAL ZONE AND SEDIMENT-DEPTH DISTRIBUTION OF AQUATIC MACROINVERTEBRATES IN THE VICINITY OF THE PV-20 SUBMARINE TRANSMISSION LINE, LAKE CHAMPLAIN, CUMBERLAND HEAD, NY AND GRAND ISLE, VT

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I. INTRODUCTION

PV-20 is a single circuit 115kV transmission line jointly owned by the New York Power Authority (NYPA) and VT Transco. A portion of PV-20 runs underground and underneath Lake Champlain for approximately 1.7 miles between Cumberland Head, NY and Grand Isle, VT. The NYPA owns the portion of the transmission line in NY, and ownership transfers to VT Transco at the NY/VT state line within the lake. A recent assessment of the condition of the submarine cable portion of the PV-20 circuit was conducted and it has been determined that the existing 115 KV submarine cables in Lake Champlain are at or near the end of their expected useful service life.

EcoLogic, LLC was contracted through CHA Consulting, Inc. to conduct a characterization of the littoral zone of Lake Champlain and determine the sediment-depth distribution of aquatic macroinvertebrates in the littoral and profundal zones of Lake Champlain in the vicinity of the PV-20 transmission line corridor. This report presents the findings of this investigation.

II. METHODS

A. Aquatic Habitat Characterization

The aquatic habitat within the littoral zone of Lake Champlain (in both New York and Vermont) along the existing and proposed transmission line corridors was characterized by a two-person crew working primarily from a canoe. The area investigated spanned approximately 240 m along the length of the shoreline and from shore out to the extent of vegetative growth at both the NY and VT ends of the corridor. This area encompassed the existing transmission lines, the proposed location of the new transmission lines, and an approximately 50-m buffer to the north and south of these features. The characteristics of the habitat with respect to substrate type, the presence and type of aquatic macrophytes, other types of cover, and bottom slope were documented via field notes and photographs.

The type, general abundance, and aerial extent of macrophytes were documented visually and through the use of rake tosses at various depths and distances from shore to sample submergent vegetation. A portable depth finder was used to document bottom coverage of macrophytes and gather information on water depth and bottom slope. Substrate composition was determined by direct observation to depths of approximately 3 m and by feel while retrieving rake tosses and lowering and raising an anchor. Observations of fish and wildlife use of the littoral zone and adjacent areas also were recorded. In addition to the field assessment, staff of regional state and federal natural resource agencies with knowledge of the aquatic resources of the project area were contacted to compile information on fish and wildlife, including rare, threatened, or endangered species known to occur or potentially occurring in the vicinity of the project.

B. Depth of Sediment Occupied by Macroinvertebrates

The depth in the bottom sediments to which aquatic macroinvertebrates occur in at three locations each in the littoral zone and the profundal zone of Lake Champlain at both the New York and Vermont ends of the transmission line corridor was determined (Figure 1). This was accomplished by analyzing samples of sediment from strata within the sediment ranging from the sediment surface down to 1.0 m below the surface. The aquatic macroinvertebrate community at the sediment surface was sampled using a Day sampler deployed from a barge with a hydraulic crane. The Day sampler was lowered to the sediment surface and a grab sample was removed, brought on board, and emptied into a bin capable of holding the entire volume of the sampler. If less than approximately 5 liters were collected in a sample, the entire sample was rinsed in a 1.0-mm sieve bucket, and all retained material and macroinvertebrates were preserved with 95% ethanol in a 1-L bottle. Samples for which substantially more than 5 L of material were obtained were stirred with a trowel and subsampled by removing approximately 5 L of material, rinsing it in a 1.0-mm sieve bucket, and preserving all retained material and macroinvertebrates with 95% ethanol in a 1-L bottle.

The aquatic macroinvertebrate community at 0.5 m and 1.0 m below the sediment surface at each sampling station was sampled by obtaining approximately 1 L of sediment from the 0.5-m and 1.0-m strata of a vibracore sample collected from the barge for chemical analyses. The material from each sample was rinsed in a 1.0-mm sieve bucket, and all retained material and macroinvertebrates were preserved with 95% ethanol in a 1-L bottle.

In the laboratory, the preservative was removed from each sample, and the sample was rinsed in a 0.5-mm sieve, spread across a white plastic sorting tray with a grid on the bottom, and viewed under a magnifying lamp. Randomly selected grids were searched for aquatic macroinvertebrates, and encountered organisms were removed until 50 organisms were obtained or until all organisms were removed from samples containing fewer than 50 organisms. Each organism was classified by taxonomic family (or lowest taxonomic level possible with a dissecting microscope). The unsorted remainder of each sample was scanned to identify any additional taxa that were not included in the 50-organism subsample. Only organisms that appeared to be living at the time of collection were recorded as being present. Organisms represented only by empty shells or exuviae (shed skins) were not recorded as present since they may have originated from a location other than the sampling station or the depth of collection.

III. RESULTS

A. Aquatic Habitat Characterization

The aquatic habitat assessment of the littoral zone in the vicinity of the PV-20 transmission line corridor was conducted on July 2, 2014. Conditions for observing aquatic habitat were good, with a light southeast wind and high water clarity (Secchi depth = 5.9-6.0 m). Lake Champlain water surface elevation was 29.6 m msl at the U. S. Geological Survey gage 04295000 at Rouses Point, NY during the investigation. The Vermont side of the littoral zone was visited during the morning, and the New York side of the littoral zone was visited in the afternoon.

1. Vermont Littoral Zone

The littoral zone at the Vermont end of the transmission line corridor varied in width from approximately 60 m at the south end to 95 m at the north end at a water surface elevation of 29.6 m (Figures 2-4). The shoreline in the vicinity of the transmission line corridor consisted of a combination of bedrock bluff and boulder/cobble substrate with a narrow band of mixed conifers, hardwoods, and shrubs between the rock shoreline and residential properties (Photos

1-3). The lake bottom in this area had a relatively gentle slope out to the 2-m depth and then sloped more steeply out to the 6-m depth at a water surface elevation of 29.6 m (Figures 2-4). This increase in slope off shore was more pronounced at the south end than at the north end of the site.

The near-shore limit of submergent aquatic vegetation (SAV) was approximately 16 m off shore at the south end and mid-section of the site and 27 m at the north end at a water surface elevation of 29.6 m (Figures 2-4). The off-shore limit of SAV was approximately 61 m from shore at the south end of the site, 76 m from shore at the mid-section, and 92 m at the north end at a water surface elevation of 29.6 m. The maximum depth at which SAV was found was 6.1 m at a water surface elevation of 29.6 m. SAV growth was widespread but sparse and scattered (Photos 4 and 5). Species encountered included small pondweed (*Potamogeton pusillus*), waterweed (*Elodea* sp.), Eurasian watermilfoil (*Myriophyllum spicatum*), and Robbins pondweed (*Potamogeton robbinsii*). SAV growth became less dense with increasing depth outside of the 4.5-m contour at a water surface elevation of 29.6 m. Small pondweed was the most widespread and abundant macrophyte, but no dense beds of SAV were observed. SAV occurred in small, sparse patches or as individual plants. Most of the Eurasian watermilfoil was collected as dead stems (Photo 6), possibly from the previous year's growth, and was collected toward the off-shore end of the littoral zone where silt was the primary substrate.

From shore out to approximately the 1.0-m depth contour at a water surface elevation of 29.6 m, the substrate was primarily a cobble/boulder/coarse gravel mix with little or no interstitial fines (Photo 7). The substrate in this near-shore band appeared to be well sorted by wave and ice action, resulting in a lack of fine substrate in which SAV could grow and a lack of dreissenid mussels as well. Bottom substrate composition was consistently a mix of cobble, bedrock, boulder, and gravel with minor amounts of interstitial fines from approximately the 1-m depth contour out to approximately the 4.5-m depth at a water surface elevation of 29.6 m (Photos 8 and 9). The proportion of each of these substrate types varied with location, but there were no large expanses of bottom dominated by a single substrate type between the 1.0-m and 4.5-m depth contours at a water surface elevation of 29.6 m. Dreissenid mussels occurred in low to moderate density on the rock substrate throughout this zone (Photos 10 and 11). Bottom substrate transitioned from rock to silt outside of the 4.5-m contour at a water surface elevation of 29.6 m.

Observations of fish and wildlife were scant during the field effort. Wildlife observed at the site was limited to double-crested cormorants (*Phalacrocorax auritus*), mallards (*Anas platyrhynchos*), and ring-billed gulls (*Larus delawarensis*). No fish species were observed during the field effort. As noted previously, dreissenid mussels were observed attached to rock substrate throughout the site and were collected occasionally in rake toss samples for SAV.

2. New York Littoral Zone

The littoral zone at the New York end of the transmission line corridor varied in width from approximately 145 m at its mid-section to 190 m at the north end at a water surface elevation of 29.6 m (Figures 5-7). The shoreline in the vicinity of the transmission line corridor consisted of a combination of cobble/boulder/coarse gravel substrate flanked by concrete retaining walls at the north and south end (Photos 12-14). Residential properties extended up slope from the shoreline. The lake bottom in the northern portion of the littoral zone had a consistent, gentle slope out to the 7-m depth at a water surface elevation of 29.6 m (Figure 5). The bottom in the mid-section of the site sloped gently out to approximately the 3-m depth and then sloped more steeply out to the 6.4-m depth at the outer limit of the littoral zone at a water surface elevation of 29.6 m (Figure 6). Bottom slope in the southern portion of the littoral zone was consistent and gentle out to the 5-m depth and then increased out to the 6.7-m depth at the outer limit of the littoral zone at a water surface elevation of 29.6 m.

The near-shore limit of SAV increased from north (approximately 25 m off shore) to south (approximately 50 m off shore) at a water surface elevation of 29.6 m (Figures 5-7). The off-shore limit of SAV was approximately 190 m from shore at the north end of the site, 145 m from shore at the mid-section, and 155 m at the south end at a water surface elevation of 29.6 m. Species encountered included small pondweed, waterweed, Eurasian watermilfoil, stonewort (*Nitella* sp.), curly-leaved pondweed (*Potamogeton crispus*), and claspingleaf pondweed (*Potamogeton perfoliatus*). No large, dense beds of SAV were observed, though waterweed and

Eurasian watermilfoil did occur in moderate density in the northern portion of the littoral zone in approximately 3-6 m of water at a water surface elevation of 29.6 m (Photo 15). SAV generally occurred in small, sparse patches or as individual plants. Small pondweed was the most widespread macrophyte species but generally occurred as scattered plants or in diffuse beds. SAV abundance generally declined from north to south, with the width of the vegetated zone also narrowing from north to south.

Bottom substrate composition varied considerably from north to south and with distance from shore (Figures 5-7). In the northern and mid-sections of the site, substrate was primarily a mix of cobble, boulder, coarse gravel, and patches of bedrock from shore to approximately the 1-m depth contour at a water surface elevation of 29.6 m (Photos 16 and 17). Interstitial spaces in the rock substrate were filled with sand and fine gravel between approximately the 1-m and 3-m contours at a water surface elevation of 29.6 m (Photo 18). Beyond this depth, substrate consisted of a mix of silt and rock in the northern and mid-sections of the site.

In the southern portion of the site, substrate was predominantly bedrock from shore out to the 2-m depth contour at a water surface elevation of 29.6 m (Photo 19). Cobble, boulder, gravel and interstitial fines became more prominent and bedrock less prominent at depths of 2-4 m. The substrate was a silt/rock mix at depths of 4-6 m and primarily silt from the 6-m depth to the off-shore limit of the littoral zone at a water surface elevation of 29.6 m.

Observations of fish and wildlife were scant during the field effort. Wildlife observed at the site was limited to a double-crested cormorant, mallards, and ring-billed gulls. Anglers were observed catching smallmouth bass (*Micropterus dolomieu*) and yellow perch (*Perca flavescens*). Dreissenid mussels were observed attached in low densities to rock substrate throughout the site and were collected occasionally in rake toss samples taken to collect SAV. Broken, weathered shells of three eastern lampmussels (*Lampsilis radiata*) were found along the shoreline.

3. Potential Use of Littoral Habitat by Fish and Wildlife

The littoral zone at both ends of the PV-20 transmission line corridor was typical of the littoral habitat found throughout much of the surrounding near-shore area of Lake Champlain. The habitat was relatively similar on both ends of the corridor, though there was more aquatic plant growth on the NY side. In general, the substrate consisted of a mix of cobble, boulder, bedrock, and gravel from shore out to about the 4-m depth contour, where the substrate changed to more silt and less rock, and became entirely silt by the 6-m depth at a water surface elevation of 29.6 m. Aquatic plant growth (consisting primarily of small pondweed, Eurasian water milfoil, and waterweed) was sparse on the Vermont side, consisting of scattered stems growing in crevices among the rocks in water less than 3 m deep at a water surface elevation of 29.6 m and became slightly more abundant farther off shore where silt was the primary substrate. Aquatic plant growth on the NY side was somewhat more abundant but not dense.

The littoral zone in the transmission line corridor appeared to be similar to the littoral zone in this general region of the lake (i.e., there was an abundance of similar habitat nearby). No habitats were noted that would provide exceptional value as fish spawning or nursery areas or be considered unique in supporting fish and wildlife resources, including threatened or endangered species. Sportfish species that could be expected to use the available habitat in the littoral zone at either end of the transmission line corridor include smallmouth bass, yellow perch, walleye (*Sander vitreus*), rock bass (*Ambloplites rupestris*), pumpkinseed (*Lepomis gibbosus*), chain pickerel (*Esox niger*), and northern pike (*Esox lucius*), all of which are common and wide-spread in the littoral zone of Lake Champlain (Fisheries Technical Committee 2009). Emerald shiner (*Notropis atherinoides*), an open-water forage species, and the invasive white perch (*Morone americana*) and alewife (*Alosa pseudoharengus*) could also be expected to use this habitat type.

Wildlife observed using the littoral zone during this investigation was limited to ducks, cormorants, and gulls. These birds likely forage throughout large areas of the surrounding littoral zone and occasionally use the area in the immediate proximity of the transmission corridor.

The U.S. Fish and Wildlife Service, Vermont Natural Heritage Inventory, and New York Natural Heritage Program were queried for records of rare, threatened, or endangered species that are known to occur or may occur at or in the vicinity of the project site. Seven animal species and one plant species were identified by these sources as potentially occurring in the vicinity of the project (Table 1). Northern harrier, listed as a threatened species in New York State, is a hawk typically associated with marshes, sloughs, and wet meadows (Terres 1980). No such habitats exist along the immediate shoreline or in the littoral zone of Lake Champlain at either end of the transmission line corridor, so this species is presumed absent from this part of the project area.

Common loon, listed as a species of special concern in NY, uses open-water and littoral lake habitat for foraging and typically nests on small islands, sheltered coves, promontories, or headlands in areas undisturbed by human activity (Terres 1980). Though not observed, common loons may occasionally forage or rest in the littoral zone in the vicinity of the transmission line corridor, but large expanses of similar habitat occur throughout this portion of the lake. No suitable nesting habitat occurs at either end of the corridor for this species.

American eel, listed as a species of concern in VT, in lake habitats typically occupy burrows in bottom mud or gravel or seek cover under objects, or in SAV beds (Scott and Crossman 1973; Fahay 1978). LaBar and Facey (1983) collected American eels from the littoral zone of Lake Champlain on the east side of Grand Isle, VT from habitats up to 2 m deep with substrate varying from mud with dense vegetation to bare rock. Mark-recapture studies conducted by these authors indicated that American eels inhabiting shallow-water areas of Lake Champlain are relatively mobile and occupied areas minimally ranging in size from 2.4-65.4 hectares. The broad array of habitat used by American eel in Lake Champlain suggests that this species may occur, at least intermittently, in the littoral zone of the lake in the vicinity of the transmission line corridor. However, given the mobility of individuals of this species and the abundance of similar littoral habitat adjacent to the transmission corridor, the habitat within the transmission line corridor does not represent a critical resource for American eel.

The black meadowhawk (VT state rank of S1S2) and lyre-tipped spreadwing (VT state rank of S3S4) are dragonfly and damselfly species, respectively. These species have an aquatic juvenile life stage and a terrestrial adult life stage. Both life stages are associated with shallow lake margin, marsh, pond, or bog habitats containing abundant emergent vegetation (Paulson 2011). There are no such habitats along the immediate shoreline or into the littoral zone of Lake Champlain at either end of the transmission line corridor, so these species are presumed absent from this portion of the project area.

Indiana bat (federally listed as endangered) and northern long-eared bat (proposed for federal listing as endangered) are terrestrial species typically not associated with aquatic habitats (USFWS 2014a, 2014b). Both species hibernate during winter in caves or, occasionally, in abandoned mines. When not hibernating, these bats are found in wooded areas where they usually roost under loose tree bark on dead or dying trees. Indiana bats typically forage in closed to semi-open forested habitats and forest edges. Northern long-eared bats forage in the understory of forested hillsides and ridges. Typical habitat of these two species is absent along the immediate shoreline and the littoral zone of Lake Champlain at either end of the transmission line corridor, so these species are presumed absent from this portion of the project area.

Handsome sedge is a NY state-listed threatened plant species that occurs in forests, forest edges, roadsides, or less frequently in open meadows (NYNHP 2013). It occurs in areas with calcareous soils, including dry deciduous forests and ravines, moist meadows, woods, and thickets. These habitats are absent along the immediate shoreline and in the littoral zone of Lake Champlain at either end of the transmission line corridor, so this species is presumed absent from this portion of the project area.

B. Depth of Sediment Occupied by Macroinvertebrates

Sediment samples for analysis of aquatic macroinvertebrate depth distribution were successfully collected from all 12 sampling locations at the sediment surface and seven of the 12 sampling locations at sediment depths of 0.5-m and 1.0-m (Table 2). Samples from sediment depths of 0.5-m and 1.0-m could not be collected at five of the six littoral zone sampling locations due to refusal of the vibracore sampler on probable bedrock at these locations. At least one aquatic macroinvertebrate was found in the surface sediment samples of all 12 sampling locations. At least one aquatic macroinvertebrate was found in only two of the seven samples from a sediment depth of 0.5-m, and no organisms were found in any of the seven samples from a sediment depth of 1.0-m.

Fifty or more organisms were found only in the six surface sediment samples from the littoral zone. No more than 25 and typically less than 10 organisms were found in surface sediment samples from the profundal zone. The two samples containing macroinvertebrates from a sediment depth of 0.5-m contained only one and three organisms, respectively. Total number of taxa at a station ranged from zero to 16. Littoral zone taxa richness ranged from nine to 16, with taxa richness being slightly higher (12-16 taxa) at the NY end of the transmission line corridor than from the VT end (9-11 taxa). Taxa richness in the surface sediments of the profundal zone ranged from one to five in both the NY and VT portions of the profundal zone.

Dreissenid mussels were the dominant taxon in the surface sediments of the VT littoral zone, representing 44-60% of the macroinvertebrate community. Tubificid worms or chironomid (midge) larvae were second in abundance in the surface sediments of the VT littoral zone, representing 14-38% of the community. All other taxa comprised less than 10% of the macroinvertebrate community in the surface sediments of the VT littoral zone. Insects other than midge larvae were relatively scarce in the surface substrate of the littoral zone. No samples could be taken in the VT littoral zone at depths of 0.5 m and 1.0 m below the sediment surface due to refusal of the core sampler by rock substrate.

Tubificid worms were the dominant taxon in the surface sediments of the VT profundal zone, representing 62-100% of the community. Only two taxa were found in samples taken in the VT profundal zone at depths of 0.5 m and 1.0 m below the sediment surface. One of these, dreissenid mussels, was represented by three individuals from a depth of 0.5 m below the sediment at station SL-04, and the other, a lumbriculid worm, was represented by a single individual from a depth of 0.5 m below the sediment at station SL-06. No organisms were found in samples taken in the VT profundal zone from 1.0 m below the sediment surface.

The dominant taxon in the surface sediments of the NY littoral zone differed among the three stations, with dreissenid mussels dominant (38% of community) at station SL-18, bithyniid snails dominant (24%) at station SL-19, and hydrobiid snails dominant (42%) at station SL-20. Other taxa representing 10% or more of the community in the surface sediments of these stations were tubificid worms, naidid worms, lymnaeid and planorbid snails, and chironomid larvae. Insects other than midge larvae were relatively scarce in the surface substrate of the littoral zone. No organisms were found at depths of 0.5 m and 1.0 m below the sediment surface in samples taken in the NY littoral zone.

The dominant taxon in the surface sediments of the NY profundal zone also differed among the three stations, with tubificid worms and sphaeriid clams dominant (but with only one individual each) at station SL-15, limnesid water mites dominant (but with only one individual) at station SL-16, and dreissenid mussels dominant (64%) at station SL-17. No organisms were found in samples taken in the NY profundal zone at depths of 0.5 m and 1.0 m below the sediment surface.

IV. CONCLUSIONS

1. The littoral zone at both ends of the PV-20 transmission line corridor was typical of the littoral habitat found throughout much of the surrounding near-shore area of Lake Champlain. The habitat was relatively similar on both ends of the corridor, though there was more aquatic plant growth on the NY side.

2. In general, the littoral zone habitat was characterized by a mix of cobble, boulder, bedrock, and gravel substrate from shore out to about the 4-m depth contour at a water surface elevation of 29.6 m, beyond which silt became an increasingly larger component of the substrate out to the off-shore edge of the littoral zone. Aquatic plant growth was sparse on the Vermont side, consisting of scattered stems growing in crevices among the rocks in water less than 3 m deep at a water surface elevation of 29.6 m and becoming slightly more abundant farther off shore where silt was the primary substrate. Aquatic plant growth on the NY side was somewhat more abundant but not dense.

3. There were no habitat features that set the littoral zone within the PV-20 transmission line corridor apart from the littoral zone in this general region of the lake. No habitats were noted that would provide exceptional value as fish spawning or nursery areas or be considered unique in supporting fish and wildlife resources, including threatened or endangered species.

4. No evidence of use of the shoreline or littoral zone within the PV-20 transmission line corridor by federally- or state-listed threatened or endangered species was found. Common loon and American eel, listed as a species of concern in NY and VT, respectively, may occasionally use the littoral zone of the transmission line corridor, but the habitat within the transmission line corridor does not represent a critical resource for either of these species.

5. The benthic macroinvertebrate community within the surface substrate of the littoral zone of the PV-20 transmission line corridor was dominated by mollusks, with dreissenid mussels being dominant at all three VT locations and dreissenid mussels, bithyniid snails, and hydrobiid snails dominant at the three NY locations. Insects other than midge larvae were relatively scarce in the surface substrate of the littoral zone.

6. The benthic macroinvertebrate community within the surface substrate of the profundal zone of the PV-20 transmission line corridor contained few taxa and low abundance of organisms. Tubificid worms were dominant (but not abundant) in the surface substrate of the profundal zone community at all three VT stations, and tubificid worms and sphaeriid clams, limnesid water mites, and dreissenid mussels were dominant (but not abundant) at the three NY locations. Only two insects representing two taxa were collected in the six surface substrate samples from the profundal zone.

7. Aquatic macroinvertebrates were nearly absent from sediment 0.5 m below the substrate surface, with only four organisms representing two taxa collected in 14 samples from 0.5 m or greater below the substrate surface. No organisms were collected from 1.0 m below the substrate surface.

8. Based on this investigation's characterization of the aquatic habitat and aquatic biota occurring in the PV-20 transmission line corridor, no significant short-term or permanent negative impacts to aquatic habitat or aquatic biota are anticipated from the proposed installation of four new transmission cables to the immediate north of the seven existing transmission cables. Trenchless installation will be used to position the new transmission cables three or more meters below the lake bottom to a point at least 30 m beyond (off-shore) the littoral zone at the NY end and at least 60 m beyond the littoral zone at the VT end. This trenchless installation will avoid any physical disturbance to the littoral zone at either end of the transmission corridor. The temporary disturbance of profundal zone bottom sediments by construction of a temporary cofferdam and jet-sled installation of buried cables farther offshore is not anticipated to have any significant negative impact on aquatic habitat or biota given the general lack of aquatic invertebrates occupying the dense silt substrate in this region. The laying of the new cables on the lake bottom surface beyond the 30-m depth contour (at mean low water elevation of 28.4 m) will have no significant negative impact for the same reason.

9. Removal of the existing seven transmission cables following installation of the four new transmission cables will necessarily result in disturbance of the lake bottom within the littoral zone, but this disturbance will be temporary and localized and is not anticipated to have any negative impacts to aquatic habitat or aquatic biota identified in this investigation. The rock rip rap covering the existing cables from shore to a distance of approximately 75 m off shore will be dredged/excavated and placed on the lake bottom next to the cables. Once the cables are removed, the rock will be laid back in place so as not to change the existing contours. Farther offshore in the profundal zone, the silt sediment will be temporarily disturbed when the sediment-covered portions of the cables and existing grounding grids, grounding grid lines, concrete anchors, fenders, and grout bags are removed. This process will result in temporary shifting of substrate and possible suspension of sediment when surface substrates are initially disturbed. However, the disturbance will be localized, short-term, and without any negative impact to the aquatic habitat and aquatic biota of the lake as long as best management practices are used to minimize the area of disturbed sediment and limit dispersion of suspended sediment. Upon completion of removal of the existing cables and

appurtenant structures, the composition and contour of the lake bottom will be essentially unchanged from the existing condition.

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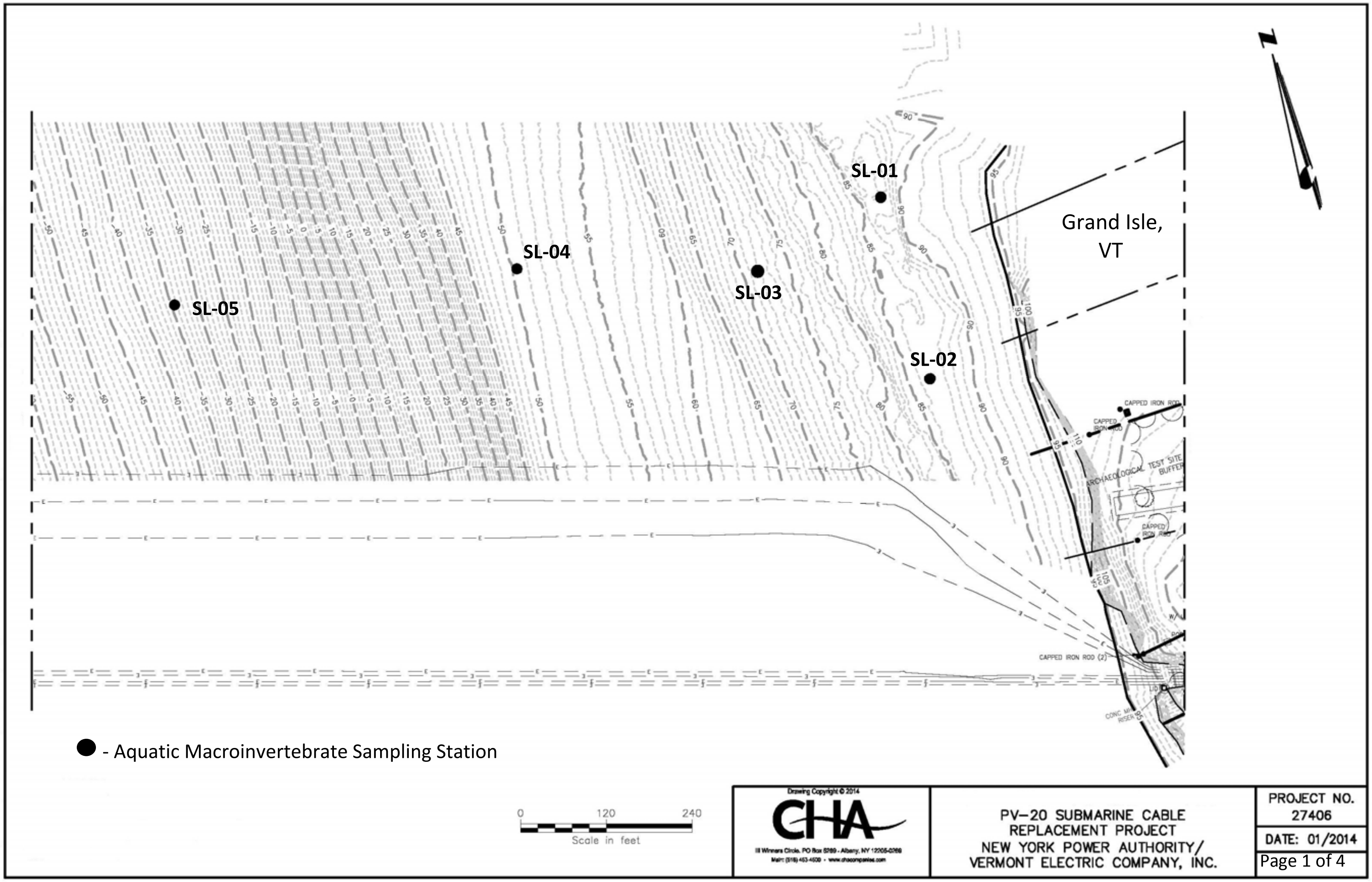
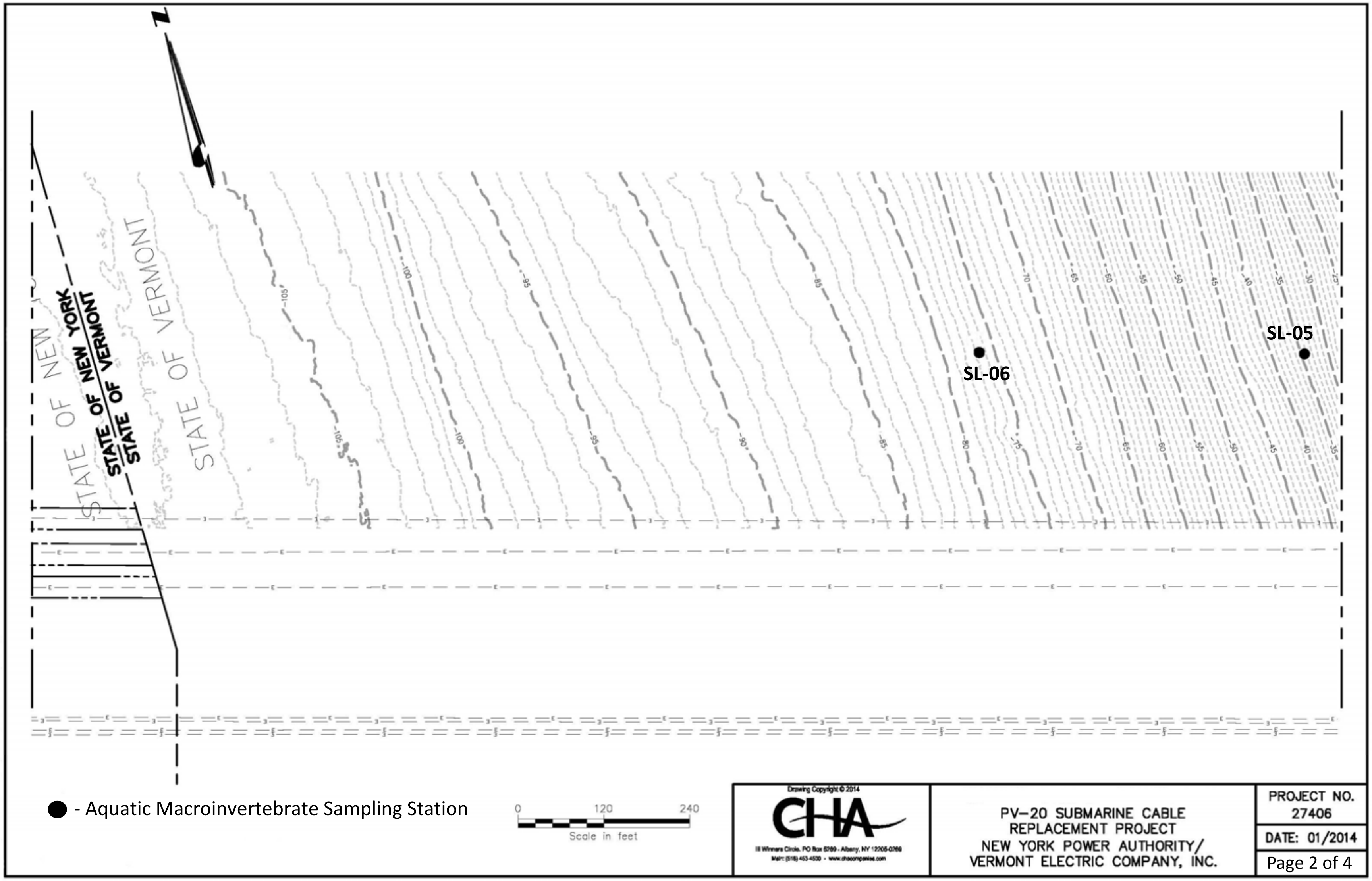


Figure 1. Location of stations at which samples were collected to assess the sediment depth distribution of aquatic macroinvertebrates along the PV-20 submarine transmission line corridor running from Cumberland Head, NY to Grand Isle, VT.



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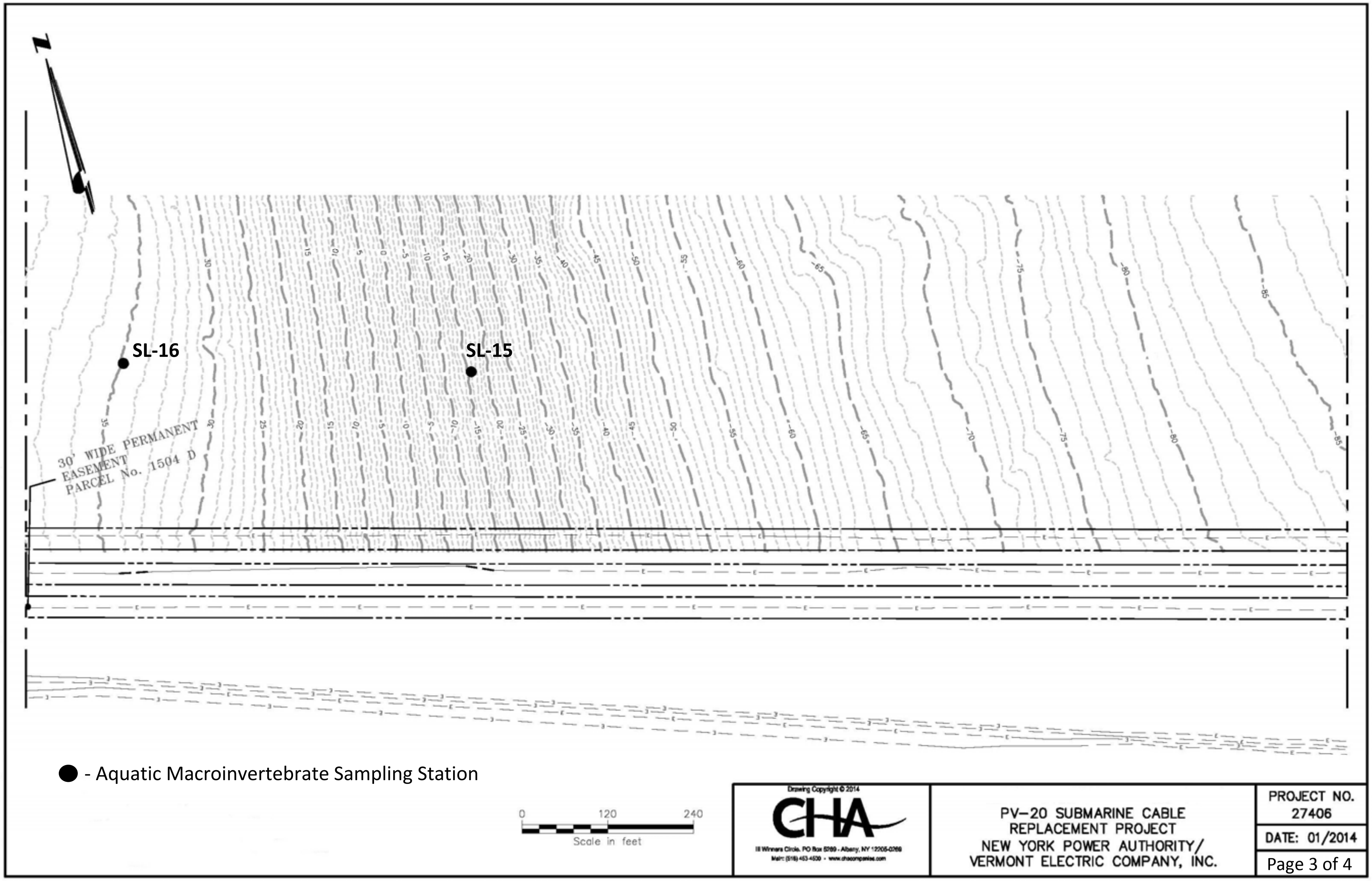

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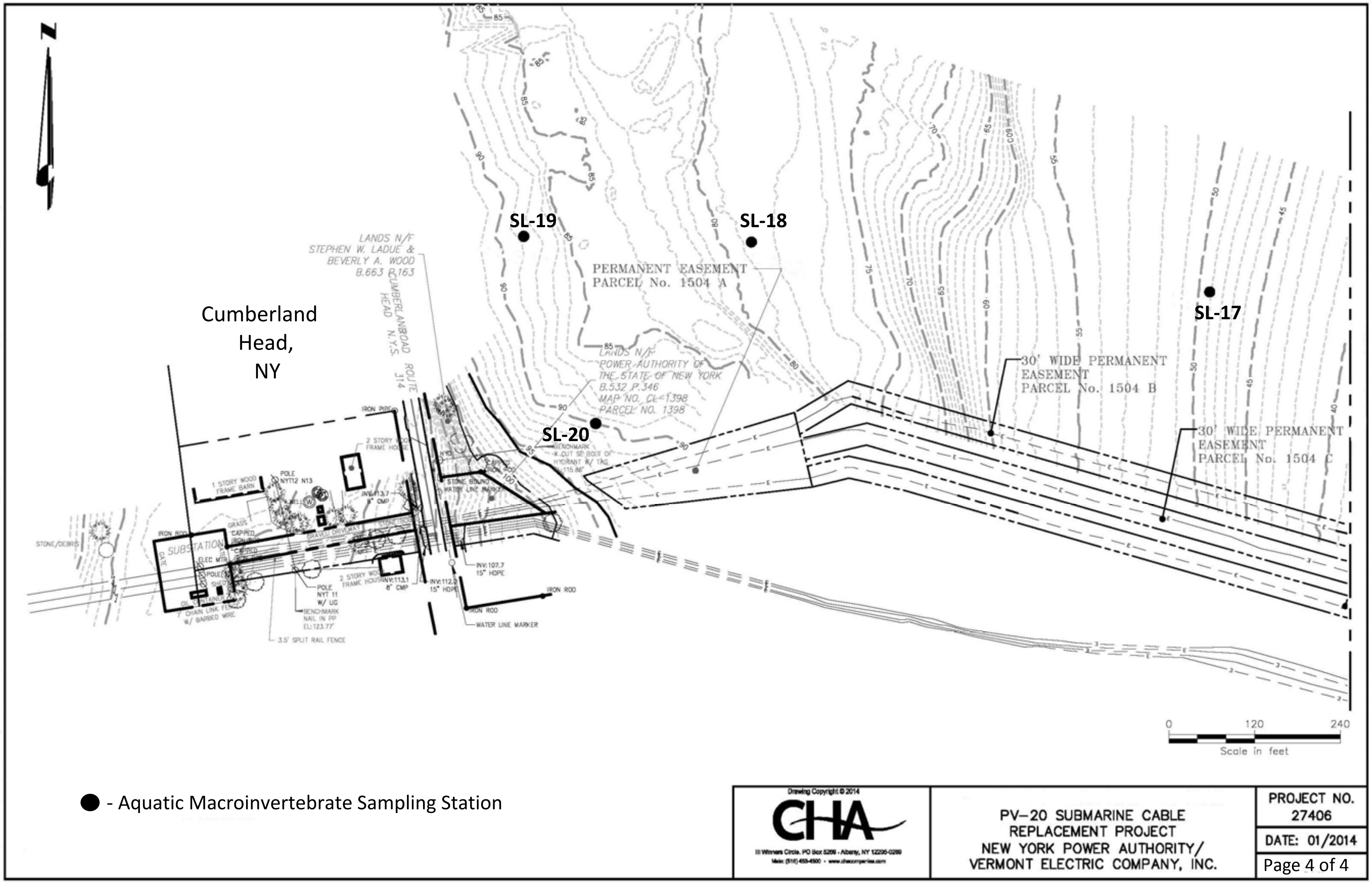

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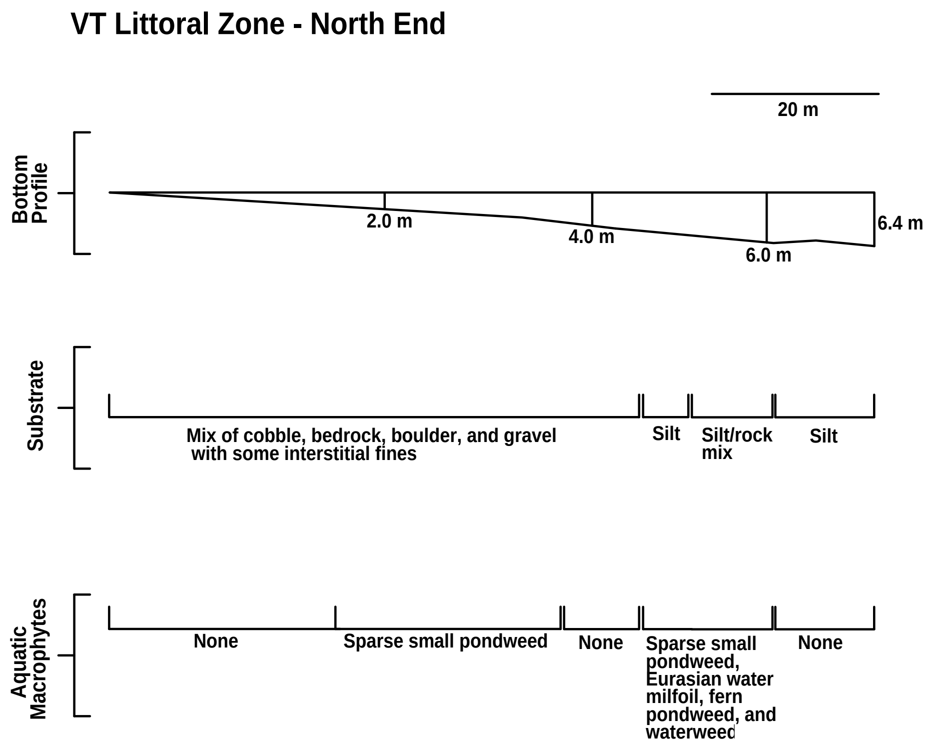

Figure 2. Schematic of the bottom profile, substrate, and aquatic macrophyte depth distribution on the north side of the Vermont end of the PV-20 submarine transmission line corridor running from Cumberland Head, NY to Grand Isle, VT (as determined at a water surface elevation of 29.6 m msl).

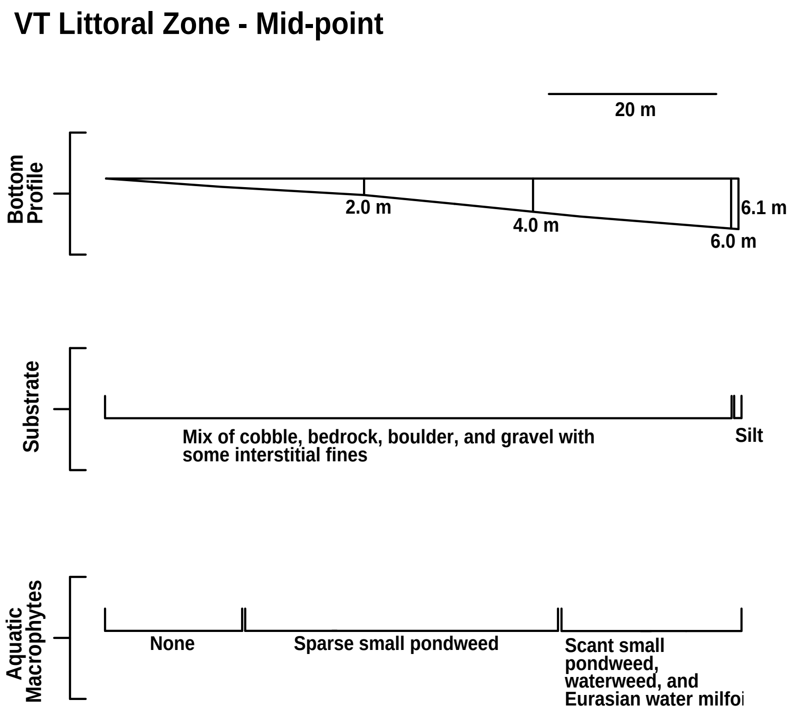

Figure 3. Schematic of the bottom profile, substrate, and aquatic macrophyte depth distribution near the mid-point of the Vermont end of the PV-20 submarine transmission line corridor running from Cumberland Head, NY to Grand Isle, VT (as determined at a water surface elevation of 29.6 m msl).

VT Littoral Zone - South End

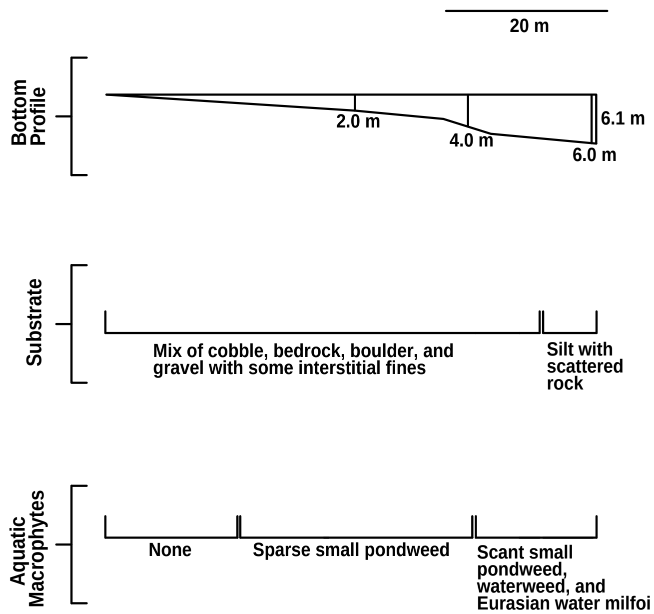

Figure 4. Schematic of the bottom profile, substrate, and aquatic macrophyte depth distribution on the south side of the Vermont end of the PV-20 submarine transmission line corridor running from Cumberland Head, NY to Grand Isle, VT (as determined at a water surface elevation of 29.6 m msl).

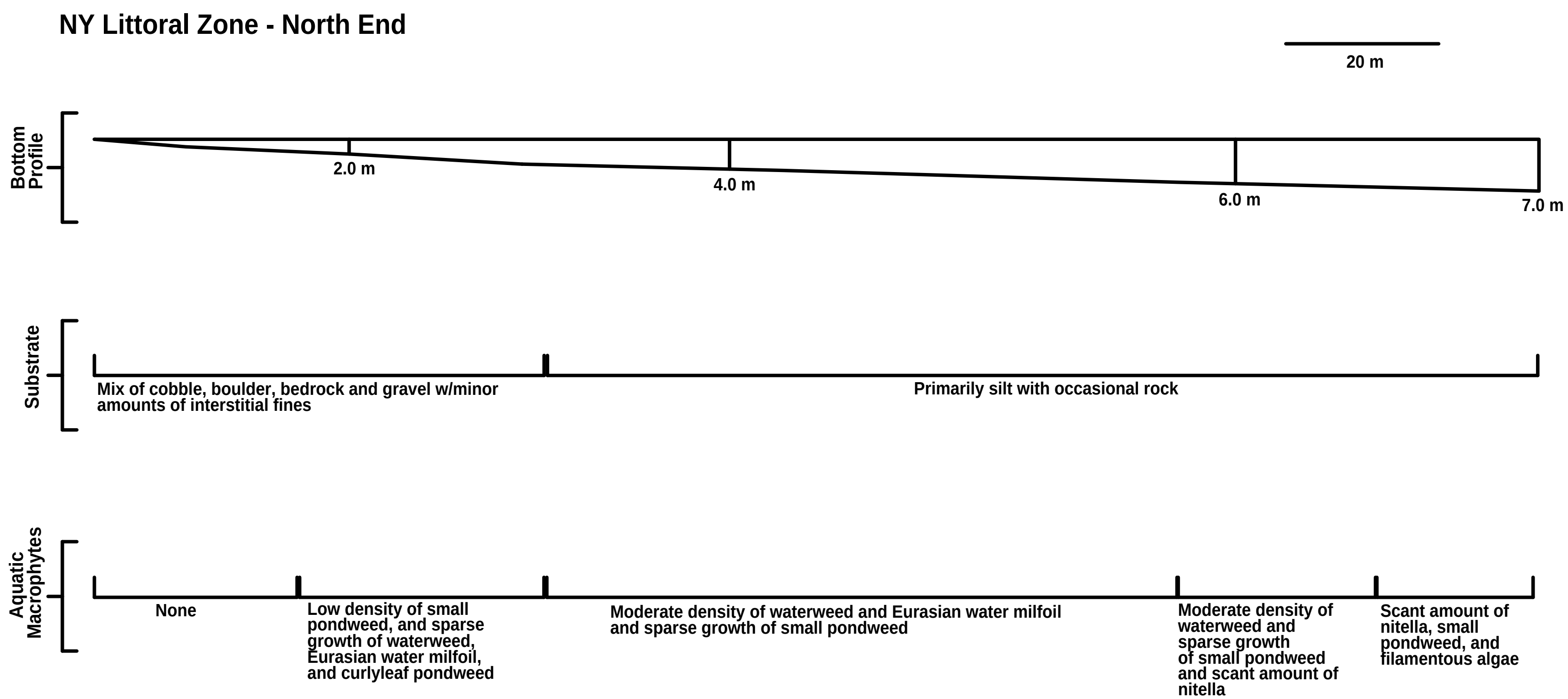

Figure 5. Schematic of the bottom profile, substrate, and aquatic macrophyte depth distribution on the north side of the New York end of the PV-20 submarine transmission line corridor running from Cumberland Head, NY to Grand Isle, VT (as determined at a water surface elevation of 29.6 m msl).

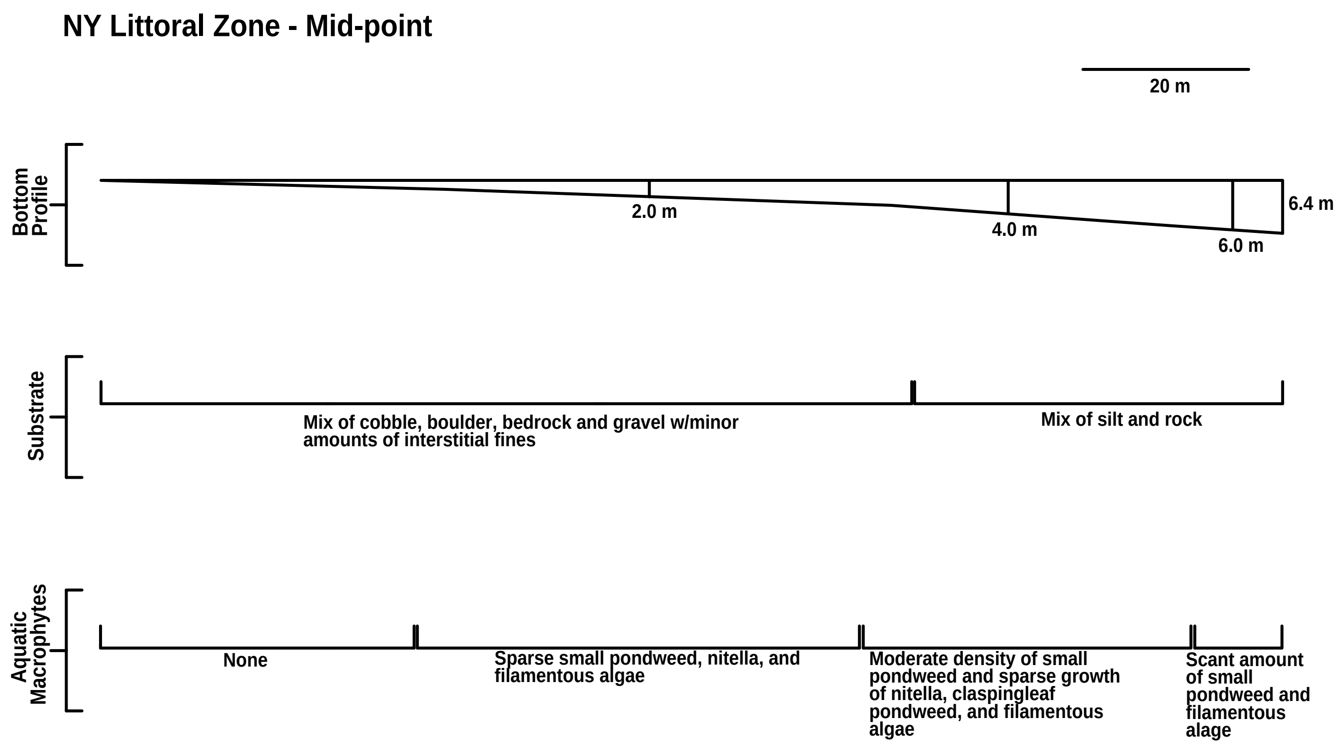

Figure 6. Schematic of the bottom profile, substrate, and aquatic macrophyte depth distribution near the mid-point of the New York end of the PV-20 submarine transmission line corridor running from Cumberland Head, NY to Grand Isle, VT (as determined at a water surface elevation of 29.6 m msl).

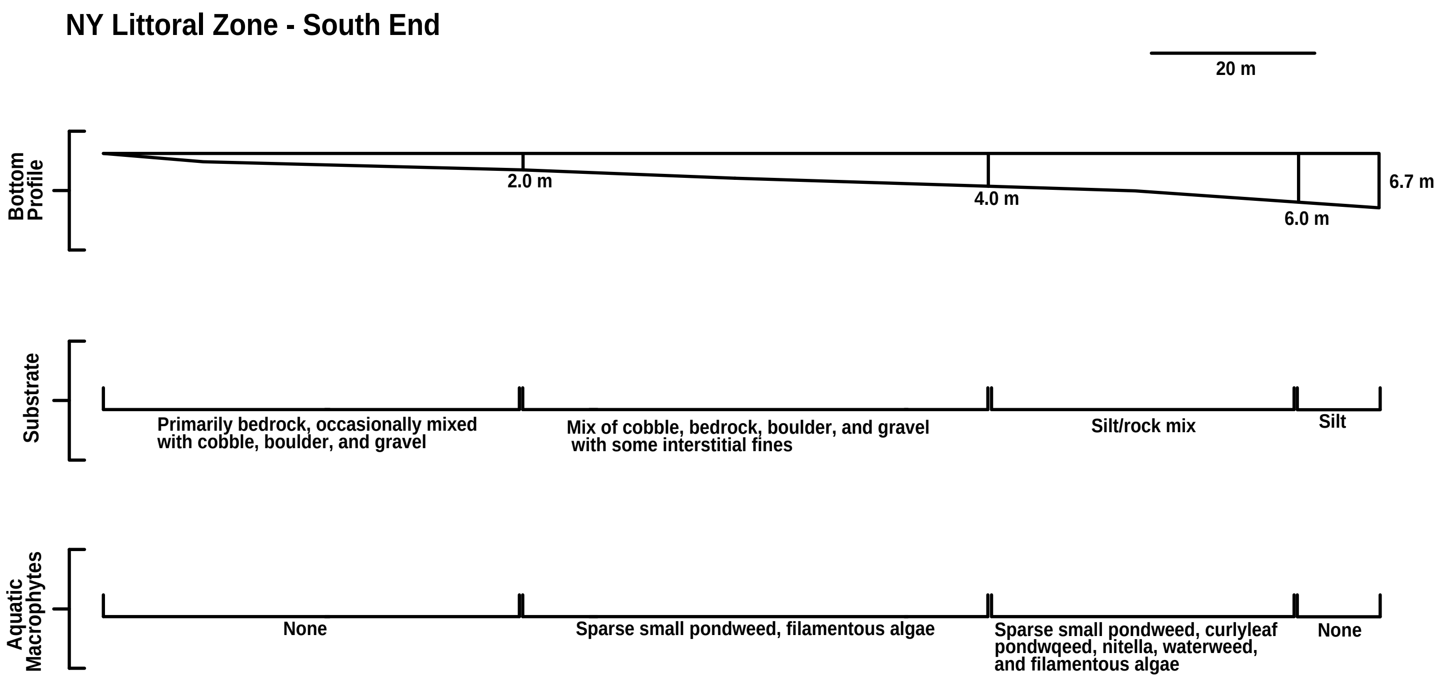

Figure 7. Schematic of the bottom profile, substrate, and aquatic macrophyte depth distribution on the south side of the New York end of the PV-20 submarine transmission line corridor running from Cumberland Head, NY to Grand Isle, VT (as determined at a water surface elevation of 29.6 m msl).

Table 1. Rare, threatened, or endangered animal and plant species known to occur or may occur at or in the vicinity of the PV-20 submarine transmission line corridor running from Cumberland Head, NY to Grand Isle, VT.

Common Name	Scientific Name	Source*	Status or Rank
Northern harrier	*Circus cyaneus*	NYNHP	NY state threatened
Common loon	*Gavia immer*	NYNHP	NY species of concern
Handsome sedge	*Carex formosa*	NYNHP	NY state threatened
American eel	*Anguilla rostrata*	VTNHI	VT species of concern
Black meadowhawk	*Sympetrum danae*	VTNHI	VT S1S2 rank
Lyre-tipped spreadwing	*Lestes unguiculatus*	VTNHI	VT S3S4 rank
Indiana bat	*Myotis sodalis*	USFWS NY	Endangered
Northern long-eared bat	*Myotis septentrionalis*	USFWS NY	Proposed endangered

* - NYNHP = New York Natural Heritage Program; VTNHI = Vermont Natural Heritage Inventory; USFWS NY = U. S. Fish & Wildlife Service New York Field Office

Table 2. Identification and number or aquatic macroinvertebrates found in samples taken at the sediment surface, 0.5 m below the sediment surface, and 1.0 m below the sediment surface along the corridor of the PV-20 submarine cable in Lake Champlain, NY and VT, November 2013, based on identification of a 50-organism subsample; X – present in sample but not in subsample.

Station	**SL-01**			**SL-02**			**SL-03**		
Taxon **Stratum**	**0.0**	**0.5**	**1.0**	**0.0**	**0.5**	**1.0**	**0.0**	**0.5**	**1.0**
OLIGOCHAETA		Rock substrate precluded collection of vibracore sample at this depth	Rock substrate precluded collection of vibracore sample at this depth		Rock substrate precluded collection of vibracore sample at this depth	Rock substrate precluded collection of vibracore sample at this depth		Rock substrate precluded collection of vibracore sample at this depth	Rock substrate precluded collection of vibracore sample at this depth
Lumbricidae									
Lumbriculidae									
Naididae									
Tubificidae	5			3			19		
NEMATODA									
HIRUDINEA									
Erpobdellidae				1			4		
GASTROPODA									
Bithyniidae							X		
Hydrobiidae	1			2			1		
Lymnaeidae									
Planorbidae	2			X			1		
Physidae	1								
Undetermined Gastropoda									
BIVALVIA									
Dreissenidae	29			30			22		
Sphaeriidae				X					
OSTRACODA	4						1		
MALACOSTRACA									
Crangonyctidae									
Gammaridae	1						1		
ACARIFORMES									
Limnesiidae									
INSECTA									
EHPEMEROPTERA									
Caenidae									
Ephemerellidae	X								
ODONATA									
Coenagrionidae							1		
COLEOPTERA									
Dytiscidae									
Elmidae	X			1			X		
Noteridae									
LEPIDOPTERA									
Pyralidae									
TRICHOPTERA									
Apataniidae	X								
Leptoceridae				X					
DIPTERA									
Chironomidae	7			13			X		
TOTAL NO.	**50**			**50**			**50**		
TOTAL TAXA	**11**			**9**			**11**		

Table 2. Continued.

Taxon / Station / Stratum	SL-04			SL-05			SL-06		
	0.0	**0.5**	**1.0**	**0.0**	**0.5**	**1.0**	**0.0**	**0.5**	**1.0**
OLIGOCHAETA									
Lumbricidae									
Lumbriculidae								1	
Naididae									
Tubificidae	4			8			5		
NEMATODA									
HIRUDINEA									
Erpobdellidae									
GASTROPODA									
Bithyniidae									
Hydrobiidae				1			1		
Lymnaeidae									
Planorbidae									
Physidae									
Undetermined Gastropoda									
BIVALVIA									
Dreissenidae		3							
Sphaeriidae				2			1		
OSTRACODA									
MALACOSTRACA									
Crangonyctidae									
Gammaridae				1					
ACARIFORMES									
Limnesiidae									
INSECTA									
EHPEMEROPTERA									
Caenidae									
Ephemerellidae									
ODONATA									
Coenagrionidae									
COLEOPTERA									
Dytiscidae									
Elmidae				1					
Noteridae									
LEPIDOPTERA									
Pyralidae									
TRICHOPTERA									
Apataniidae									
Leptoceridae									
DIPTERA									
Chironomidae									
TOTAL NO.	**4**	**3**	**0**	**13**	**0**	**0**	**7**	**1**	**0**
TOTAL TAXA	**1**	**1**	**0**	**5**	**0**	**0**	**3**	**1**	**0**

Table 2. Continued.

Taxon / Station / Stratum	SL-15 0.0	SL-15 0.5	SL-15 1.0	SL-16 0.0	SL-16 0.5	SL-16 1.0	SL-17 0.0	SL-17 0.5	SL-17 1.0
OLIGOCHAETA									
Lumbricidae							1		
Lumbriculidae									
Naididae									
Tubificidae	1								
NEMATODA							6		
HIRUDINEA									
Erpobdellidae									
GASTROPODA									
Bithyniidae									
Hydrobiidae							1		
Lymnaeidae									
Planorbidae									
Physidae									
Undetermined Gastropoda									
BIVALVIA									
Dreissenidae							16		
Sphaeriidae	1								
OSTRACODA									
MALACOSTRACA									
Crangonyctidae									
Gammaridae									
ACARIFORMES									
Limnesiidae				1					
INSECTA									
EHPEMEROPTERA									
Caenidae									
Ephemerellidae									
ODONATA									
Coenagrionidae									
COLEOPTERA									
Dytiscidae									
Elmidae									
Noteridae									
LEPIDOPTERA									
Pyralidae									
TRICHOPTERA									
Apataniidae									
Leptoceridae									
DIPTERA									
Chironomidae							1		
TOTAL NO.	**2**	**0**	**0**	**1**	**0**	**0**	**25**	**0**	**0**
TOTAL TAXA	**2**	**0**	**0**	**1**	**0**	**0**	**5**	**0**	**0**

Table 2. Continued.

Taxon **Station Stratum**	**SL-18** 0.0	**SL-18** 0.5	**SL-18** 1.0	**SL-19** 0.0	**SL-19** 0.5	**SL-19** 1.0	**SL-20** 0.0	**SL-20** 0.5	**SL-20** 1.0
OLIGOCHAETA					Rock substrate precluded collection of vibracore sample at this depth	Rock substrate precluded collection of vibracore sample at this depth		Rock substrate precluded collection of vibracore sample at this depth	Rock substrate precluded collection of vibracore sample at this depth
Lumbricidae							4		
Lumbriculidae									
Naididae				6					
Tubificidae	7			1			5		
NEMATODA									
HIRUDINEA									
Erpobdellidae	1						X		
GASTROPODA									
Bithyniidae	3			12			4		
Hydrobiidae	3			X			21		
Lymnaeidae				7			1		
Planorbidae	5						3		
Physidae	1			X			2		
Undetermined Gastropoda				X					
BIVALVIA									
Dreissenidae	19			9			1		
Sphaeriidae	2			2			4		
OSTRACODA	1						1		
MALACOSTRACA									
Crangonyctidae				4					
Gammaridae	1						X		
ACARIFORMES				3					
Limnesiidae							X		
INSECTA									
EHPEMEROPTERA									
Caenidae				4					
Ephemerellidae									
ODONATA									
Coenagrionidae									
COLEOPTERA									
Dytiscidae				2					
Elmidae	2						3		
Noteridae				X					
LEPIDOPTERA									
Pyralidae							X		
TRICHOPTERA									
Apataniidae									
Leptoceridae									
DIPTERA									
Chironomidae	5						1		
TOTAL NO.	**50**	**0**	**0**	**50**			**50**		
TOTAL TAXA	**12**	**0**	**0**	**14**			**16**		

Photo 1. Lake Champlain shoreline and littoral zone at the Grand Isle, VT end of the PV-20 submarine transmission line corridor, July 2, 2014.

Photo 2. Lake Champlain shoreline and littoral zone at the Grand Isle, VT end of the PV-20 submarine transmission line corridor, July 2, 2014.

Photo 3. Lake Champlain shoreline and littoral zone at the Grand Isle, VT end of the PV-20 submarine transmission line corridor, July 2, 2014.

Photo 4. Sparse growth of small pondweed in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, VT, July 2, 2014.

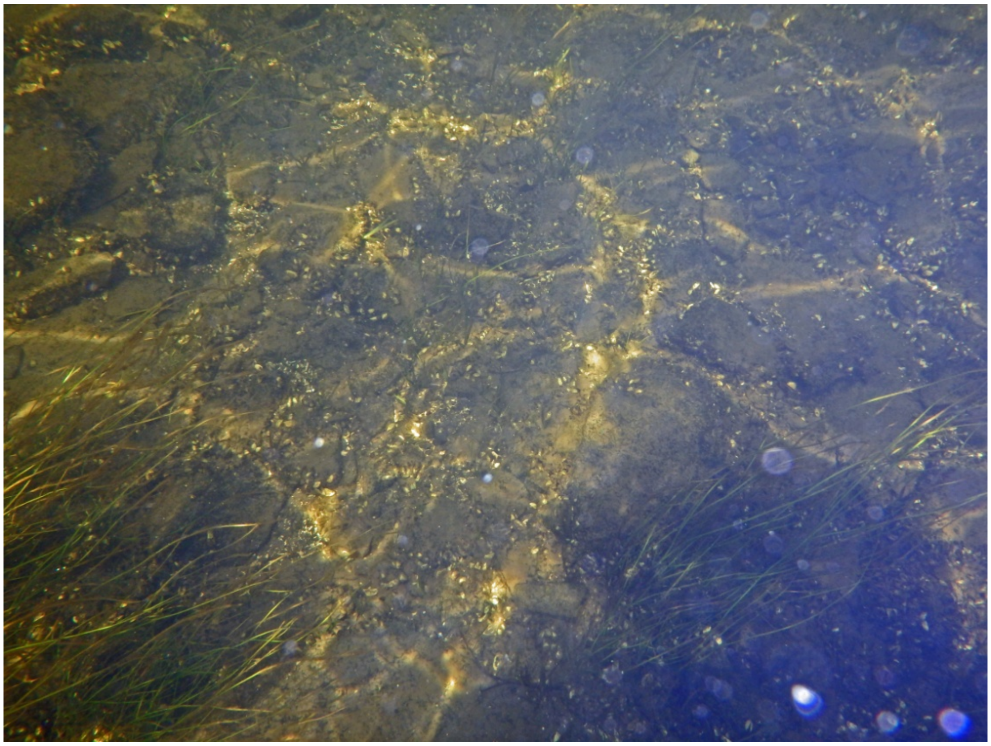

Photo 5. Scattered patches of small pondweed in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, VT, July 2, 2014.

Photo 6. Dead stems of Eurasian watermilfoil collected in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, VT, July 2, 2014.

Photo 7. Clean cobble/boulder/coarse gravel in the near-shore zone of the PV-20 submarine transmission line corridor, Lake Champlain, VT, July 2, 2014.

Photo 8. Cobble/bedrock/boulder/gravel substrate in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, VT, July 2, 2014.

Photo 9. Cobble/bedrock/boulder/gravel substrate in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, VT, July 2, 2014.

Photo 10. Low density of dreissenid mussels on substrate in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, VT, July 2, 2014.

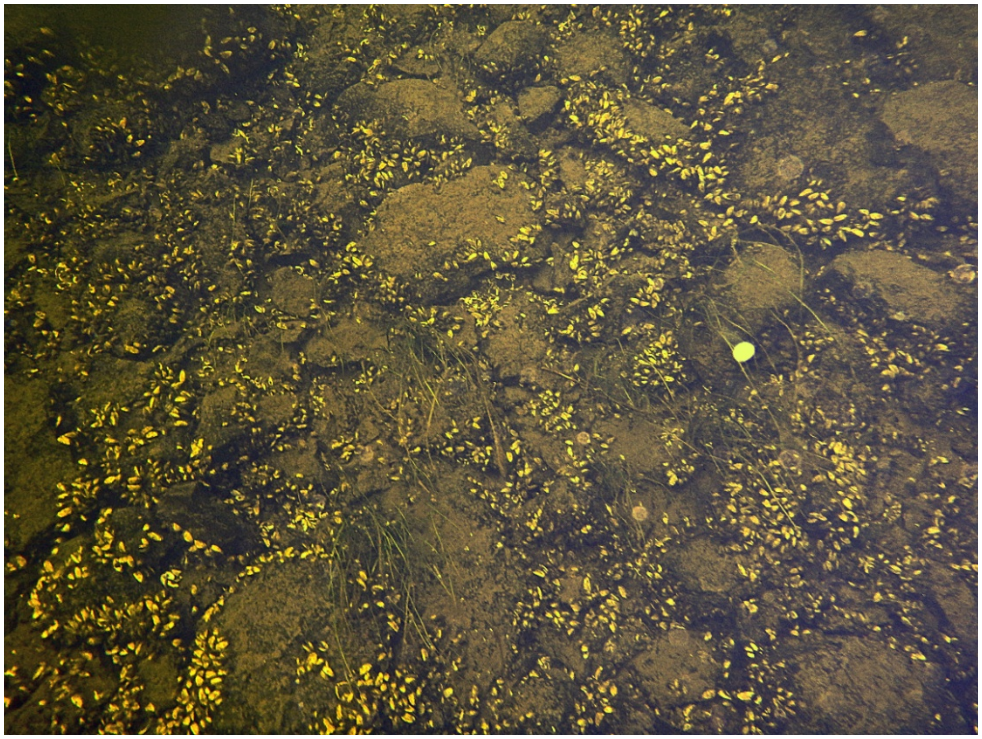

Photo 11. Moderate density of dreissenid mussels in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, VT, July 2, 2014.

Photo 12. Lake Champlain shoreline and littoral zone looking north from the NY end of the PV-20 submarine transmission line corridor, July 2, 2014.

Photo 13. Lake Champlain shoreline and littoral zone looking south from the NY end of the PV-20 submarine transmission line corridor, July 2, 2014.

Photo 14. Lake Champlain shoreline and littoral zone viewed from off shore at the NY end of the PV-20 submarine transmission line corridor, July 2, 2014.

Photo 15. Moderate density of macrophytes found in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, NY, July 2, 2014.

Photo 16. Cobble/boulder/bedrock/gravel substrate in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, NY, July 2, 2014.

Photo 17. Cobble/boulder/bedrock/gravel substrate in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, NY, July 2, 2014.

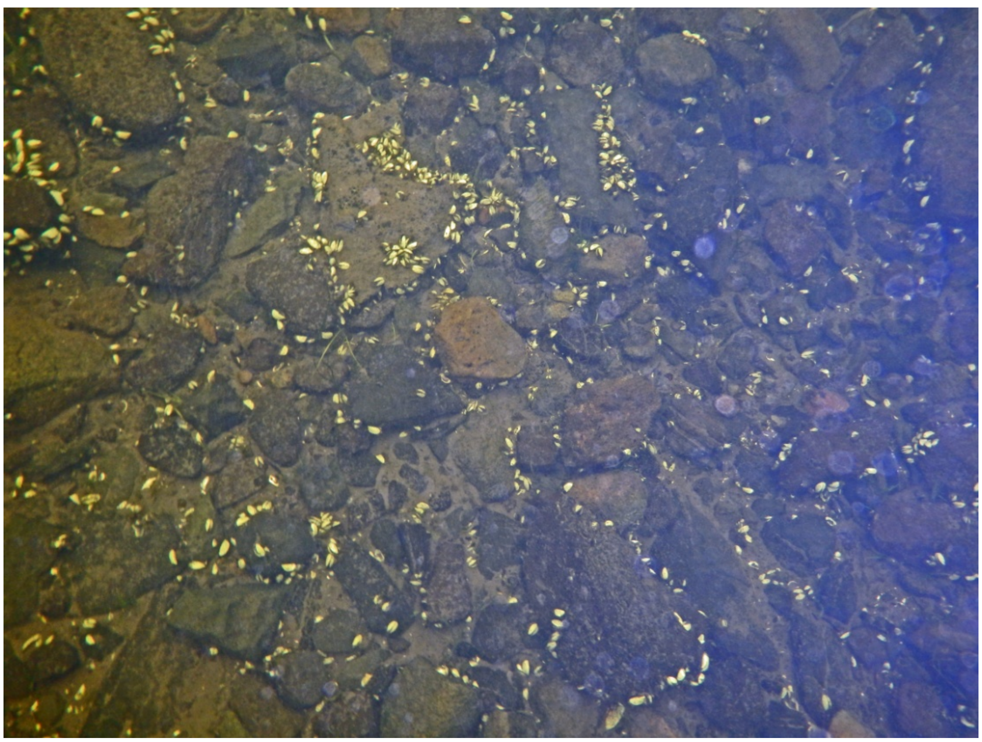

Photo 18. Rock substrate with interstitial fines in the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, NY, July 2, 2014.

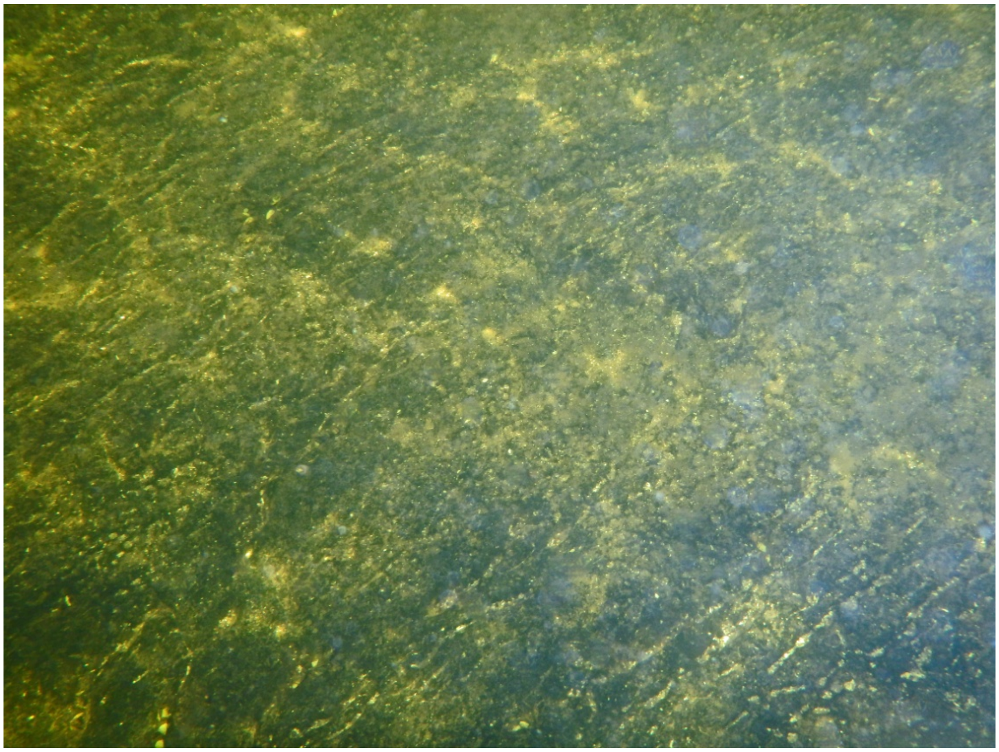

Photo 19. Bedrock substrate in the southern portion of the littoral zone of the PV-20 submarine transmission line corridor, Lake Champlain, NY, July 2, 2014.