



AQUETONG CREEK RESTORATION PROJECT

2024 MONITORING REPORT

SOLEBURY TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA

NOVEMBER 2024

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INTRODUCTION

The purpose of this annual monitoring report, the fourth of five, is to document the status and development of the Aquetong Creek Restoration Project (Restoration Project) located within Aquetong Spring Park in Solebury Township, Bucks County, Pennsylvania (Site; **Figures 1 and 2**).

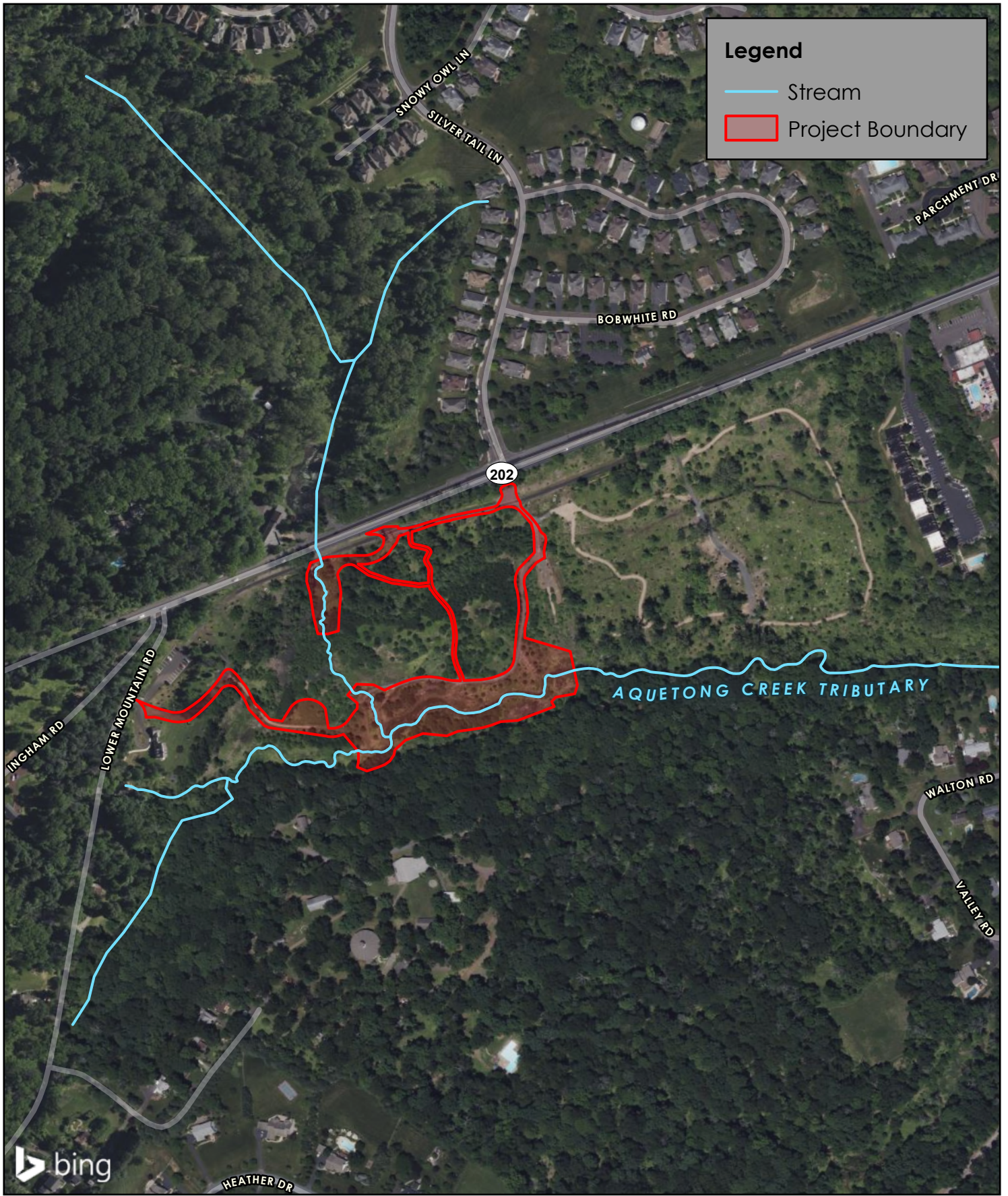
The Restoration Project is situated within the former impoundment of Aquetong Lake (Lake), which was a 15-acre impoundment formed in 1870 by the construction of an earthen dam on Aquetong Creek (Creek). Solebury Township removed the dam in April 2015 via a controlled partial breach that drained the Lake and re-exposed the Lake bottom. The goal of the dam breach was to reduce thermal impacts on the Creek, a high-quality, cold-water fishery designated waterbody. With the dam removed and the Lake drained, a meandering channel formed through the exposed Lakebed, connecting the upper and lower headwater sections of the Creek. The primary source of inflow to the headwater portion of the Creek is Ingham Spring, an artesian spring formed at the contact of two geologic formations, with a sustained flow rate of 2,000 gallons per minute (F.X. Browne, Inc. 2004). The Creek also receives flow from an unnamed tributary that enters the Site from the north under Route 202. The tributary receives inflow from a detention basin located to the northeast of the Site, as well as a large pond to the north of the Site. There is supplemental overland flow which enters the Creek via stormwater runoff discharged from the adjacent developed areas located to the north and south of the Site.

Following the breaching of the dam, stewardship was necessary to guide the early developmental stages of the former impoundment to facilitate the establishment of desirable ecological communities and a productive surface water feature that continues to maintain its population of brook trout. The Restoration Project was implemented following Solebury Township's (herein referred to as "the Township") purchase of the Site. From the onset, the Township and its environmental partners recognized the unique environmental benefits of the cold-water spring and the possibilities associated with the re-establishment of the Creek through the breaching of the dam. Following the dam breach, the Township and its project partner, Bucks County Trout Unlimited, successfully transplanted 1,000 native Pocono brook trout to the re-established Creek channel. Scientific monitoring of the Creek, commissioned by the Township, confirmed that, after a year, the transplanted brook trout population was reproducing.

In 2018, the Township completed its Strategic Master Plan for Aquetong Spring Park which expanded the objectives for the restoration of the former impoundment as part of the park design. The restoration efforts included the management of diseased forest, impoundment restoration (including stormwater management), and park improvements focused on passive recreation, education, and cultural components. Immediately downgradient of the former dam remnants was a forest comprised of mostly diseased green ash (*Fraxinus pennsylvanica*) and black walnut (*Juglans nigra*) trees. The Township removed these hazard trees in 2019 and re-established the area with other desirable native species. The Township concurrently established an invasive species management program. The Township reused the removed trees within the park (with Pennsylvania Department of Environmental Protection (PADEP) approval) in conjunction with the Restoration Project as habitat and park features.

A PADEP-approved Restoration Waiver 16 (Authorization ID No. 1278424, dated October 23, 2019) (See Appendix IV) approved the monitoring of the stream and wetland restoration areas and wetland creation areas in accordance with the Mitigation Plan narrative provided as module S4 of the *Aquetong Creek Restoration Project Environmental Assessment Addendum*, dated June 2019, last updated September 2019. The restoration of the wetlands commenced in 2020 and included the enhancement of 1.09-acres of existing palustrine emergent (PEM) wetlands through floodplain re-connectivity, invasive species removal, subsequent installation of native herbaceous and woody plant material, and the creation of 0.25-acres of forested wetlands. The wetland enhancement and creation elements were designed to provide additional functions and values

File: P:\03888\Projects\03888011\GIS\APRX\Aquetong Year 2 Monitoring Report\Aquetong Year 2 Monitoring Report.aprx, 11/6/2023, Drawn by Isrinivasan, Copyright Princeton Hydro, LLC.



NOTES:
 1. Stream and project boundary are approximate.
 2. Aerial imagery obtained through ArcGIS Online Bing Maps (C) 2023 Microsoft Corporation and its data suppliers.

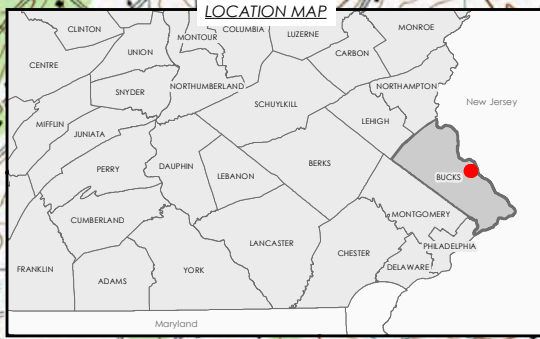
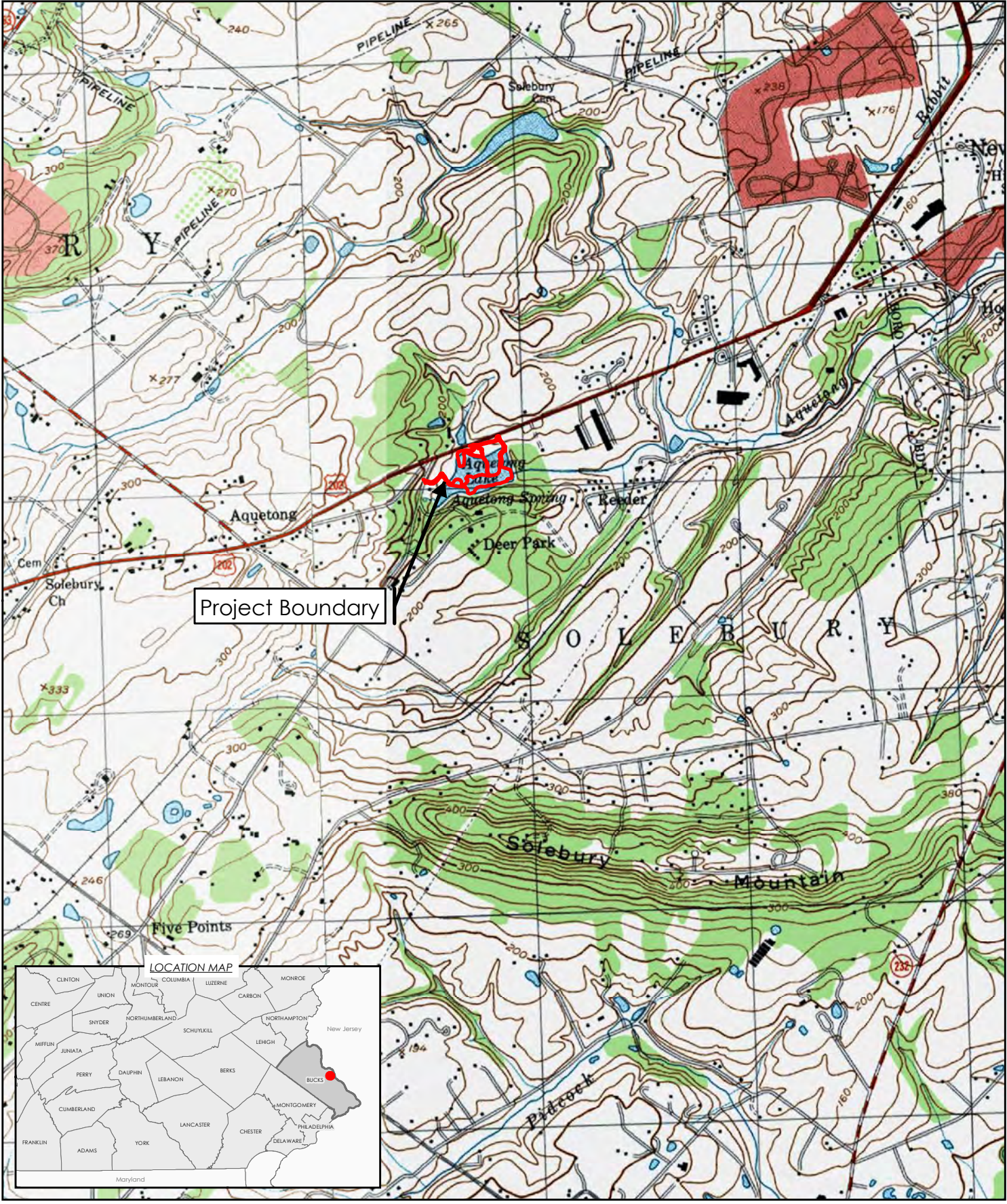
AERIAL OVERVIEW MAP

AQUETONG CREEK RESTORATION PROJECT
 WETLAND MITIGATION MONITORING
 AQUETONG SPRING PARK
 SOLEBURY TOWNSHIP
 BUCKS COUNTY, PENNSYLVANIA



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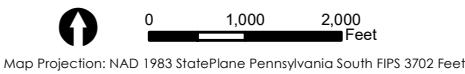
- NOTES:
1. Project boundary obtained from Princeton Hydro planset titled "Aquetong Creek Restoration" dated 10/18/2019.
 2. USGS topographic digital raster graphic obtained from Terrain Navigator Pro, Lambertville and Buckingham, PA quadrangle.

USGS LOCATION MAP

AQUETONG CREEK RESTORATION PROJECT
 WETLAND MITIGATION MONITORING
 AQUETONG SPRING PARK
 SOLEBURY TOWNSHIP
 BUCKS COUNTY, PENNSYLVANIA



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when compared with the pre-existing degraded PEM wetlands. The creation of wetlands was necessitated via the permanent conversion of approximately 0.07-acres of degraded PEM wetlands to open water; thus, 0.25-acres of forested wetland were created in accordance with Chapter 105.20a(a)1 to compensate for the permanent areal loss of wetland. Additionally, the creation of 0.25-acres of forested wetland complies with Chapter 105.20a(a)2 as the forested wetland was designed to provide additional functions and values when compared to the previously degraded PEM wetland. The resulting ratio was 3:1, greater than the required 1:1 wetland replacement criterion outlined in Chapter 105.20a(a)(1). The forested wetlands are located adjacent to the permanently converted PEM wetland in accordance with the Siting Criteria outlined in Chapter 105.20a(a)(3). Overall, the project resulted in a 0.18-acre net gain of forested wetlands on-Site.

This monitoring report presents data collected during the 2024 growing season, the Site's fourth full growing season after planting, to illustrate compliance and document the status and development of the Restoration Project since monitoring was initiated in 2021. The data collected serves to steward the wetland's development moving forward. The information provided in this monitoring report includes the following: (i) a description of the general success of the Restoration Project at the time of inspection, (ii) an inventory of plant species present, (iii) a qualitative description of wildlife utilization, (iv) a determination of the percent areal coverage of vegetation, (v) color photographs, (vi) a Site plan indicating location and orientation of the photographs, (vii) and a description of adaptive management measures that were and/or need to be implemented to address potential problems or deficiencies identified during the inspection.



Figure 3. View of healthy installed woody species amidst a robust herbaceous stratum within the wetland enhancement area.

The goals for the Restoration Project are to achieve at least 85% vegetative coverage by native, desirable hydrophytic species; to achieve at least 85% woody plant survivorship; minimize the areal coverage of undesirable, non-native species to the maximum extent practicable; and to stabilize the Creek channel.



SECTION 1: PRE-CONSTRUCTION SITE ENVIRONMENT

Following the breaching of the dam and draining of the Lake, a meandering channel formed through the exposed Lakebed sediment, connecting the spring to the reach of the Creek below the former dam. Sufficient sediment had accumulated in the former Lake such that the meandering channel that re-formed following dam removal initiated the process of channel incision or “downcutting” (i.e., active erosion of sediment from a stream that results in lowering the elevation of a channel bed and reduces channel slope). The Restoration Project experienced downcutting, creek channel instability, and erosion of the former Lake bottom. Certain sections of the Creek’s channel were unstable and underlain by additional erodible sediment. Further, the exposure of Lake sediments following the dam breach facilitated the establishment of invasive species within portions of the former Lakebed, negatively impacting the ecological functions and values of recently exposed floodplain wetlands and associated upland areas.

SECTION 2: DESIGN AND CONSTRUCTION

The Restoration Project is comprised of wetland creation and wetland enhancement areas. The wetland creation area consists of 0.25 acres (10,804 square feet) of palustrine forested (PFO) freshwater wetlands designed to replace the permanent loss and conversion of the adjacent degraded PEM wetland to open water. The forested wetland creation area was designed to foster the development of a forested floodplain wetland adjacent to the stabilized Creek channel. The wetland creation area is located adjacent to the Creek and its tributary (Appendix III, Photos 7 and 8). The wetland enhancement area is comprised of 1.09 acres (47,301 square feet) of PEM wetlands. The purpose of the wetland enhancement area is to enhance the biological and physical functions of the existing PEM wetlands on-Site, such as providing fish and wildlife habitat, enhancing the water quality of the Creek, providing flood storage, and controlling erosion along the Creek banks. The wetland enhancement areas are located on portions of the western bank of the unnamed tributary to the Creek, and along both the northern and southern bank of the Creek (Appendix III, Photos 9 and 10).

The Restoration Project resulted in the creation of PFO wetland and enhancement of PEM wetland that currently possess and will continue to support a variety of native herbaceous and woody species. The wetland enhancement area was designed to connect the Creek to its floodplain in order to store floodwater from the Creek and its tributary, which are the primary hydrologic sources for the wetlands within the Restoration Project footprint. In addition to the Restoration Project’s wetland creation and enhancement elements, the project also aimed to develop a stable Creek channel capable of passing various flow rates without being subject to erosion. Specifically, the restoration of the wetlands and Creek channel serves to foster the Site’s capability of supporting a high-quality, cold-water aquatic community. Additionally, the Restoration Project improves the Creek’s water quality via the stabilization of the Creek channel.

A planting plan was devised for the 1.35-acre wetland portion of the Restoration Project, and is based on the local plant assemblage, hydrology, and other observed Site conditions. In 2020, an initial native seed mix was applied, and 6,600 two-inch herbaceous plugs were installed throughout the wetland portion of the Restoration Project. The type, hydrologic indicator status, and quantity of herbaceous plant material that was installed in the wetlands is provided in **Tables 1** and **2** below.



Table 1. Wetland Restoration Area Seed Mix

Botanical Name	Common Name	Indicator Status	Rate (lb/acre) ¹	Quantity (%)
<i>Bidens frondosa</i>	Devil's beggartick	FACW	1.00	5.0
<i>Calamagrostis canadensis</i>	Bluejoint grass	FACW	1.50	5.0
<i>Cinna arundinaceae</i>	Wood reedgrass	FACW	2.25	8.0
<i>Echinochloa muricata</i>	Rough barnyard grass	OBL	3.00	10.0
<i>Elymus virginicus</i>	Virginia wildrye	FACW	5.25	18.0
<i>Carex vulpinoidea</i>	Fox sedge	OBL	4.00	14.0
<i>Lolium multiflorum</i>	Annual rye	NL	4.50	15.0
<i>Panicum dichotoflorum</i>	Smooth panic grass	FACW	3.00	10.0
<i>Dichanthelium clandestinum</i>	Deertongue	FAC	4.25	15.0
<i>Persicaria pensylvanica</i>	Pennsylvania smartweed	FACW	0.75	3.0
<i>Verbena hastata</i>	Blue vervain	FACW	0.25	1.0
<i>Senna hebecarpa</i>	Wild senna	FACW	0.25	1.0

¹ Seed was spread over entire area (1.35 acres) at a rate of 30 pounds per acre.

Table 2. Wetland Restoration Area Herbaceous Plugs

Botanical Name	Common Name	Indicator Status	Planting Type	Quantity ¹
<i>Asclepias incarnata</i>	Swamp milkweed	OBL	2" Plug	300
<i>Carex comosa</i>	Longhair sedge	OBL	2" Plug	450
<i>Carex crinita</i>	Fringed sedge	OBL	2" Plug	500
<i>Carex lurida</i>	Shallow sedge	OBL	2" Plug	500
<i>Carex scoparia</i>	Broom sedge	FACW	2" Plug	600
<i>Elymus virginicus</i>	Virginia wildrye	FACW	2" Plug	600
<i>Eupatorium perfoliatum</i>	Boneset	FACW	2" Plug	250
<i>Helenium autumnale</i>	Common sneezeweed	FACW	2" Plug	400
<i>Iris versicolor</i>	Blueflag iris	OBL	2" Plug	350
<i>Juncus effusus</i>	Soft rush	OBL	2" Plug	600
<i>Leersia oryzoides</i>	Rice cutgrass	OBL	2" Plug	400
<i>Schoenoplectus tabernaemontani</i>	Soft-stem bulrush	OBL	2" Plug	500
<i>Scirpus cyperinus</i>	Woolgrass	FACW	2" Plug	550
<i>Smphyotrichum novae-angliae</i>	New England aster	FACW	2" Plug	300
<i>Verbena hastata</i>	Blue vervain	FACW	2" Plug	300

¹ The quantity of herbaceous plants is based on a planting density of 3 feet on center.

Additionally, a total of 710 woody plants (385 trees and 325 shrubs) were installed in the wetland creation and enhancement areas in 2020. The tree species included red maple (*Acer rubrum*, FAC), river birch (*Betula nigra*, FACW), American sycamore (*Platanus occidentalis*, FACW), swamp white oak (*Quercus bicolor*, FACW), pin oak (*Quercus palustris*, FACW), and black willow (*Salix nigra*, OBL). The shrub species included smooth alder (*Alnus serrulata*, OBL), red chokecherry (*Aronia arbutifolia*, FACW), common buttonbush (*Cephalanthus occidentalis*, OBL), silky dogwood (*Cornus amomum*, FACW), winterberry holly (*Ilex verticillata*, FACW), swamp rose (*Rosa palustris*, OBL), and pussy willow (*Salix discolor*, FACW). Woody material was installed where suitable habitat was present and were selected based on (1) being indigenous to the region, (2) providing either good cover or food for wildlife, and (3) having generally good to high survivorship. The type, wetland hydrologic indicator status, and quantity of woody plant material installed within the wetland portion of the Restoration Project is provided in **Tables 3 and 4.**



Table 3. Wetland Restoration Area Tree Installation

Botanical Name	Common Name	Indicator Status	Planting Type	Quantity ¹
<i>Acer rubrum</i>	Red maple	FAC	24" - 36" Container	20
<i>Betula nigra</i>	River birch	FACW	24" - 36" Container	40
<i>Platanus occidentalis</i>	American sycamore	FACW	24" - 36" Container	60
<i>Quercus bicolor</i>	Swamp white oak	FACW	24" - 36" Container	95
<i>Quercus palustris</i>	Pin oak	FACW	24" - 36" Container	95
<i>Salix nigra</i>	Black willow	OBL	24" - 36" Container	75

¹ The quantity of trees is based on a planting density of 10 feet on center.

Table 4. Wetland Restoration Area Shrub Installation

Botanical Name	Common Name	Indicator Status	Planting Type	Quantity ¹
<i>Alnus serrulata</i>	Smooth alder	OBL	24" - 36" Container	35
<i>Aronia arbutifolia</i>	Red chokecherry	FACW	24" - 36" Container	65
<i>Cephalanthus occidentalis</i>	Common buttonbush	OBL	24" - 36" Container	15
<i>Cornus amomum</i>	Silky dogwood	FACW	24" - 36" Container	65
<i>Ilex verticillata</i>	Winterberry holly	FACW	24" - 36" Container	50
<i>Rosa palustris</i>	Swamp rose	OBL	24" - 36" Container	30
<i>Salix discolor</i>	Pussy willow	FACW	24" - 36" Container	65

¹ The quantity of shrubs is based on a planting density of 10 feet on center.

SECTION 3: MONITORING METHODOLOGY

Vegetative cover of the wetland creation and enhancement areas was determined through the use of eight (8) permanent 1 x 1-meter quadrats. The area within each quadrat that lacked vegetation (hereinafter referred to as the “unvegetated area”) was visually estimated in accordance with the *Ocular Estimation of Cover Technique* (USFWS, 1981). The total vegetative cover was the area that remained after excluding the areas determined to be unvegetated. Percent vegetative cover determined by this method is derived by subtracting the unvegetated area from the total area of each quadrat. The formula below was utilized to determine the percent vegetative cover by this method.

$$\text{Percent Vegetative Cover} = \{(\text{total area} - \text{unvegetated area}) / \text{total area}\} \times 100$$



All references to vegetative cover in this document are based on this formula. Subsequently, the vegetative cover provided by each species was visually estimated. Species that were present, but provided less than 1 percent cover, were indicated to be “P” (present). The species-by-species sampling data for each quadrat is provided in Tables 5 and 6. The estimates of total vegetative cover provided by this method are essentially relative values comparing the area within each quadrat that is covered by vegetation relative to un-vegetated areas within the quadrat. However, since plant cover can overlap, the total vegetative cover present in any given quadrat often exceeds the percent vegetative cover



derived by the above referenced formula. The formula used above provides a simple mechanism to portray the area within each quadrat that is covered by vegetation relative to meeting established regulatory objectives. The use of total vegetative cover, however, more effectively conveys the ecological development of the area since it considers the cover provided by each species. Total vegetative cover thus provides a mechanism to see the changes in cover that occur as the wetland matures and becomes more structurally complex.

SECTION 4: MONITORING INSPECTION

The monitoring inspection, the fourth of five, was conducted on September 27, 2024. The inspection included the evaluation of the eight (8) fixed monitoring plots which includes representative locations of both the wetland creation (4) and wetland enhancement (4) areas. Vegetative cover and woody survivorship of the wetland restoration areas was estimated and evaluated in accordance with the methodology detailed in Section 3.0. At the time of the inspection, the wetland restoration area exhibited 100% vegetative cover and 151.2% total cover. The monitoring plot data for the wetland creation and wetland enhancement areas are discussed below in Subsections 4.1 and 4.2, respectively. In accordance with the *Aquetong Creek Restoration Project Environmental Assessment Addendum* (Princeton Hydro, 2019), a qualitative description of wildlife utilization of the wetland restoration areas is also provided in Subsection 4.6.



Figure 4. View of Aquetong Creek's banks that support well-established hydrophytic vegetation.

SUBSECTION 4.1 WETLAND CREATION AREA PLOTS

Four (4) quadrats were established in representative locations throughout the wetland creation area. At the time of the fall 2024 inspection, the wetland creation area possessed 100% vegetative cover and 152.5% total cover (**Table 5**), satisfying the 85% vegetative cover threshold stipulated by PADEP. The high total percent cover



observed in 2024 supports the position that the Restoration Project continues on a positive developmental trajectory while also developing increased structural heterogeneity (Appendix III, Photos 1, 3, 8, and 12).

Vegetative species richness in 2024 ($n = 17$) slightly increased from 2023 ($n = 16$). Similarly to 2023, common reed (*Phragmites australis*, FACW) and Nepalese browntop (*Microstegium vimineum*, FAC) were absent from the monitoring plots in the wetland creation area. However, three additional undesirable, non-native and invasive species were observed within the wetland creation monitoring plots: Canada thistle (*Cirsium arvense*, FACU) at 10.0%; Japanese bristlegrass (*Setaria faberi*, UPL) at 1.3%; and garlic mustard (*Alliaria petiolata*, FACU) at 1.3%. These species are acclimated to dryer conditions and likely took advantage of the dry conditions during the growing season of 2024. These species were treated during the herbicide treatment efforts of 2024 and their mean cover is anticipated to decrease. Additionally, the percent cover of these species is anticipated to decrease over time as desirable native species coverage increases.

The five (5) most prevalent species observed within the wetland creation area were jewelweed (*Impatiens capensis*, FACW) (27.5%), American sycamore (25.0%), Maryland senna (*Senna marilandica*, FAC) (15.0%), purpleleaf willowherb (*Epilobium coloratum*, FACW) (15.0%), and Pennsylvania smartweed (*Persicaria pensylvanicum*, FACW) (12.5%). Despite the dry conditions observed during the 2024 growing season, the wetland creation area continues to be dominated by hydrophytic species with wetland indicator statuses of FACW and OBL. For example, the mean percent cover of jewelweed increased nearly two-fold from 2023 (15.0%). Additionally, American sycamore cover increased from 2023 (22.5%) and purpleleaf willowherb colonized large portions of the wetland creation areas. The dominance of hydrophytic plant species indicates that the Site's hydrologic regime and hydrologic connectivity to the Creek and its tributary is functioning as designed.

No barren areas were observed within the wetland creation area. The continued establishment of a diverse assemblage of native species throughout the wetland creation portions of the Restoration Project supports the position that the wetland creation areas possess suitable substrate and hydrology resulting in a structurally diverse, desirable plant assemblage. Further, the positive developmental trajectory is anticipated to continue moving forward, satisfying the established goals for the Restoration Project to be deemed a success.

As stated above, undesirable, non-native species such as Canada thistle, Japanese bristlegrass, and garlic mustard was observed within the monitoring plots. Despite their presence, the overall presence of these species occurred in small and scattered patches. To address their presence, these species were targeted with an herbicide on August 28th, 2024, September 20th, 2024, and October 17th, 2024 (see Section 4.4). It is anticipated that the 2024 herbicide treatment will prevent the re-establishment of undesirable invasive species within the Restoration Project.



Table 5. Wetland Creation Area Percent Vegetative Cover

Sampling Plot	Wetland Creation				Mean % Cover
	W3	W5	W6	W7	
Barren Soil	0	0	0	0	0.0
<i>Impatiens capensis</i>	20	20	40	30	27.5
<i>Platanus occidentalis</i>	0	0	0	100	25.0
<i>Senna marilandica</i>	0	60	0	0	15.0
<i>Epilobium coloratum</i>	0	20	40	0	15.0
<i>Persicaria pennsylvanicum</i>	10	0	40	0	12.5
<i>Betula nigra</i>	40	0	0	0	10.0
<i>Cirsium arvense</i>	30	0	0	10	10.0
<i>Cornus amomum</i>	0	0	30	0	7.5
<i>Symphyotrichum novae-angliae</i>	0	30	0	0	7.5
<i>Solidago canadensis</i>	15	0	0	0	3.8
<i>Helianthus strumosus</i>	15	0	0	0	3.8
<i>Quercus bicolor</i>	15	0	0	0	3.8
<i>Phytolacca americana</i>	0	0	15	0	3.8
<i>Symphyotrichum novi-belgii</i>	10	0	0	0	2.5
<i>Erechtites hieraciifolius</i>	10	0	0	0	2.5
<i>Setaria faberi</i>	5	0	0	0	1.3
<i>Alliaria petiolata</i>	0	0	0	5	1.3
Percent Cover	100	100	100	100	100.0
Total Cover	170	130	165	145	152.5

SUBSECTION 4.2 WETLAND ENHANCEMENT AREA PLOTS

Four (4) quadrats were established in representative locations throughout the wetland enhancement area. At the time of inspection, the wetland enhancement area possessed 100% vegetative cover and 149.8% total cover (Table 6), satisfying the requisite 85% vegetative cover threshold. As observed within the wetland creation portion of the Restoration Project, the overall total vegetative cover is indicative of (1) a site that is on a positive developmental trajectory, and (2) the continued establishment of a diverse assemblage of desirable native species supports the position that the wetland enhancement areas possess suitable substrate and hydrology (Appendix III, Photos 9, 10, and 13).

No barren ground was observed, and all plots were well-established with a diverse native herbaceous plant community. All four (4) plots in the wetland enhancement area possessed greater than 100% total herbaceous cover. The species richness decreased in 2024 (n = 17) from 2023 (n = 21). Although the total number of plant species (n) decreased in 2024, non-native species, such as common reed, which was present in prior years, were absent from the monitoring plots within the wetland enhancement area.

The five most prevalent species were jewelweed (46.3%), black willow (37.5%), river birch (12.5%), Nepalese browntop (10.0%), and Pennsylvania smartweed (7.5%). Despite the dry conditions observed during the 2024 growing season, the wetland enhancement area continues to be dominated by hydrophytic species with wetland indicator statuses of FACW and OBL. For example, the mean percent cover of jewelweed increased over six-fold from 2023 (7.5%). The dominance of hydrophytic plant species indicates that the Site's hydrologic regime and hydrologic connectivity to the Creek and its tributary is functioning as designed.



Overall, the results of the fourth monitoring inspection indicate that the wetland enhancement area is on a positive developmental trajectory, given the high vegetative cover, species richness, and a plant community comprised of desirable native and target hydrophytes. Further, the positive developmental trajectory is anticipated to continue moving forward, satisfying the established goals for the Restoration Project to be deemed a success.

Table 6. Wetland Enhancement Area Percent Vegetative Cover

Sampling Plot	Wetland Enhancement				Mean % Cover
	W1	W2	W4	W8	
Barren Soil	0	0	0	0	0.0
<i>Impatiens capensis</i>	70	85	0	30	46.3
<i>Salix nigra</i>	0	0	100	50	37.5
<i>Betula nigra</i>	0	0	0	50	12.5
<i>Microstegium vimineum</i>	0	10	0	30	10.0
<i>Panicum pensylvanicum</i>	0	30	0	0	7.5
<i>Leersia oryzoides</i>	20	0	0	0	5.0
<i>Elymus virginicus</i>	0	0	0	20	5.0
<i>Carex lurida</i>	20	0	0	0	5.0
<i>Panicum hydropiperoides</i>	5	10	0	0	3.8
<i>Epilobium coloratum</i>	0	0	15	0	3.8
<i>Lycopus americanus</i>	0	15	0	0	3.8
<i>Pilea pumila</i>	5	0	5	0	2.5
<i>Cinna arundinaceae</i>	0	0	0	10	2.5
<i>Typha latifolia</i>	10	0	0	0	2.5
<i>Cephalanthus occidentalis</i>	0	0	3	0	0.8
<i>Verbena hastata</i>	0	3	0	0	0.8
<i>Juncus effusus</i>	3	0	0	0	0.8
Percent Cover	100	100	100	100	100.0
Total Cover	133	153	123	190	149.8

SUBSECTION 4.3 WOODY PLANT SURVIVORSHIP

As shown in **Table 7**, the woody plant survivorship within the Restoration Project was 81.7%, which is below the 85% survivorship threshold stipulated by the permit. Survivorship decreased from 87.3% in 2023 to 81.7% in 2024. This decrease is likely associated with the prolonged period of abnormally dry (D0) to moderate drought (D1) conditions from late May through October as per the National Oceanic and Atmospheric Administration’s drought.gov website. The drought also provided a suitable hydrological regime for American burnweed (*Erechtites hieraciifolius*), which is a native annual herbaceous species that can reach heights greater than 5-feet, which can make it difficult to locate installed woody material, particularly shrubs. For example, areas within the wetland enhancement areas where swamp rose was observed in prior monitoring inspections was dominated by American burnweed at the time of the 2024 monitoring inspection. It is likely that swamp rose was still present, but difficult to locate. Additionally, there was evidence of deer herbivory on installed red chokecherry and silky dogwood. These factors, when combined, resulted in a small reduction in woody plant material survivorship.



Table 7. Wetland Restoration Area Woody Plant Survivorship

Botanical Name	Common Name	Quantity Installed	Quantity Observed	Survivorship (%)
<i>Acer rubrum</i>	Red maple	20	14	70.0
<i>Betula nigra</i>	River birch	40	76	>100.0
<i>Platanus occidentalis</i>	American sycamore	60	70	>100.0
<i>Quercus bicolor</i>	Swamp white oak	95	51	53.7
<i>Quercus palustris</i>	Pin oak	95	37	38.9
<i>Salix nigra</i>	Black willow	75	175	>100.0
<i>Alnus serrulata</i>	Smooth alder	35	10	28.6
<i>Aronia arbutifolia</i>	Red chokecherry	65	10	15.4
<i>Cephalanthus occidentalis</i>	Common buttonbush	15	12	80.0
<i>Cornus amomum</i>	Silky dogwood	65	85	>100.0
<i>Ilex verticillata</i>	Winterberry holly	50	0	0.0
<i>Rosa palustris</i>	Swamp rose	30	0	0.0
<i>Salix discolor</i>	Pussy willow	65	40	61.5
Total		710	580	81.7

The species with the highest survivorship (>100%) were river birch, American sycamore, black willow, and silky dogwood. These species continue to colonize the Restoration Project; for example, seventy-five (75) black willow saplings were installed, and one hundred and seventy-five (175) viable black willow saplings were observed in 2024.

In order to comply with the 85% survivorship criterion, it is recommended that the supplemental installation of native trees and/or shrubs be implemented in 2025 to return the Restoration Site to the 85% survival of woody plantings. Any tree and shrub species selected should be based upon which species have shown an aptitude for the Site's underlying environmental variables, such as red maple, river birch, American sycamore, black willow, common buttonbush, and silky dogwood. It should be noted that the Solebury Township is working towards acquiring funding for plantings. Supplemental planting information will be provided to PADEP once funding has been obtained.



Figure 5. A healthy installed common buttonbush.



SUBSECTION 4.4 UNDESIRABLE PLANT SPECIES

As outlined within the subsections above, portions of the Restoration Project possessed undesirable non-native species, specifically, Canada thistle, Japanese bristlegrass, and garlic mustard. Common reed was not observed in any monitoring plots in 2024. Additionally, the patches of common reed that were located outside of the monitoring plots, but within the Restoration Project, have decreased in areal cover and possessed signs of stress, including stunted growth.

Overall invasive species cover increased slightly within the wetland creation monitoring plots between 2023 (19.5%) and 2024 (22.4%) (Tables 5 and 6). This increase is attributable to the colonization by Canada thistle, Japanese bristlegrass, and garlic mustard. These species prefer a dryer hydrologic regime and given the drought conditions documented during the 2024 growing season their presence is not unexpected. The wetland enhancement portion of the Restoration Project observed a decrease in undesirable, non-native species cover between 2023 (19.5%) and 2024 (10%). Notably, common reed was absent from the wetland enhancement monitoring plots in 2024. It is anticipated that the 2024 herbicide treatment and the continued development of a canopy will continue to reduce the areal extent of undesirable non-native species.

In addition to the undesirable non-native species listed above, the following undesirable non-native species were observed in small numbers scattered around the Site: reed canarygrass (*Phalaris arundinacea*, FACW), watercress (*Nasturtium officinale*, OBL), yellow iris (*Iris pseudacorus*, OBL), multiflora rose (*Rosa multiflora*, FACU), autumn olive (*Elaeagnus umbellata*, NL), purple loosestrife (*Lythrum salicaria*, FACW), Asiatic tearthumb (*Persicaria perfoliata*, FAC), tree of heaven (*Ailanthus altissima*, FACU), and charlock mustard (*Sinapis arvensis*, NL).

To address the presence of undesirable non-native species, Princeton Hydro targeted these species with an herbicide application on August 28th, September 20th, and October 17th, 2024. It is anticipated that these efforts will (1) prevent the continued establishment of undesirable non-native species, and (2) facilitate continued development of desirable native species. Additionally, as the installed woody material continues to mature, it is anticipated that the presence of undesirable non-native species will concomitantly reduce in areal coverage as they generally require full sun exposure to proliferate. The continued need for implementation of adaptive management efforts related to the presence of undesirable non-native species will continue to be monitored moving forward with additional herbicide applications targeting these species on an as warranted basis.

SUBSECTION 4.5 SOILS AND HYDROLOGY

As outlined by the U.S. Department of Agriculture (1988), "a hydric soil is a soil in which the surface horizons are saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions." Hydric soils have a water table at less than 1 foot from the surface for a significant period, typically a week or more, during the growing season (U.S. Army Corps of Engineers, 1987).

The project has been designed to support wetland creation and enhancement areas, and to enhance the floodplain and hydrologic connectivity with the Creek and its tributary (See Appendix III, Photos 17 and 18). The planting plan was informed by the Restoration Project's hydrology. Specifically, selected flora installed within the wetland restoration areas are classified as facultative (FAC), facultative wetland (FACW), or obligate (OBL). Currently, the herbaceous species present within the seed mix are well-established, especially in the periodically inundated zones of the wetland creation area which indicates that the hydrology is adequate to support hydrophytic plant species, even during drought conditions (See Appendix III, Photos 6, 8, and 11). The existing wetland areas are supporting obligate hydrophytes, including hop sedge (*Carex lupulina*, OBL), jewelweed, pussy willow, black willow, swamp smartweed, shallow sedge, and rice cutgrass. The continued presence of desirable hydrophytic vegetation within the wetland creation and wetland enhancement areas supports the



position that a suitable wetland hydrologic regime has developed within the wetland portions of the Restoration Project.

SUBSECTION 4.6 WILDLIFE UTILIZATION

During the Site inspection conducted on September 27, 2024, fewer avian, fish, amphibian, mammal, and insect species were visually and/or audibly observed compared to prior years. This is likely associated with the prevailing weather conditions, which included rain and wind with high stream flows. Given these conditions, the reduced levels of animal activity are not surprising as wildlife activity tends to be reduced during inclement weather.

Despite the inclement weather, a variety of avian and mammal species were observed utilizing the Site, particularly within the wetland restoration areas. During the monitoring event, the most commonly observed avian species was Common Yellowthroat (*Geothlypis trichas*), which were observed utilizing the shrub and canopy strata within the wetland restoration area along the Creek actively foraging and sheltering. Due to the large number of Common Yellowthroat observed on-Site, it is presumed that they were either (1) utilizing the Site as a stop-over during migration, or (2) were resident breeders that have yet to migrate south. A Great Blue Heron (*Ardea herodias*) was observed actively foraging, consuming small fish within the Creek. Other observed species included Turkey Vulture (*Cathartes aura*), Northern Cardinal (*Cardinalis cardinalis*), Gray Catbird (*Dumetella carolinensis*), and Carolina Wren (*Thryothorus ludovicianus*).

Fish species observed within the pool portions of the Creek and its tributary included creek chub (*Semotilus atromaculatus*), panfish (*Lepomis sp.*), and longnose dace (*Rhinichthys cataractae*). A few green frog (*Lithobates clamitans*) and pickerel frog (*Lithobates palustris*) were also observed throughout the wetland and stream portions of the Restoration Project.

White-tailed deer (*Odocoileus virginianus*) was observed within the uplands and northern wetland enhancement portions of the Site. In 2023, American mink (*Neovison vison*) was observed within the wetland enhancement area along the east bank of the tributary to the Creek.

Additionally, previous monitoring inspections yielded observations of a wide assemblage and diversity of avian, fish, amphibian, mammal, and insect species utilizing the wetland restoration areas, which indicate that the Restoration Project is providing quality habitat and is supporting both resident and migratory avifauna.

SECTION 5: DISCUSSION AND RECOMMENDATIONS

As of September 2024, the wetland creation area possessed 100% vegetative cover and 152.5% total cover, and the wetland enhancement area possessed 100% vegetative cover and 149.8% total cover, with species composition and abundance primarily driven by desirable hydrophytic native herbaceous and woody species. Both areas supported the installed seed mix, herbaceous plugs, and woody species. The average vegetative and total cover of the wetland restoration area is 100% and 151.2%, respectively.

The observed survivorship of woody plants within the wetland restoration area was 81.7%, which is below the 85% survivorship threshold. The decrease in survivorship is likely associated with the drought conditions which resulted in the proliferation of American burnweed. Additionally, signs of deer herbivory were observed. As such, the installation of supplemental trees and shrubs is warranted to bring the Restoration Site back up to above an 85% survivorship for woody plant material. Despite the decrease in overall survivorship, several woody plant species continue to possess high survivorship, which is primarily driven by the continued development and recruitment of silky dogwood, red maple, river birch, American sycamore, and black willow.



Cover of non-native, undesirable species within the wetland restoration areas increased slightly from 19.5% in 2023 to 22.4% in 2024 (**Tables 5 and 6**). Invasive species observed within the wetland restoration area monitoring plots included Canada thistle, Nepalese browntop, and garlic mustard. As noted in *Subsections 4.1 and 4.2* above, the increase of non-native invasive species was attributable to the colonization of the aforementioned species within the wetland creation area, whereas the wetland enhancement area observed an overall decrease in Nepalese browntop and elimination of common reed. While other undesirable species such as reed canarygrass, watercress, yellow iris, multiflora rose, autumn olive, purple loosestrife, Asiatic tearthumb, tree of heaven, and charlock mustard were observed, these species mainly occurred outside of the wetland restoration areas and in small, scattered patches. As discussed above, monitoring of invasive species presence will continue moving forward with additional herbicide applications occurring on an as warranted basis.

To address invasive species, an herbicide application occurred on August 28th, September 20th, and October 17th, 2024, with the effort targeting the aforementioned undesirable species. It is anticipated that, as the Restoration Project continues to develop, desirable native species will continue to proliferate and colonize areas where invasive species were present prior to herbicide application.

Overall, the Restoration Project continues on a positive developmental trajectory, as evidenced by the diverse suite of desirable native species, structural diversity, and utilization of the Restoration Project by breeding avifauna that require specific habitat associated with the presence of desirable native species and structural diversity. Equally important is the presence of a suitable hydrological regime that supports the development of hydrophytic plant species, both herbaceous and woody. It is anticipated that this positive developmental trajectory will continue moving forward, ultimately resulting in the restoration areas satisfying the conditions set forth by the PADEP Restoration Waiver 16 and accompanying statutes.



SECTION 6: REFERENCES

Environmental Laboratory. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0). U.S. Army Engineer Research and Development Center, Vicksburg, MS.

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Princeton Hydro, LLC. June 2019. *Aquetong Creek Restoration Project Environmental Assessment Addendum*. Last updated September 2019.

United States Army Corps of Engineers (USACE). (2023). 2022 National Wetland Plant List, version 3.6. U.S. Army Engineer Research and Development Center, Vicksburg, MS. <http://wetland-plants.usace.army.mil/>

APPENDIX I
PLANT SPECIES LIST

PLANT SPECIES LIST

The following is a list of plant species that occur at the Aquetong Spring Park Restoration Project located in Solebury Township, Bucks County, Pennsylvania. Nomenclature follows the National Wetland Plant List: 2022 wetland ratings (USACE 2023) for the Eastern Mountains and Piedmont Region. NA = Not Applicable, NI = No Indicator, NL = Not Listed.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Indicator Status</u>
Aceraceae	Maple Family	
<i>Acer negundo</i>	Boxelder	FAC
<i>Acer rubrum</i>	Red maple	FAC
<i>Acer saccharinum</i>	Silver maple	FACW
Alismataceae	Water-Plantain Family	
<i>Sagittaria latifolia</i>	Broadleaf arrowhead	OBL
Anacardiaceae	Sumac Family	
<i>Toxicodendron radicans</i>	Eastern poison ivy	FAC
Apiaceae	Carrot Family	
<i>Zizia aurea</i>	Golden Alexanders	FAC
Apocynaceae	Dogbane Family	
<i>Apocynum cannabinum</i>	Indianhemp	FACU
Aquifoliaceae	Holly Family	
<i>Ilex opaca</i>	American holly	FACU
<i>Ilex verticillata</i>	Common winterberry	FACW
Asclepiadaceae	Milkweed Family	
<i>Asclepias incarnata</i>	Swamp milkweed	OBL
<i>Asclepias syriaca</i>	Common milkweed	FACU
Asteraceae / Compositae	Aster Family	
<i>Ageratina altissima</i>	White snakeroot	FACU
<i>Ambrosia artemisiifolia</i>	Annual ragweed	FACU
<i>Artemisia vulgaris</i>	Common wormwood	UPL
<i>Bidens cernua</i>	Nodding beggartick	OBL
<i>Bidens frondosa</i>	Devil's beggartick	FACW
<i>Cirsium arvense</i>	Canada thistle	FACU
<i>Erechtites hieraciifolius</i>	American burnweed	NL
<i>Erigeron philadelphicus</i>	Philadelphia fleabane	FACU
<i>Eupatorium perfoliatum</i>	Common boneset	FACW
<i>Eupatorium serotinum</i>	Lateflowering thoroughwort	FAC
<i>Helenium autumnale</i>	Common sneezeweed	FACW

<u>Scientific Name</u>	<u>Common Name</u>	<u>Indicator Status</u>
<i>Helianthus strumosus</i>	Paleleaf woodland sunflower	FACU
<i>Lactuca biennis</i>	Tall blue lettuce	FACU
<i>Rudbeckia laciniata</i>	Cutleaf coneflower	FACW
<i>Solidago altissima</i>	Tall goldenrod	FACU
<i>Solidago canadensis</i>	Canada goldenrod	FACU
<i>Symphotrichum lateriflorum</i>	Calico aster	FACW
<i>Symphotrichum novae-angliae</i>	New England aster	FACW
<i>Symphotrichum novi-belgii</i>	New Belgium American-aster	FACW
<i>Symphotrichum puniceum</i>	Purplestem aster	OBL
Balsaminaceae	Touch-Me-Not Family	
<i>Impatiens capensis</i>	Jewelweed	FACW
Betulaceae	Birch Family	
<i>Alnus serrulata</i>	Smooth alder	OBL
<i>Betula nigra</i>	River birch	FACW
Boraginaceae	Borage Family	
<i>Hackelia virginiana</i>	Beggar's-lice	FACU
<i>Myosotis scorpioides</i>	True forget-me-not	OBL
Brassicaceae/Cruciferae	Mustard Family	
<i>Alliaria petiolata</i>	Garlic mustard	FACU
<i>Cardamine bulbosa</i>	Bulbous bittercress	OBL
<i>Cardamine hirsute</i>	Hairy bittercress	FACU
<i>Cardamine impatiens</i>	Narrowleaf bittercress	FAC
<i>Nasturtium officinale</i>	Watercress	OBL
<i>Sinapis arvensis</i>	Charlock mustard	NL
<i>Thlapsi arvense</i>	Field pennycress	UPL
Buddlejaceae	Butterfly-bush Family	
<i>Buddleka davidii</i>	Orange-eye butterfly-bush	FACU
Caprifoliaceae	Honeysuckle Family	
<i>Lonicera japonica</i>	Japanese honeysuckle	FACU
<i>Viburnum dentatum</i>	Southern arrowwood	FAC
<i>Viburnum sieboldii</i>	Siebold's viburnum	NL
Cornaceae	Dogwood Family	
<i>Cornus amomum</i>	Silky dogwood	FACW
Cucurbitaceae	Cucumber Family	
<i>Sicyos angulatus</i>	One-seed bur cucumber	FACU

<u>Scientific Name</u>	<u>Common Name</u>	<u>Indicator Status</u>
Cupressaceae	Cypress Family	
<i>Juniperus virginiana</i>	Eastern redcedar	FACU
Cyperaceae	Sedge Family	
<i>Carex comosa</i>	Longhair sedge	OBL
<i>Carex crinita</i>	Fringed sedge	OBL
<i>Carex gracillima</i>	Graceful sedge	FACU
<i>Carex hystericina</i>	Bottlebrush sedge	OBL
<i>Carex lupulina</i>	Hop sedge	OBL
<i>Carex lurida</i>	Shallow sedge	OBL
<i>Carex scoparia</i>	Broom sedge	FACW
<i>Carex vulpinoidea</i>	Fox sedge	OBL
<i>Cyperus esculentus</i>	Yellow nutsedge	FACW
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	OBL
<i>Scirpus atrovirens</i>	Green bulrush	OBL
<i>Scirpus cyperinus</i>	Woolgrass	FACW
Elaeagnaceae	Oleaster Family	
<i>Elaeagnus angustifolia</i>	Russian olive	FACU
<i>Elaeagnus umbellata</i>	Autumn olive	NL
Fabaceae/Leguminosae	Pea Family	
<i>Chamaecrista fasciculata</i>	Partridge pea	FACU
<i>Robinia pseudoacacia</i>	Black locust	FACU
<i>Senna hebecarpa</i>	American senna	FAC
<i>Senna marilandica</i>	Maryland senna	FAC
<i>Trifolium repens</i>	White clover	FACU
Fagaceae	Beech Family	
<i>Quercus bicolor</i>	Swamp white oak	FACW
<i>Quercus palustris</i>	Pin oak	FACW
<i>Quercus phellos</i>	Willow oak	FAC
Iridaceae	Iris Family	
<i>Iris versicolor</i>	Harlequin blueflag	OBL
<i>Iris pseudacorus</i>	Paleyellow iris	OBL
Juglandaceae	Walnut Family	
<i>Juglans nigra</i>	Black walnut	FACU
Juncaceae	Rush Family	
<i>Juncus effusus</i>	Common rush	FACW
<i>Juncus tenuis</i>	Path rush	FAC

<u>Scientific Name</u>	<u>Common Name</u>	<u>Indicator Status</u>
Lamiaceae <i>Lycopus americanus</i>	Mint Family Cut-leaf water-horehound	OBL
Lemnaceae <i>Lemna minor</i>	Duckweed Family Common duckweed	OBL
Liliaceae <i>Allium vineale</i>	Lily Family Wild garlic	FACU
Lythraceae <i>Lythrum salicaria</i>	Loosestrife Family Purple loosestrife	FACW
Magnoliaceae <i>Liriodendron tulipifera</i>	Magnolia family Tuliptree	FACU
Malvaceae <i>Abutilon theophrasti</i>	Mallow Family Velvetleaf	UPL
Oleaceae <i>Fraxinus pennsylvanica</i>	Olive Family Green ash	FACW
Onagraceae <i>Chamerion angustifolium</i> <i>Epilobium coloratum</i>	Evening Primrose family Fireweed Purpleleaf willowherb	FAC FACW
Phytolaccaceae <i>Phytolacca americana</i>	Pokeweed Family American pokeweed	FACU
Poaceae / Gramineae <i>Arthraxon hispidus</i> <i>Bromus inermis</i> <i>Calamagrostis canadensis</i> <i>Cinna arundinacea</i> <i>Dichanthelium clandestinum</i> <i>Echinochloa muricata</i> <i>Elymus virginicus</i> <i>Glyceria striata</i> <i>Leersia oryzoides</i> <i>Lolium multiflorum</i> <i>Microstegium vimineum</i> <i>Panicum dichotoflorum</i> <i>Panicum virgatum</i> <i>Poa pratensis</i> <i>Phalaris arundinacea</i> <i>Phragmites australis</i>	Grass Family Small carpetgrass Smooth brome Bluejoint grass Woodreed Deertongue Rough barnyard grass Virginia wildrye Fowl mannagrass Rice cutgrass Italian ryegrass Nepalese browntop Fall panicgrass Switchgrass Kentucky bluegrass Reed canarygrass Common reed	FAC UPL FACW FACW FACW OBL FACW OBL OBL NL FAC FACW FAC FACU FACW FACW

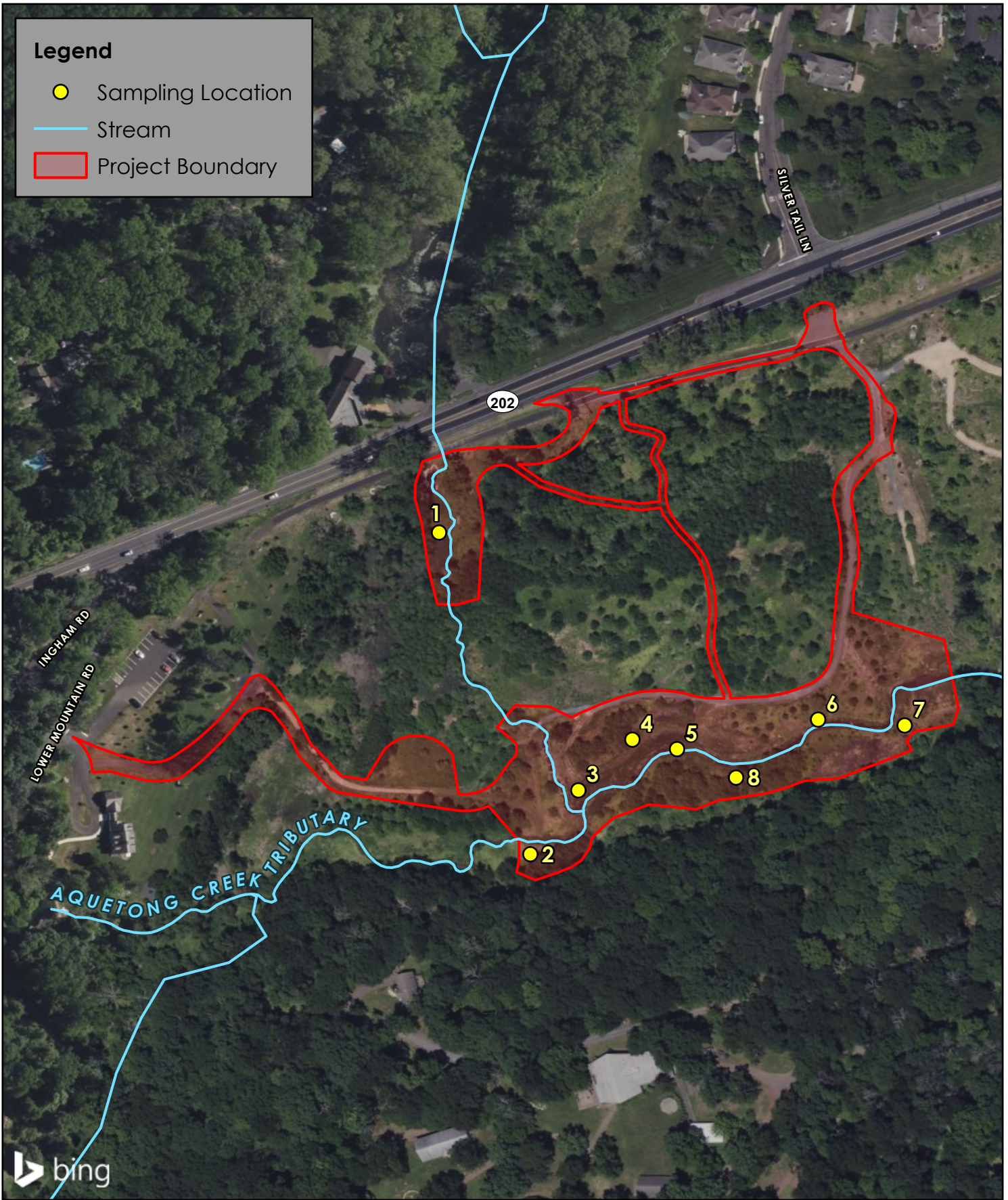
<u>Scientific Name</u>	<u>Common Name</u>	<u>Indicator Status</u>
<i>Schedonorus arundinaceus</i>	Tall fescue	FACU
<i>Setaria faberi</i>	Japanese bristlegrass	UPL
<i>Tridens flavus</i>	Purpletop tridens	FACU
Polygonaceae	Buckwheat Family	
<i>Persicaria hydropiperoides</i>	Swamp smartweed	OBL
<i>Persicaria pensylvanicum</i>	Pennsylvania smartweed	FACW
<i>Persicaria perfoliata</i>	Asiatic tearthumb	FAC
<i>Persicaria punctata</i>	Dotted smartweed	OBL
<i>Polygonum persicaria</i>	Spotted lady's-thumb	FACW
<i>Rumex obtusifolius</i>	Bitter dock	FACU
Potamogetonaceae	Pondweed Family	
<i>Potamogeton crispus</i>	Curly pondweed	OBL
Platanaceae	Plane-Tree Family	
<i>Platanus occidentalis</i>	American sycamore	FACW
Rosaceae	Rose Family	
<i>Amelanchier canadensis</i>	Canadian serviceberry	FAC
<i>Aronia arbutifolia</i>	Red chokecherry	FACW
<i>Rosa multiflora</i>	Multiflora rose	FACU
<i>Rosa palustris</i>	Swamp rose	OBL
<i>Rubus phoenicolasius</i>	Wine raspberry	FACU
Rubiaceae	Madder Family	
<i>Cephalanthus occidentalis</i>	Common buttonbush	OBL
Salicaceae	Willow Family	
<i>Populus deltoides</i>	Eastern cottonwood	FAC
<i>Salix discolor</i>	Pussy willow	FACW
<i>Salix nigra</i>	Black willow	OBL
Scrophulariaceae	Figwort Family	
<i>Paulownia tomentosa</i>	Princesstree	UPL
<i>Penstemon digitalis</i>	Foxglove beardtongue	FAC
<i>Verbascum thapsus</i>	Common mullein	FACU
<i>Veronica anagallis-aquatica</i>	Water speedwell	OBL
Simaroubaceae	Quassia Family	
<i>Ailanthus altissima</i>	Tree of heaven	FACU
Solanaceae	Potato Family	
<i>Solanum dulcamara</i>	Climbing nightshade	FAC

<u>Scientific Name</u>	<u>Common Name</u>	<u>Indicator Status</u>
Typhaceae <i>Typha latifolia</i>	Cat-tail Family Broadleaf cattail	OBL
Urticaceae <i>Boehmeria cylindrica</i> <i>Pilea pumila</i>	Nettle Family Smallspike false nettle Canadian clearweed	FACW FACW
Hydrocharitaceae <i>Vallisneria americana</i>	Tape-grass Family American eelgrass	OBL
Verbenaceae <i>Verbena hastata</i> <i>Verbena urticifolia</i>	Verbena Family Swamp verbena White vervain	FACW FAC
Vitaceae <i>Parthenocissus quinquefolia</i>	Grape Family Virginia creeper	FACU

APPENDIX II

SAMPLING PLOT LOCATIONS

File: P:\03888\Projects\03888011\GIS\APRX\Aquetong Year 2 Monitoring Report.aprx, 11/6/2023, Drawn by Isrinivasan, Copyright Princeton Hydro, LLC.



Legend

- Sampling Location
- Stream
- Project Boundary

NOTES:
 1. Sampling locations, stream, and project boundary are approximate.
 2. Aerial imagery obtained through ArcGIS Online Bing Maps (C) 2023 Microsoft Corporation and its data suppliers.

SAMPLING LOCATION MAP

AQUETONG CREEK RESTORATION PROJECT
 WETLAND MITIGATION MONITORING
 AQUETONG SPRING PARK
 SOLEBURY TOWNSHIP
 BUCKS COUNTY, PENNSYLVANIA

PRINCETON HYDRO
 SCIENCE DESIGN ENGINEERING
 www.PrincetonHydro.com



0 100 200 Feet
 Map Projection: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

APPENDIX III
PHOTOGRAPHS
PHOTO LOCATION MAP



Photographic Log

<p>Client: Solebury Township Site Name: Aquetong Spring Park Restoration Project Project Number: 0388.011 Site Location: Solebury Township, PA</p>	
<p>Photograph ID: 1</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: East</p>	
<p>Comments: General view of healthy and thriving (>5 ft.) installed woody species, including pussy willow (<i>Salix discolor</i>) along the south bank of Aquetong Creek.</p>	
<p>Photograph ID: 2</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: West</p>	
<p>Comments: View of black willow (<i>Salix nigra</i>) live stakes that have established along the banks of Aquetong Creek.</p>	

Photographic Log

<p>Client: Solebury Township Site Name: Aquetong Spring Park Restoration Project Project Number: 0388.011 Site Location: Solebury Township, PA</p>	
<p>Photograph ID: 3</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: Northwest</p>	
<p>Comments: View of several healthy black willow along the banks of Aquetong Creek.</p>	
<p>Photograph ID: 4</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: East</p>	
<p>Comments: View of Aquetong Creek near the location of the former dam.</p>	

Photographic Log

<p>Client: Solebury Township Site Name: Aquetong Spring Park Restoration Project Project Number: 0388.011 Site Location: Solebury Township, PA</p>	
<p>Photograph ID: 5</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: North</p>	
<p>Comments: General view of healthy and thriving (>5 ft.) installed woody species, including river birch (<i>Betula nigra</i>) and silver maple (<i>Acer saccharinum</i>) along the tributary to Aquetong Creek.</p>	
<p>Photograph ID: 6</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: Southeast</p>	
<p>Comments: General view of the diverse and well-established herbaceous layer along the banks of the tributary to Aquetong Creek, including sweet-scented joe-pye-weed (<i>Eutrochium purpureum</i>).</p>	


Photographic Log

<p>Client: Solebury Township Site Name: Aquetong Spring Park Restoration Project Project Number: 0388.011 Site Location: Solebury Township, PA</p>	
<p>Photograph ID: 7</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: East</p>	
<p>Comments: View of the diverse plant community within the wetland creation area.</p>	
<p>Photograph ID: 8</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: Southwest</p>	
<p>Comments: View of thriving installed woody species, including swamp white oak (<i>Quercus bicolor</i>) and river birch amidst a well-established herbaceous stratum within the wetland creation area along Aquetong Creek.</p>	

Photographic Log

<p>Client: Solebury Township Site Name: Aquetong Spring Park Restoration Project</p>		<p>Project Number: 0388.011 Site Location: Solebury Township, PA</p>	
<p>Photograph ID: 9</p>			
<p>Date: Sept. 27, 2024</p>			
<p>Location: See photo location map.</p>			
<p>Direction: West</p>			
<p>Comments: View of the wetland enhancement area featuring a robust herbaceous stratum and healthy woody species.</p>			
<p>Photograph ID: 10</p>			
<p>Date: Sept. 27, 2024</p>			
<p>Location: See photo location map.</p>			
<p>Direction: West</p>			
<p>Comments: General view of the diverse and well-established vegetation within the wetland enhancement area along Aquetong Creek.</p>			

Photographic Log

<p>Client: Solebury Township Site Name: Aquetong Spring Park Restoration Project Project Number: 0388.011 Site Location: Solebury Township, PA</p>	
<p>Photograph ID: 11</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: North</p>	
<p>Comments: View of the well-established herbaceous and woody vegetation within the wetland enhancement and creation areas along Aquetong Creek.</p>	
<p>Photograph ID: 12</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: Northwest</p>	
<p>Comments: Typical view of Aquetong Creek and its banks that are well-established with a robust herbaceous plant community and healthy and thriving woody plant material.</p>	

Photographic Log

Client: Solebury Township
Site Name: Aquetong Spring Park Restoration Project

Project Number: 0388.011
Site Location: Solebury Township, PA

Photograph ID: 13

Date: Sept. 27, 2024

Location:
See photo location map.

Direction: East

Comments: View of a healthy pin oak (*Quercus palustris*) and silver maple within the wetland enhancement area adjacent to Aquetong Creek.



Photograph ID: 14

Date: Sept. 27, 2024

Location:
See photo location map.

Direction: Northwest

Comments:
General view of several healthy black willow live stakes along the north bank of Aquetong Creek.



Photographic Log




<p>Client: Solebury Township Site Name: Aquetong Spring Park Restoration Project Project Number: 0388.011 Site Location: Solebury Township, PA</p>	
<p>Photograph ID: 15</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: Northeast</p>	
<p>Comments: View of the diverse assemblage of hydrophytic herbaceous and woody plants within the wetland creation areas on the banks of Aquetong Creek.</p>	
<p>Photograph ID: 16</p>	
<p>Date: Sept. 27, 2024</p>	
<p>Location: See photo location map.</p>	
<p>Direction: East</p>	
<p>Comments: General view of healthy and thriving (>5 ft.) installed woody species, including river birch and pin oak within the wetland enhancement area along the south bank of Aquetong Creek.</p>	

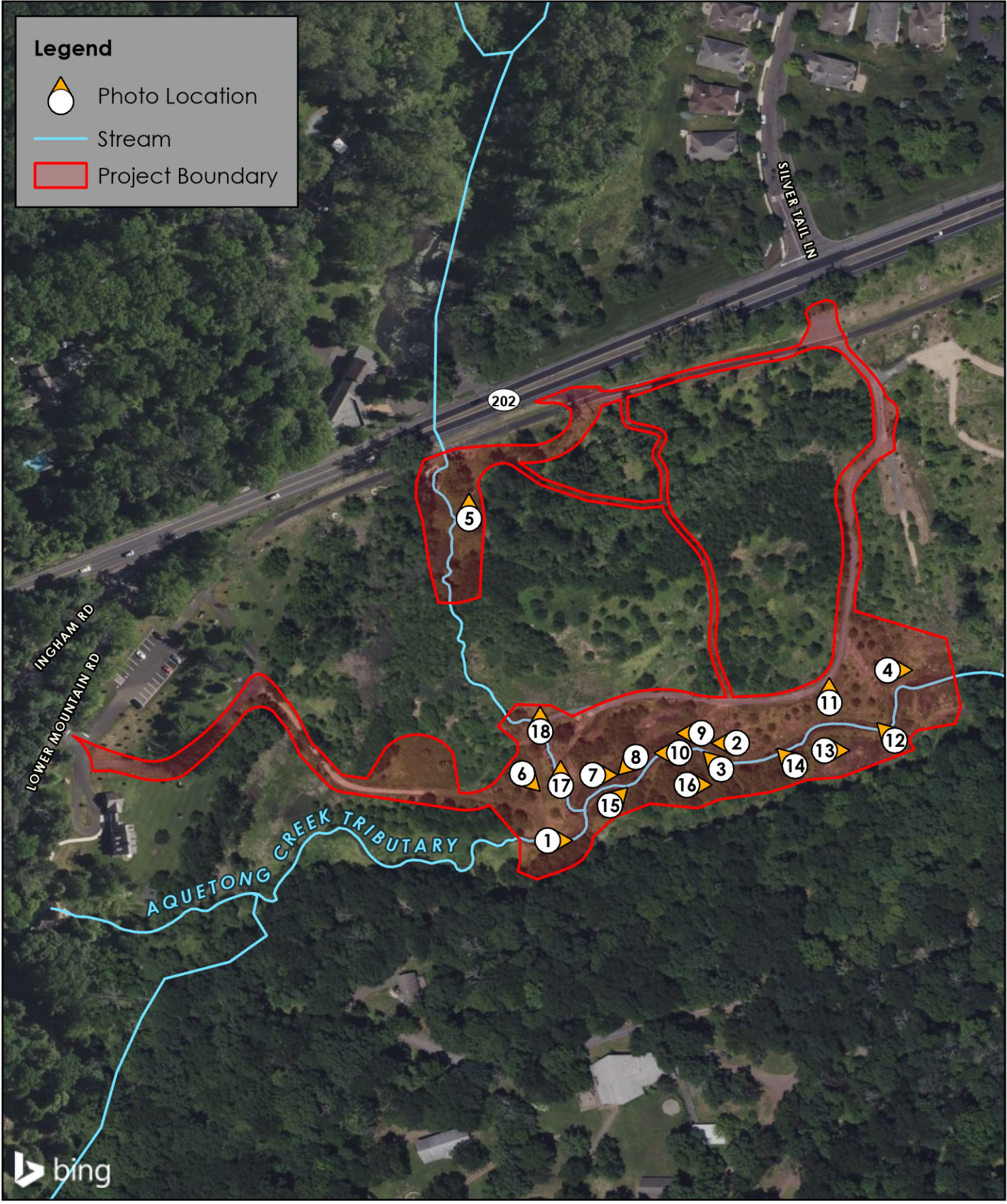
Photographic Log

<p>Client: Solebury Township Site Name: Aquetong Spring Park Restoration Project</p>		<p>Project Number: 0388.011 Site Location: Solebury Township, PA</p>	
<p>Photograph ID: 17</p>			
<p>Date: Sept. 27, 2024</p>			
<p>Location: See photo location map.</p>			
<p>Direction: North</p>			
<p>Comments: View of the diverse assemblage of hydrophytic herbaceous plants within the wetland creation area along the banks of the tributary to Aquetong Creek.</p>			
<p>Photograph ID: 18</p>			
<p>Date: Sept. 27, 2024</p>			
<p>Location: See photo location map.</p>			
<p>Direction: North</p>			
<p>Comments: View of the well-established hydrophytic herbaceous and woody plants along the banks of the tributary to Aquetong Creek, including broadleaf cattail (<i>Typha latifolia</i>) and pussy willow.</p>			

File: P:\03888\Projects\03888011\GIS\APRX\Aquetong Monitoring Report.aprx, 11/15/2024, Drawn by Isrinivasan, Copyright Princeton Hydro, LLC.

Legend

-  Photo Location
-  Stream
-  Project Boundary



NOTES:
 1. Photo locations, stream, and project boundary are approximate.
 2. Aerial imagery obtained through ArcGIS Online Bing Maps (C) 2024 Microsoft Corporation and its data suppliers.

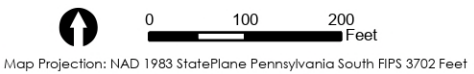


PHOTO LOCATION MAP

AQUETONG CREEK RESTORATION PROJECT
 WETLAND MITIGATION MONITORING
 AQUETONG SPRING PARK
 SOLEBURY TOWNSHIP
 BUCKS COUNTY, PENNSYLVANIA



PRINCETON HYDRO
 SCIENCE DESIGN ENGINEERING
 www.PrincetonHydro.com

APPENDIX IV

PADEP CHAPTER 105 RESTORATION WAIVER 16 APPROVAL LETTER



October 23, 2019

Mr. Dennis Carney
Solebury Township
3092 Sungan Road
P.O. Box 139
Solebury, PA 18963

Re: Aquetong Creek Restoration Project
DEP File Nos. EA09-013 and WL0919301
APS No. 996246, AUTH ID No. 1278424
Solebury Township
Bucks County

Dear Mr. Carney:

The Department of Environmental Protection (DEP) has reviewed and approved the Environmental Assessment and Restoration Plan, including the 401 Water Quality Certification to restore and maintain approximately 1,200 linear feet of stream channel and to enhance the floodplain grading and riparian corridor along Aquetong Creek (Perennial, HQ-CWF). The southern limit of the site is located at the former terminus of the Aquetong Lake impoundment (Lambertville, NJ, USGS Quadrangle, Latitude: 40.354181N"; Longitude: -74.988711W").

This letter may be considered sufficient authorization for the proposed stream restoration plan with the following special conditions:

- A. Stream and wetland restoration areas and wetland creation areas shall be monitored, and reports submitted to DEP, in accordance with the Mitigation Plan narrative included in the Environmental Assessment provided to DEP.
- B. All Conservation Measures recommended in the Pennsylvania Department of Conservation and Natural Resource's review letter dated May 1, 2019, shall be incorporated into the project.
- C. Temporary stream crossing(s) shall be constructed of suitable nonerodible material in order to prevent any road materials from washing out if structure is overtopped during periods of high water.

- D. Streambank disturbance shall be kept to a minimum and stabilized with indigenous vegetation within 20 days of final earthmoving to prevent erosion and provide cover, shading, and food source for aquatic life.
- E. All disturbed areas are to be restored to the original or proposed contours and shall be replanted with indigenous plant species.
- F. Demolition or excavated materials shall not be deposited in any wetland, watercourse, floodway, floodplain, or other body of water without applying for and receiving the written permit of DEP.
- G. Water pumped from the construction area shall be diverted into a sediment trap or basin, or into an appropriate vegetated filter area to prevent sediment from being discharged into any waters of the Commonwealth.
- H. Upon discovery of significant changes that could compromise the integrity of the project, the permittee shall immediately notify DEP and the Bucks County Conservation District.

This authorization does not give any property rights, either in real estate or material, nor any exclusive privileges, nor shall it be construed to grant or confer any right, title, easement, or interest in, to, or over any land belonging to the Commonwealth of Pennsylvania; nor any infringement of Federal, State, or local laws or regulations.

Regarding Federal authorization, we have determined that your proposed work, if accomplished in accordance with the enclosed terms and conditions, is authorized by the Pennsylvania State Programmatic General Permit-5 (PASPGP-5). This PASPGP-5 verification provides U.S. Army Corps of Engineers authorization pursuant to Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act. This authorization may be subject to modification, suspension, or revocation if any of the information contained in the application, including the plans, is later found to be in error.

The enclosed list of conditions must be followed for purposes of the PASPGP-5 (Enclosure 1). A PASPGP-5 Permit Compliance, Self-Certification Form must be completed and returned to the appropriate Corps of Engineers office upon completion of construction (Enclosure 2).

Proper erosion and sediment control measure are required during and after construction and the adequacy of the measures can be determined by contacting the Bucks County Conservation District at 215.345.7577.

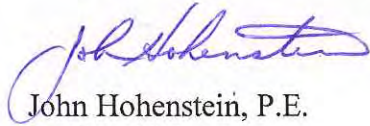
Mr. Dennis Carney

- 3 -

October 23, 2019

If you have any questions, you may contact Mr. Jason Oseredzuk at the address located in the first page footer or by telephone at 484.250.5158.

Sincerely,



John Hohenstein, P.E.
Regional Manager
Waterways and Wetlands

Enclosure

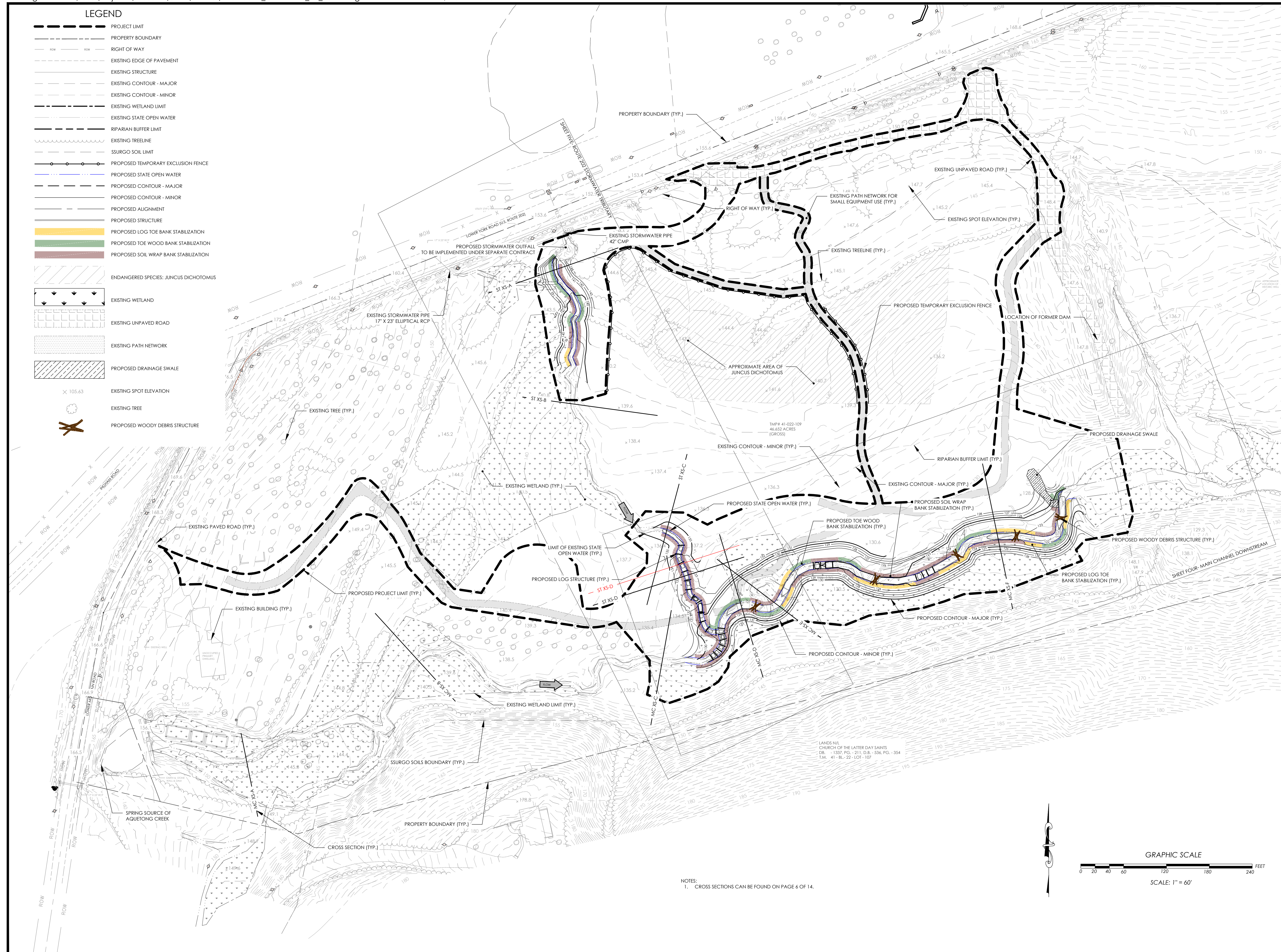
cc: Bucks County Conservation District
PA Fish and Boat Commission
Army Corps of Engineers
Mr. George - Princeton Hydro, LLC
Mr. Oseredzuk
Re 30 (GJS19WAW)296-10

APPENDIX V

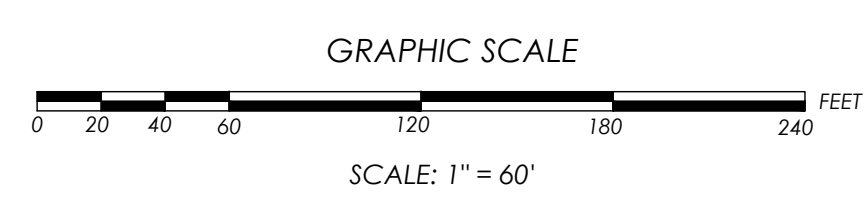
SITE PLANS

LEGEND

- PROJECT LIMIT
- PROPERTY BOUNDARY
- RIGHT OF WAY
- EXISTING EDGE OF PAVEMENT
- EXISTING STRUCTURE
- EXISTING CONTOUR - MAJOR
- EXISTING CONTOUR - MINOR
- EXISTING WETLAND LIMIT
- EXISTING STATE OPEN WATER
- RIPARIAN BUFFER LIMIT
- EXISTING TREELINE
- SSURGO SOIL LIMIT
- PROPOSED TEMPORARY EXCLUSION FENCE
- PROPOSED STATE OPEN WATER
- PROPOSED CONTOUR - MAJOR
- PROPOSED CONTOUR - MINOR
- PROPOSED ALIGNMENT
- PROPOSED STRUCTURE
- PROPOSED LOG TOE BANK STABILIZATION
- PROPOSED TOE WOOD BANK STABILIZATION
- PROPOSED SOIL WRAP BANK STABILIZATION
- ENDANGERED SPECIES: JUNCUS DICHOTOMUS
- EXISTING WETLAND
- EXISTING UNPAVED ROAD
- EXISTING PATH NETWORK
- PROPOSED DRAINAGE SWALE
- EXISTING SPOT ELEVATION
- EXISTING TREE
- PROPOSED WOODY DEBRIS STRUCTURE



NOTES:
1. CROSS SECTIONS CAN BE FOUND ON PAGE 6 OF 14.



CALL BEFORE YOU DIG!
PENNSYLVANIA LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE - STOP CALL
PENNSYLVANIA ONE CALL SYSTEM, INC.
REFERENCE PENNSYLVANIA ACT 38
 1-800-242-1776

PROJECT NOTES

1. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAV88), FEET. THE FOLLOWING CONVERSION FOR NAV88 TO NGVD29 IS APPLICABLE FOR THIS LOCATION:
NGVD29 = NAV88 - 0.63 FT
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM OF 1983 (NAD83), FEET.
3. TOPOGRAPHIC MAPPING PREPARED BY ROBINSON PHOTOGRAMMETRIC MAPPING DATED 4/11/2016. FLIGHT DATE 3/7/2016 FOR C. ROBERT WYNN ASSOCIATES, INC.
4. TOPOGRAPHIC MAPPING OF THE STREAM PREPARED BY GEOTREK ENVIRONMENTAL AND SURVEYING, LLC IN APRIL OF 2019.
5. WETLAND DELINEATION COMPLETED BY PRINCETON HYDRO, LLC. STAFF IN NOVEMBER OF 2018.
6. FEMA FIRM NOT MAPPED SINCE DAM REMOVAL; NO FHA AREA AVAILABLE.
7. IN A RESPONSE DATED MAY 1, 2019 TO PNDI NO. 492836, PADNCR PROVIDED A MAP OUTLINING A POPULATION OF PA ENDANGERED JUNCUS DICHOTOMUS. BY INSTALLING EXCLUSIONARY FENCING AROUND THIS AREA, NO IMPACT ANTICIPATED.
8. 150-FT RIPARIAN BUFFER DETERMINED IN ACCORDANCE WITH 25 PA CODE CHAPTER 102.14
9. AS-BUILT DATA COLLECTED BY PRINCETON HYDRO ON OCTOBER 22, 2020 AND OCTOBER 15, 2021.

10/10/19	REVISED PER BUCKS COUNTY CONSERVATION DISTRICT COMMENTS
7/25/19	REVISED FOR CONSTRUCTION CLARITY
DATE	DESCRIPTION
REVISIONS	

GEOFFREY M. GOLL
Professional Engineer
PA Lic. No. PE-050997-E

11/19/2021
DATE

PRINCETON HYDRO

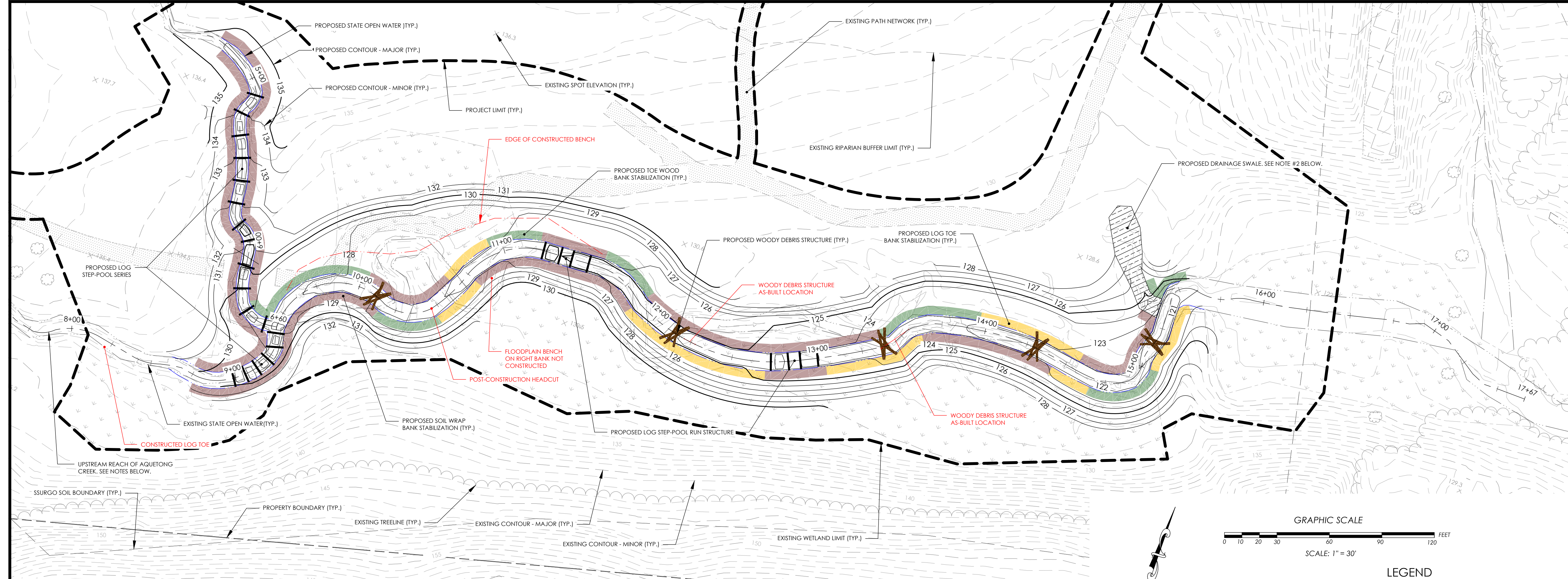
SCIENCE ENGINEERING DESIGN
1108 OLD YORK RD, SUITE 1
RINGOES, NEW JERSEY 08551
PHONE: 908.237.5660
PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
AQUETONG CREEK RESTORATION
AQUETONG SPRING PARK
TOWNSHIP OF SOLEBURY
BUCKS COUNTY, PENNSYLVANIA
AS-BUILT PLANS

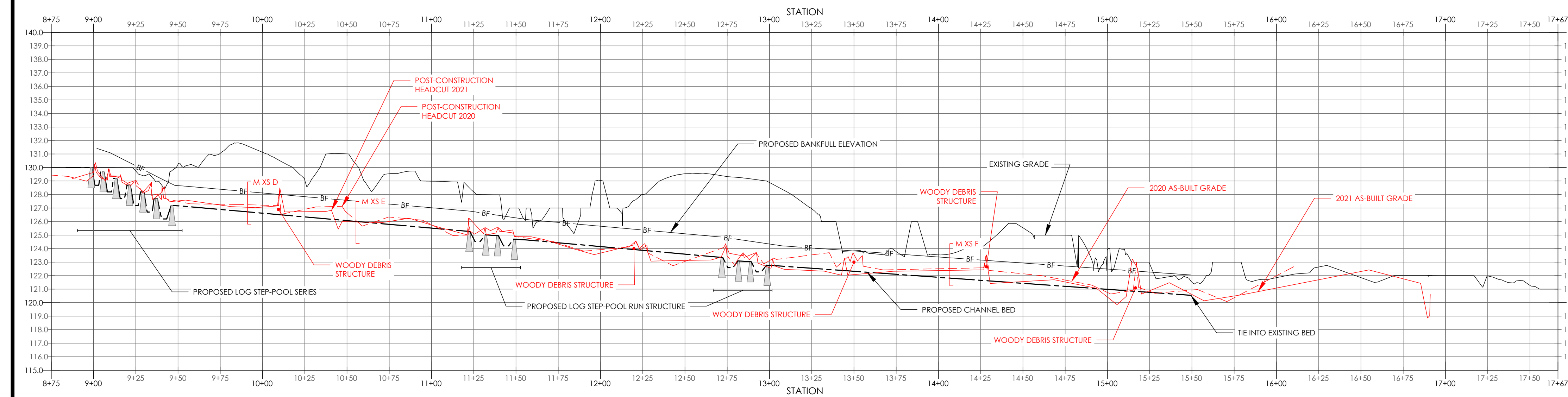
DRAWING NAME:
PROPOSED CONDITIONS OVERVIEW

DATE:	12/21/2020
PROJECT NO.:	0388.011
SCALE:	1"=60'
DRAWN BY:	CPS/BS
CHECKED BY:	GG/AEM/CC

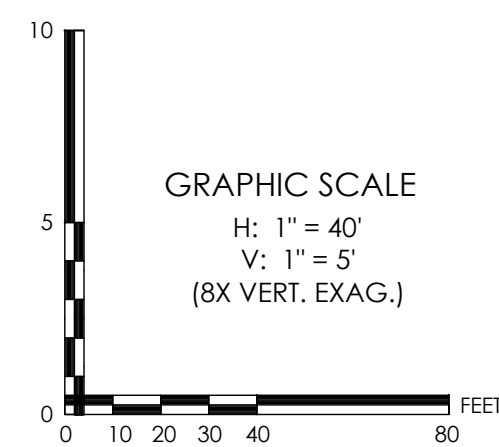
SHEET NO.
3 OF **15**



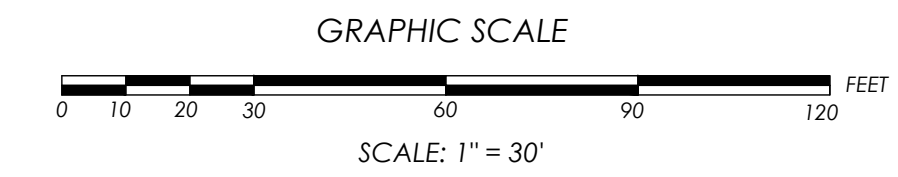
A PROPOSED PLAN VIEW - MAIN CHANNEL - DOWNSTREAM
1" = 30'



B PROPOSED PROFILE - MAIN CHANNEL - DOWNSTREAM
HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 5' (8X VERT. EX.)



- NOTES:
- ACTIVE EROSION IS OCCURRING THROUGHOUT THE REACH OF AQUETONG CREEK UPSTREAM OF STATION 08+75, HOWEVER NO TREATMENT OR ACTIVE RESTORATION IS CURRENTLY PROPOSED. IF TREATMENT IS NEEDED IN THE FUTURE, IT SHALL BE COMPLETED UNDER SEPARATE COVER.
 - THE DRAINAGE SWALE SHALL BE STABILIZED USING STEP POOLS CONSTRUCTED FROM EXCESS LOGS AND ROCKS. THESE STEP POOLS SHALL BE FIELD FIT BASED ON THE FIELD CONDITIONS AT THE TIME OF CONSTRUCTION AND AS DIRECTED BY ONSITE ENGINEER. THE STEP POOLS SHALL BE CONSTRUCTED IN ACCORDANCE WITH DETAIL A ON SHEET 7 OF 15.
 - THE TWO CULVERTS UNDER ROUTE 202 DRAINING INTO THE 202 STORMWATER TRIBUTARY SHALL BE STABILIZED UNDER A SEPARATE CONTRACT.



- LEGEND
- PROJECT LIMIT
 - PROPERTY BOUNDARY
 - RIGHT OF WAY
 - EXISTING EDGE OF PAVEMENT
 - EXISTING STRUCTURE
 - EXISTING CONTOUR - MAJOR
 - EXISTING CONTOUR - MINOR
 - EXISTING WETLAND LIMIT
 - EXISTING STATE OPEN WATER
 - RIPIARIAN BUFFER LIMIT
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 - EXISTING PATH NETWORK
 - PROPOSED DRAINAGE SWALE
 - EXISTING SPOT ELEVATION
 - EXISTING TREE
 - PROPOSED WOODY DEBRIS STRUCTURE
 - 2020 AS-BUILT GRADE
 - 2021 AS-BUILT GRADE

CALL BEFORE YOU DIG!
PENNSYLVANIA LAW REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 10 WORKING
DAYS IN DESIGN STAGE - STOP CALL
PENNSYLVANIA ONE CALL SYSTEM, INC.
REFERENCE PENNSYLVANIA ACT 38
1-800-242-1776

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 - FEMA FIRM NOT MAPPED SINCE DAM REMOVAL; NO FHA AREA AVAILABLE.
 - IN A RESPONSE DATED MAY 1, 2019 TO PNDI NO. 682836, PADCHR PROVIDED A MAP OUTLINING A POPULATION OF PA ENDANGERED JUNCUS DICHOTOMUS. BY INSTALLING EXCLUSIONARY FENCING AROUND THIS AREA, NO IMPACT ANTICIPATED.
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DATE	DESCRIPTION
10/10/19	REVISED PER BUCKS COUNTY CONSERVATION DISTRICT COMMENTS
7/25/19	REVISED FOR CONSTRUCTION CLARITY

GEOFFREY M. GOLL
Professional Engineer
PA Lic. No. PE-050997-E

11/19/2021
DATE

PRINCETON HYDRO


SCIENCE ENGINEERING DESIGN
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RINGOES, NEW JERSEY 08551
PHONE: 908.237.5660
PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
AQUETONG CREEK RESTORATION
AQUETONG SPRING PARK
TOWNSHIP OF SOLEBURY
BUCKS COUNTY, PENNSYLVANIA
AS-BUILT PLANS

DRAWING NAME:
**PROPOSED
CONDITIONS-MAIN
CHANNEL DOWNSTREAM**

DATE:	12/21/2020
PROJECT NO.:	0388.011
SCALE:	AS SHOWN
DRAWN BY:	CPS/BS
CHECKED BY:	GG/AEM/CC

SHEET NO.
4 OF **15**

CALL BEFORE YOU DIG!
 PENNSYLVANIA LAW REQUIRES
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REVISONS	

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11/19/2021
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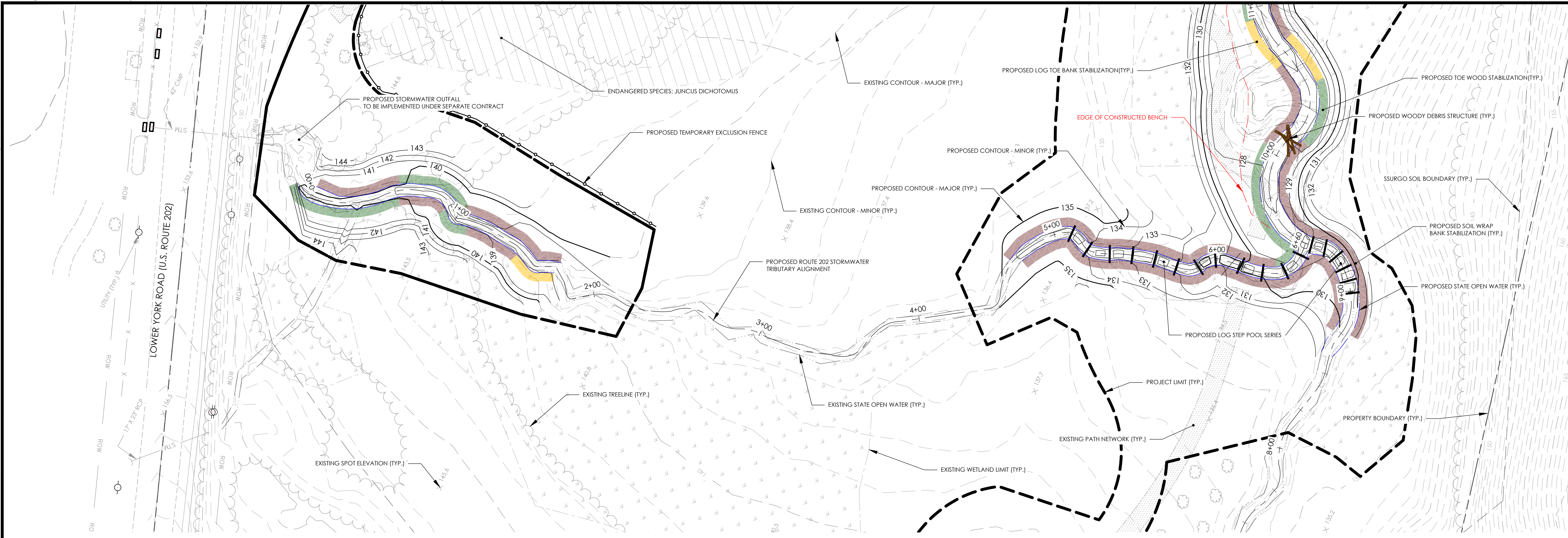
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PROJECT NAME/LOCATION:
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 AQUETONG SPRING PARK
 TOWNSHIP OF SOLEBURY
 BUCKS COUNTY, PENNSYLVANIA
AS-BUILT PLANS

DRAWING NAME:
**PROPOSED CONDITIONS-
 ROUTE 202 STORMWATER
 TRIBUTARY**

DATE:	12/21/2020
PROJECT NO.:	0388.011
SCALE:	AS SHOWN
DRAWN BY:	CPS/BS
CHECKED BY:	GG/AEM/CC

SHEET NO.
5 OF **15**

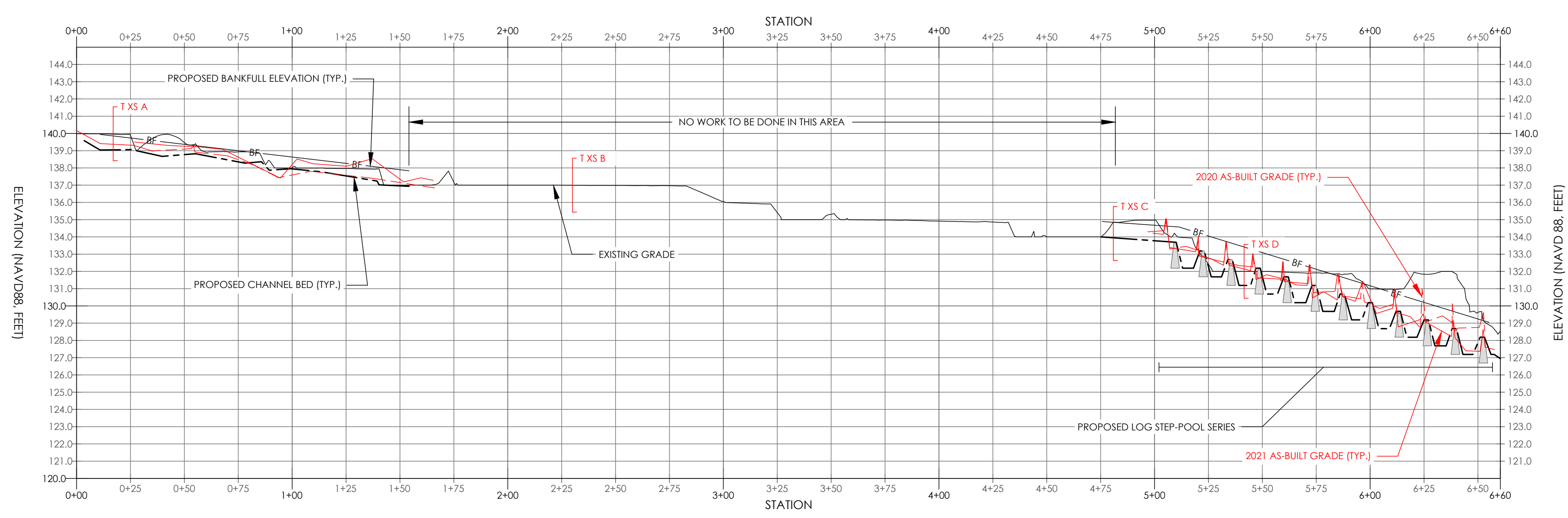


A PROPOSED PLANVIEW - STORMWATER TRIBUTARY
 1" = 30'

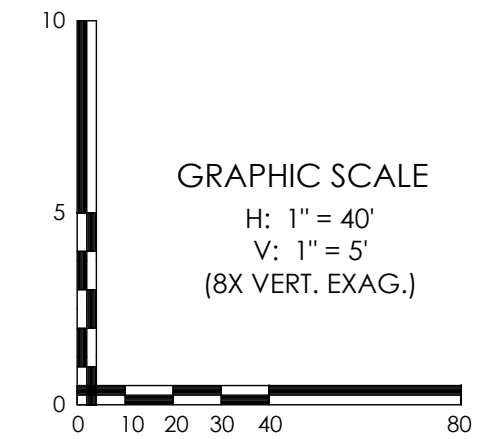
- LEGEND**
- PROJECT LIMIT
 - PROPERTY BOUNDARY
 - RIGHT OF WAY
 - EXISTING EDGE OF PAVEMENT
 - EXISTING STRUCTURE
 - EXISTING CONTOUR - MAJOR
 - EXISTING CONTOUR - MINOR
 - EXISTING WETLAND LIMIT
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 - PROPOSED TEMPORARY EXCLUSION FENCE
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 - PROPOSED CONTOUR - MAJOR
 - PROPOSED CONTOUR - MINOR
 - PROPOSED ALIGNMENT
 - PROPOSED STRUCTURE
 - PROPOSED LOG TOE BANK STABILIZATION
 - PROPOSED TOE WOOD BANK STABILIZATION
 - PROPOSED SOIL WRAP BANK STABILIZATION
 - PROPOSED CHANNEL BED
 - PROPOSED BANKFULL ELEVATION
 - ENDANGERED SPECIES: JUNCUS DICHOTOMUS
 - EXISTING WETLAND
 - EXISTING UNPAVED ROAD
 - EXISTING PATH NETWORK
 - PROPOSED DRAINAGE SWALE
 - EXISTING SPOT ELEVATION
 - EXISTING TREE
 - PROPOSED WOODY DEBRIS STRUCTURE
 - 2020 AS-BUILT GRADE
 - 2021 AS-BUILT GRADE

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B PROPOSED PROFILE - STORMWATER TRIBUTARY
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (8X VERT. EX.)



CALL BEFORE YOU DIG!
 PENNSYLVANIA LAW REQUIRES
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 1-800-242-1776

PROJECT NOTES

1. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), FEET. THE FOLLOWING CONVERSION FOR NAVD88 TO NGVD29 IS APPLICABLE FOR THIS LOCATION:
 NGVD29 = NAVD88 - 0.43 FT
2. THE HORIZONTAL DATUM IS NORTH AMERICAN DATUM OF 1983 (NAD83), FEET.
3. TOPOGRAPHIC MAPPING PREPARED BY ROBINSON PHOTOGRAMMETRIC MAPPING DATED 4/11/2016. FLIGHT DATE 3/7/2016 FOR C. ROBERT WYNN ASSOCIATES, INC.
4. TOPOGRAPHIC MAPPING OF THE STREAM PREPARED BY GEOTREK ENVIRONMENTAL AND SURVEYING, LLC IN APRIL OF 2019.
5. WETLAND DELINEATION COMPLETED BY PRINCETON HYDRO, LLC. STAFF IN NOVEMBER OF 2018.
6. FEMA FIRM NOT MAPPED SINCE DAM REMOVAL; NO FHA AREA AVAILABLE.
7. IN A RESPONSE DATED MAY 1, 2019 TO PNDI NO. 482836, PADNCR PROVIDED A MAP OUTLINING A POPULATION OF PA ENDANGERED JUCIUS DICHOTOMUS. BY INSTALLING EXCLUSIONARY FENCING AROUND THIS AREA, NO IMPACT ANTICIPATED.
8. 150-FT RIPARIAN BUFFER DETERMINED IN ACCORDANCE WITH 25 PA CODE CHAPTER 102.14
9. AS-BUILT DATA COLLECTED BY PRINCETON HYDRO ON OCTOBER 22, 2020 AND OCTOBER 15, 2021.

10/10/19	REVISED PER BUCKS COUNTY CONSERVATION DISTRICT COMMENTS
7/25/19	REVISED FOR CONSTRUCTION CLARITY
DATE	DESCRIPTION
REVISIONS	

GEOFFREY M. GOLL
 Professional Engineer
 PA Lic. No. PE-050997-E

11/19/2021
 DATE



SCIENCE ENGINEERING DESIGN
 1108 OLD YORK RD, SUITE 1
 RINGOES, NEW JERSEY 08551
 PHONE: 908.237.5660
 PRINCETONHYDRO.COM

PROJECT NAME/LOCATION:
 AQUETONG CREEK RESTORATION
 AQUETONG SPRING PARK
 TOWNSHIP OF SOLEBURY
 BUCKS COUNTY, PENNSYLVANIA
AS-BUILT PLANS

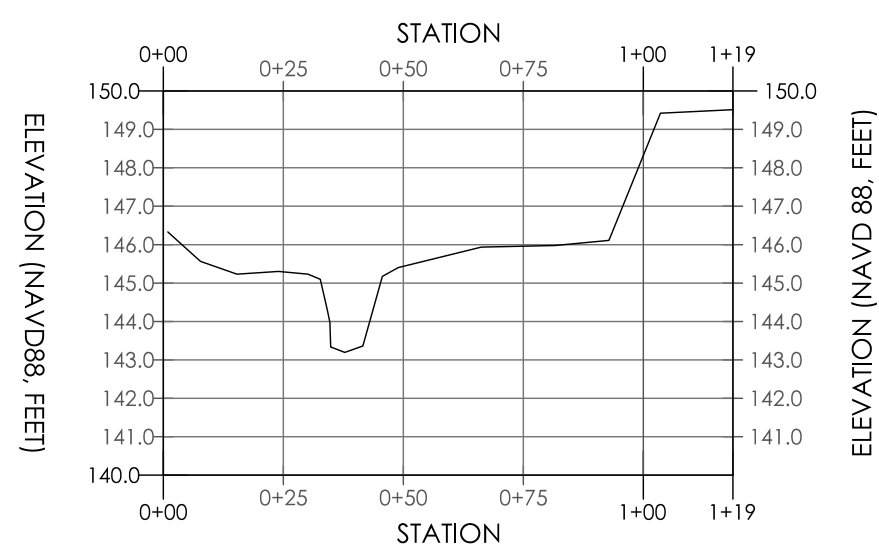
DRAWING NAME:

CROSS SECTIONS

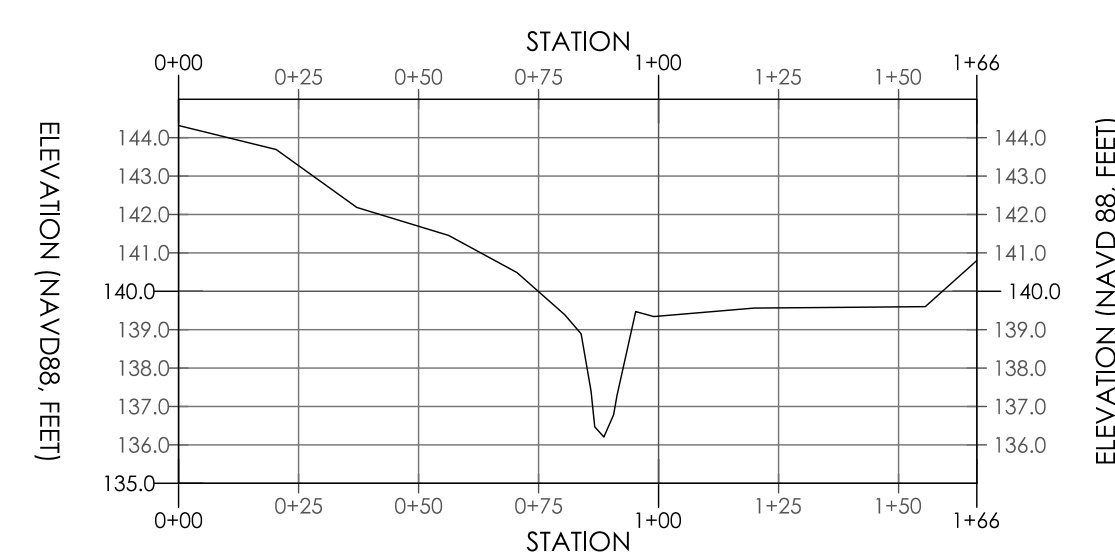
DATE:	12/21/2020
PROJECT NO.:	0388.011
SCALE:	AS SHOWN
DRAWN BY:	CPS/BS
CHECKED BY:	GG/AEM/CC

SHEET NO.

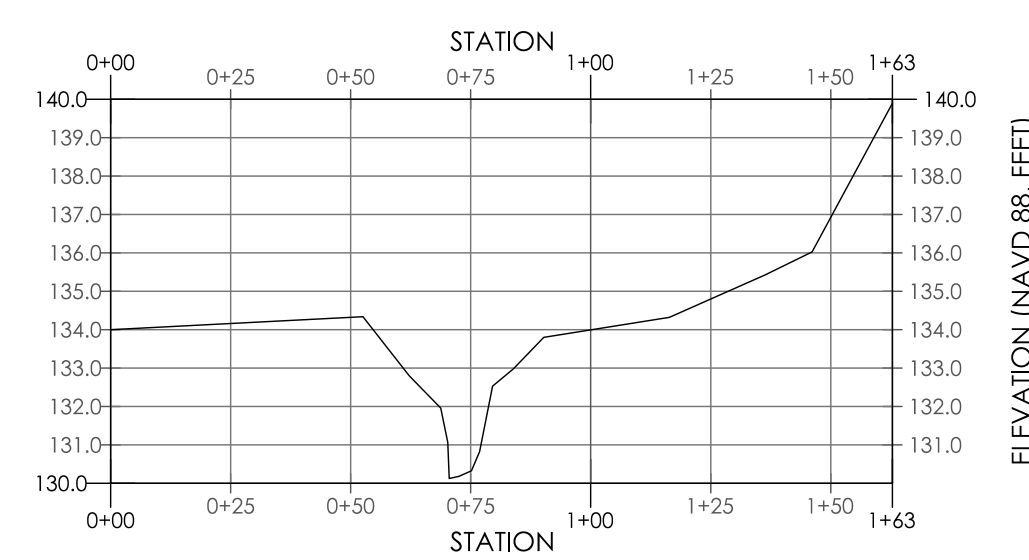
6 OF **15**



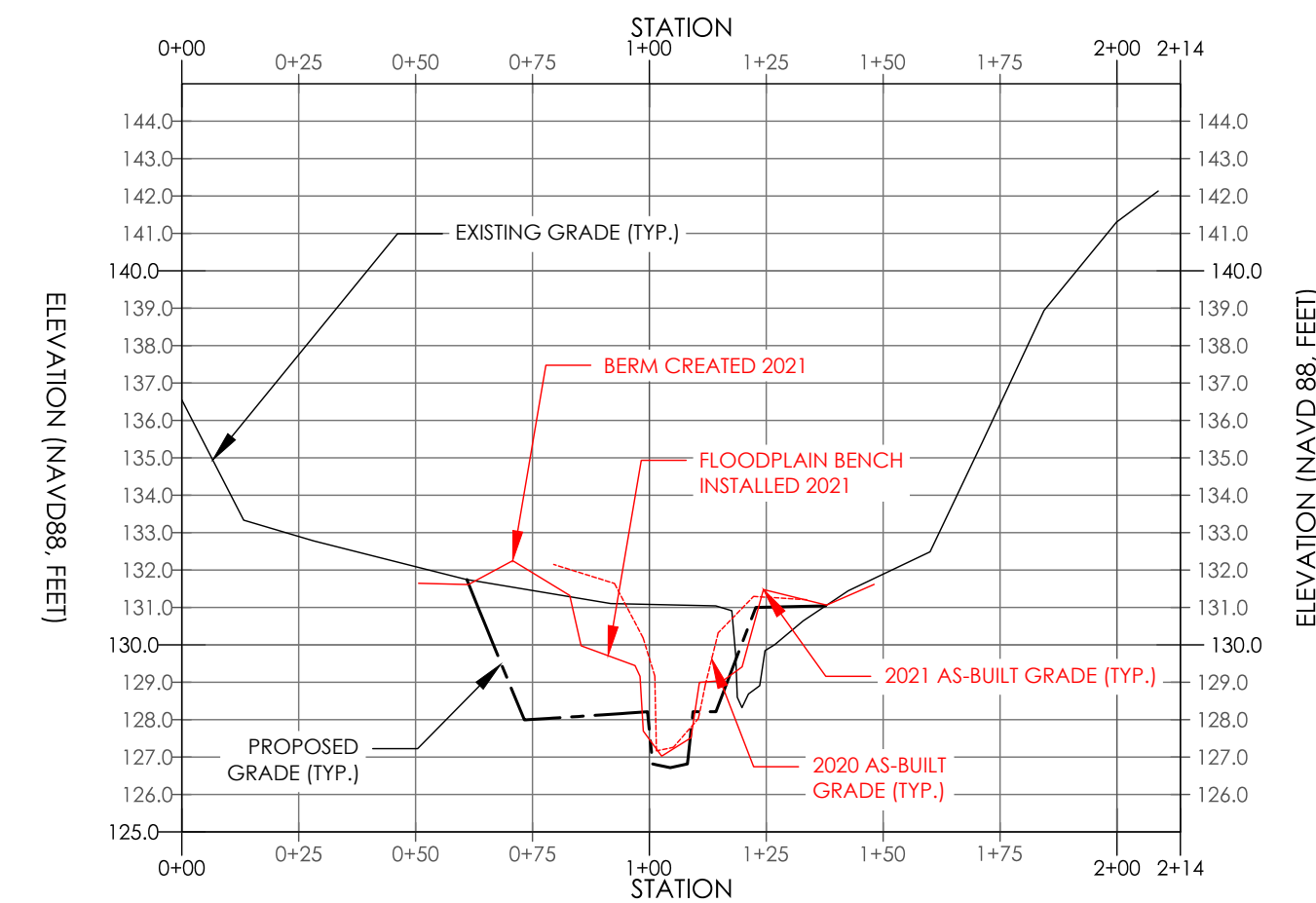
A MAIN CHANNEL CROSS SECTION A (MC XS-A)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



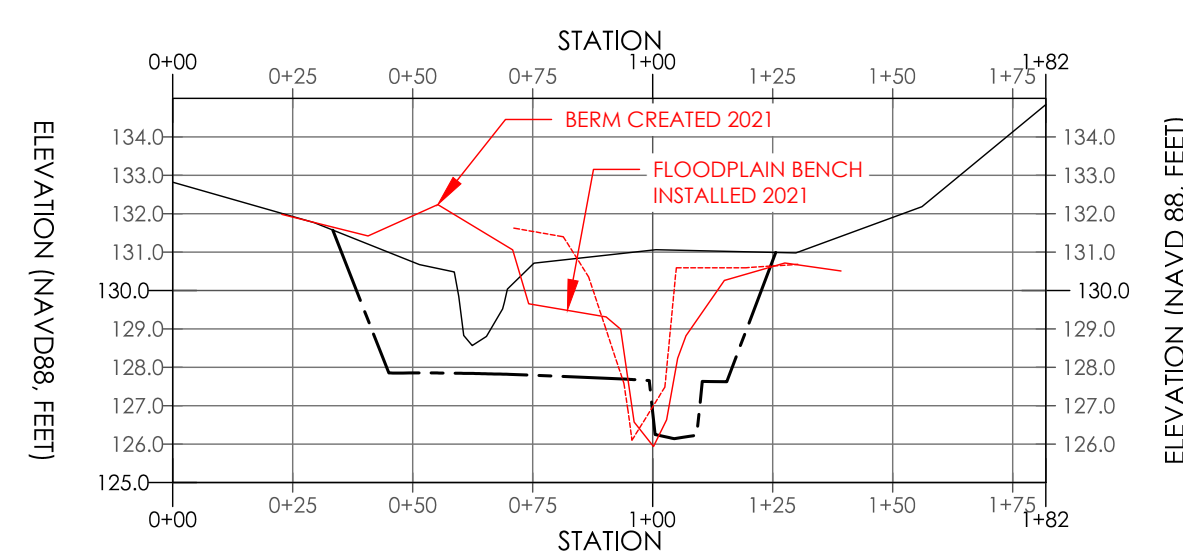
B MAIN CHANNEL CROSS SECTION B (MC XS-B)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



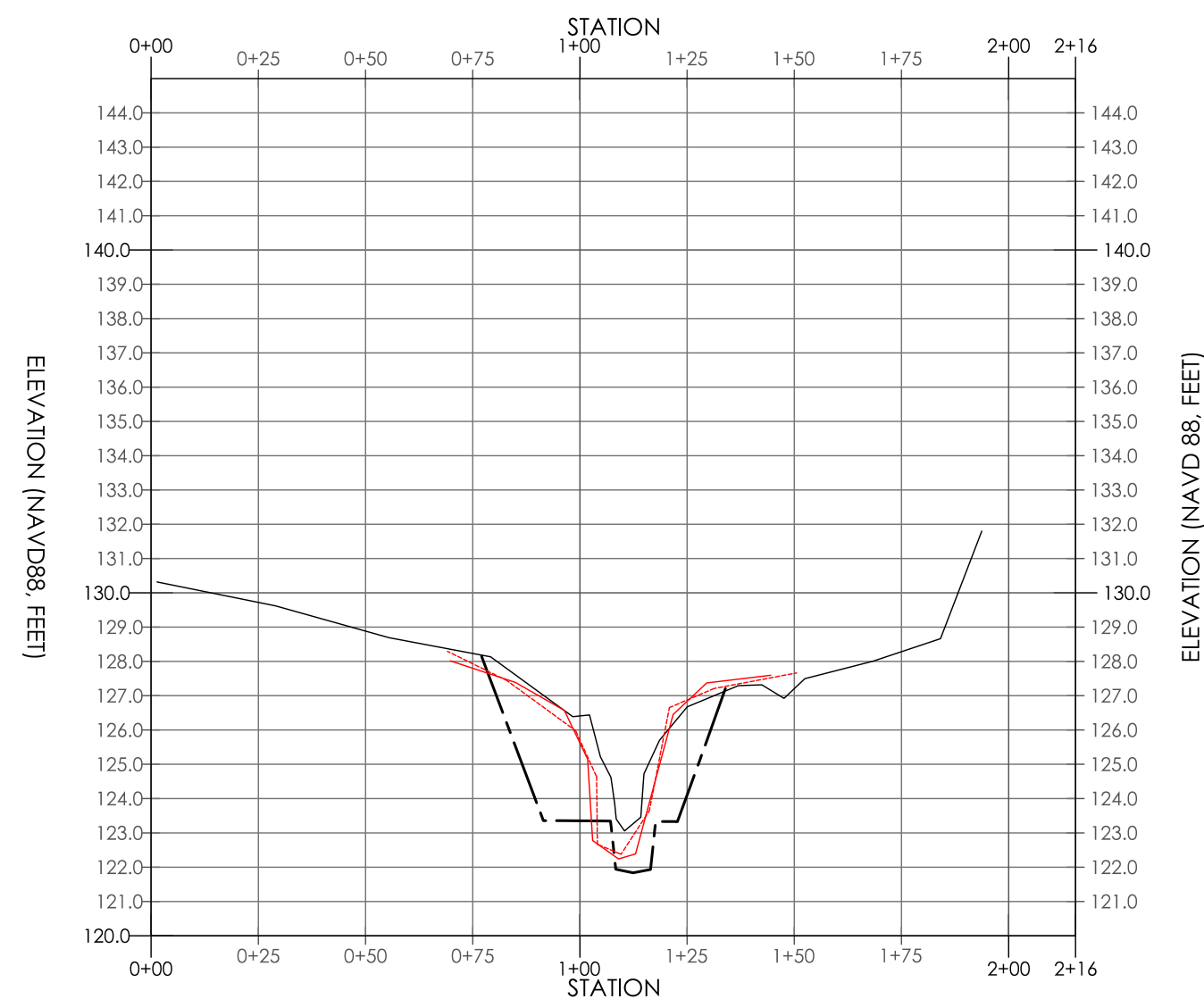
C MAIN CHANNEL CROSS SECTION C (MC XS-C)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



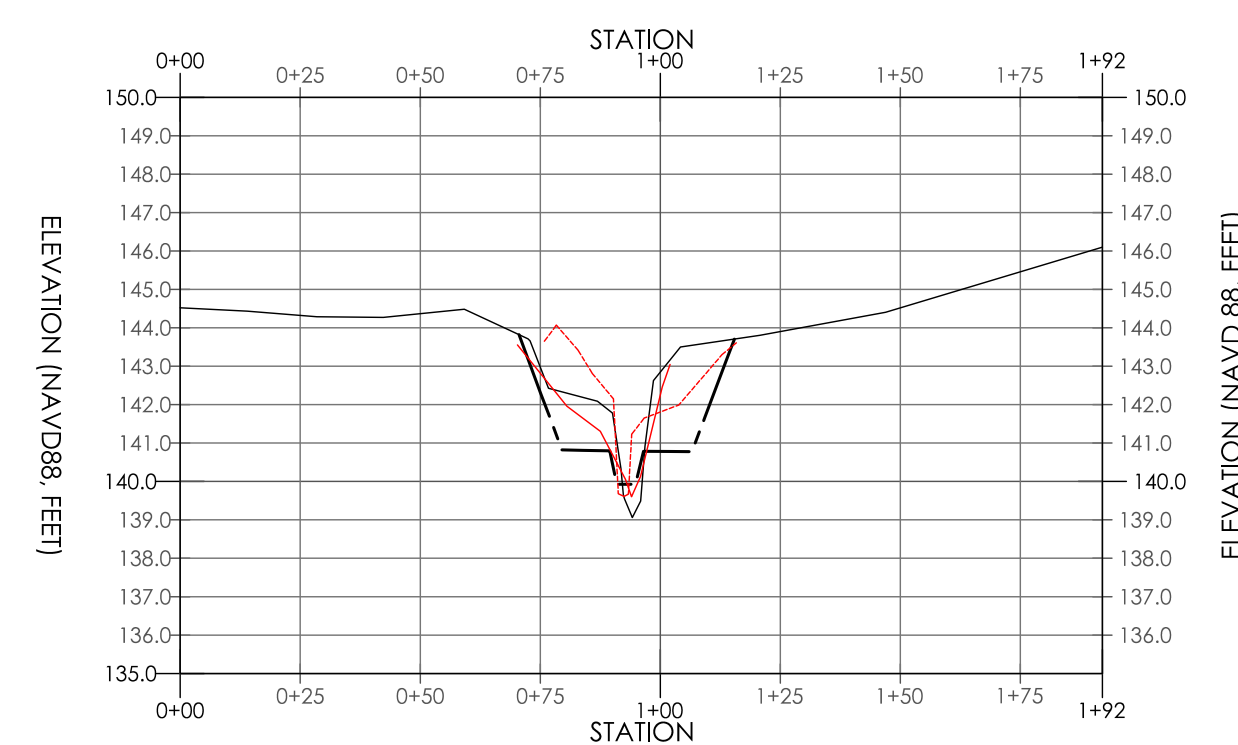
D MAIN CHANNEL CROSS SECTION D (MC XS-D)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



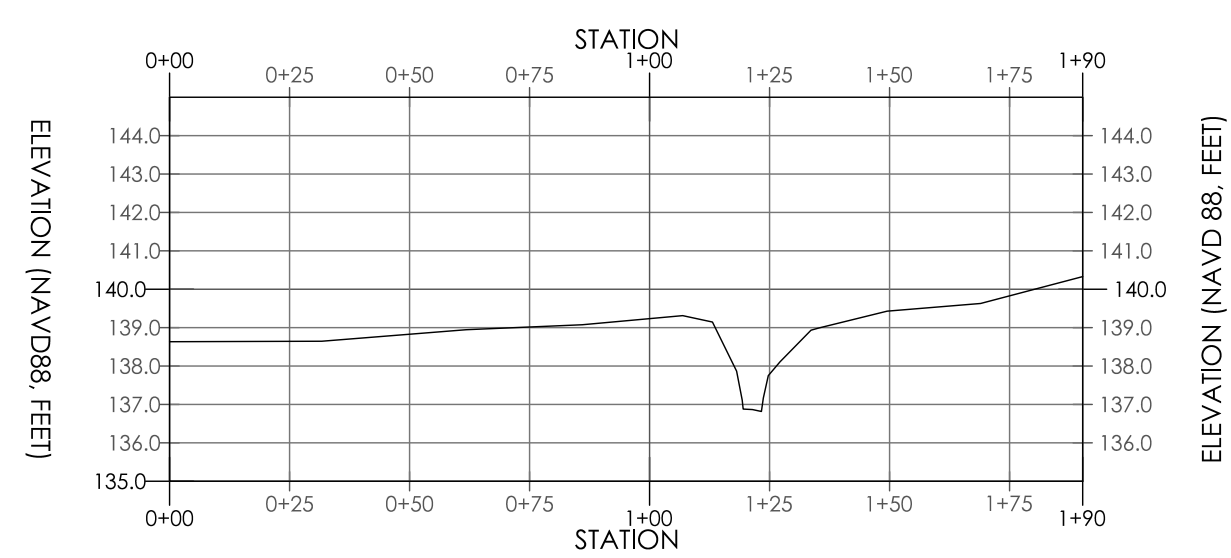
E MAIN CHANNEL CROSS SECTION E (MC XS-E)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



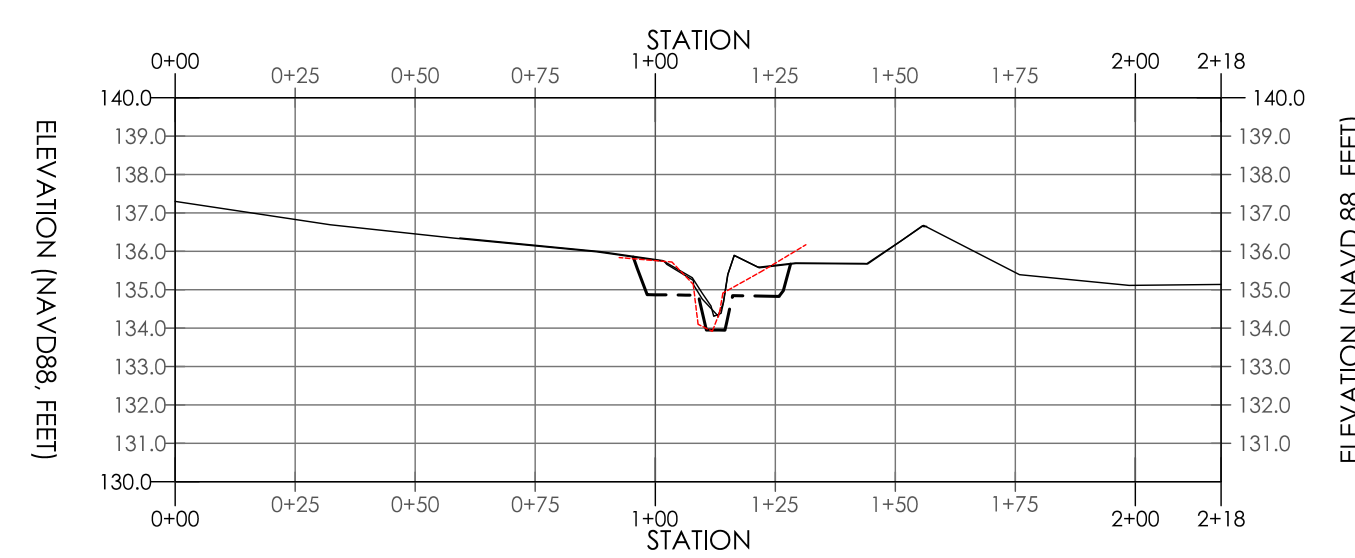
F MAIN CHANNEL CROSS SECTION F (MC XS-F)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



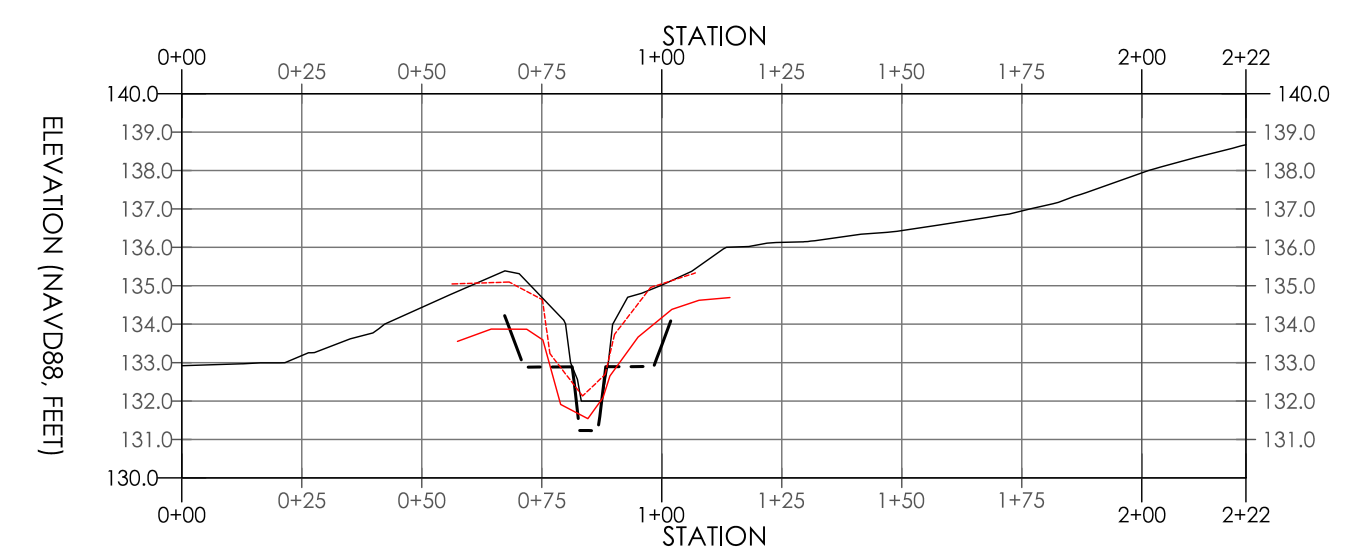
G STORWATER TRIBUTARY CROSS SECTION A (ST XC-A)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



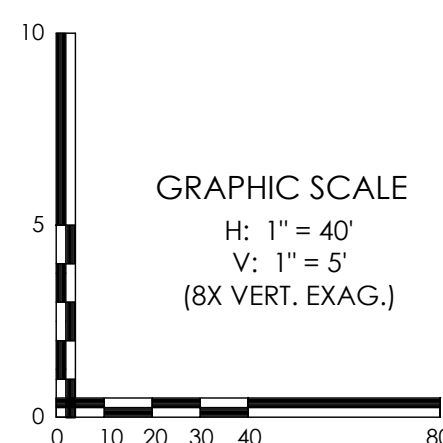
H STORWATER TRIBUTARY CROSS SECTION B (ST XC-B)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



I STORWATER TRIBUTARY CROSS SECTION C (ST XC-C)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)







J STORWATER TRIBUTARY CROSS SECTION D (ST XC-D)
 HORIZONTAL SCALE: 1" = 40'
 VERTICAL SCALE: 1" = 5' (VERT. EXAG. = 8X)



- NOTES:
1. ALL CROSS SECTIONS ARE DEPICTED FROM LEFT BANK TO RIGHT BANK, LOOKING DOWNSTREAM.
 2. CROSS SECTION LOCATIONS CAN BE FOUND ON PAGE 3 OF 15.

LEGEND

-  EXISTING GRADE
-  PROPOSED GRADE
-  2020 AS-BUILT GRADE
-  2021 AS-BUILT GRADE