# STARRUCCA CREEK MITIGATION BANK

# FINAL PROSPECTUS

# (DRAFT MITIGATION SITE PLAN)

**Thompson Township, Susquehanna County,**
**Starrucca Borough, Wayne County,**
**Pennsylvania**

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# 1.0 Introduction

## 1.1 Project Name and Organization

First Pennsylvania Resource, LLC (FPR, Sponsor), a wholly-owned subsidiary of Resource Environmental Solutions, LLC (RES) proposes to establish the Starrucca Creek Mitigation Bank – (Bank Site, Project) within the approved Pennsylvania Statewide Umbrella Mitigation Banking Instrument (PSUMBI). The purpose of the PSUMBI is to provide compensatory mitigation for unavoidable impacts to waters of the United States (U.S.) occurring as a result of activities authorized under Section 401 and 404 of the Clean Water Act; Section 10 of the Rivers and Harbors Act; Pennsylvania Department of Environmental Protection (PADEP) Chapters 102, 105, and 106 regulatory programs; and Department of the Army Permits, provided such activities have met all applicable requirements and are authorized by the appropriate agencies.

FPR is submitting this Final Prospectus (Draft Mitigation Site Plan) (MSP) to the U.S. Army Corps of Engineers (USACE), Baltimore District and Interagency Review Team to initiate evaluation of the proposed Bank Site in accordance with 33 CFR 332.8(d)(2). The proposed Bank Site is located within the Upper Susquehanna River Subbasin (8-digit HUC #02050101) (Pennsylvania State Water Plan Watershed Subbasin 4).

## 1.2 Authorities

The establishment, use, operation, and maintenance of the PSUMBI and the Bank Site are carried out in accordance with the following authorities:

1. Clean Water Act (33 USC 1251 et seq.)
2. Rivers and Harbors Act (33 USC 403)
3. Fish and Wildlife Coordination Act (16 USC 661 et seq.)
4. Regulatory Programs of the Corps of Engineers, Final Rule (33 CFR Parts 320-332)
5. Guidelines for Specification of Disposal Sites for Dredged and Fill Material (40 CFR Part 230)
6. Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army concerning the Determination of Mitigation Under Clean Water Act, Section 404 (b)(1) Guidelines (February 6, 1990);
7. Regulatory Guidance Letter No. 05-01. U.S. Army Corps of Engineers, February 14, 2005
8. Compensatory Mitigation for Losses of Aquatic Resources; Final Rule. 33 CFR Parts 325 and 332, Department of the Army, Corps of Engineers and 40 CFR Part 230, Environmental Protection Agency, April 10, 2008
9. Regulatory Guidance Letter No. 08-03. U.S. Army Corps of Engineers, October 10, 2008
10. Pennsylvania Department of Environmental Protection, Chapters 102, 105, and 106 regulatory programs, and
11. Pennsylvania State Programmatic General Permits (PASPGP) 3, 4 and 5 and the requirements of Title 25 PA Code 105 rules and regulations.

## 1.3 Phasing

This MSP is being submitted for review by the Interagency Review Team (IRT) and approval by the USACE as an addendum to the PSUMBI. Upon approval, the MSP for the Bank Site will be attached to the PSUMBI, and the Bank Site will be deemed a component of the PSUMBI. Credits will be released consistent with the schedule of credit availability in accordance with Section 10.1: Credit Release Schedule of this MSP. Credits released for the Bank Site will be accounted for in the overall bank ledger for the PSUMBI. Individual bank sites will have separate ledgers and

separate entries in the Regulatory In-Lieu Fee and Bank Information Tracking System (RIBITS), but all ledgers will be governed by the PSUMBI.

# 2.0 Mitigation Objectives

## 2.1 Location

The Bank Sponsor has secured a 104.95-acre (ac) tract of land composed of 39.41 acres of wetland and riparian floodplain as well as 17,265.37 linear feet (lf) of waterways and 5,273.29 lf of ditches located along and around the main stem of Starrucca Creek within the Upper Starrucca Creek watershed (HUC #020501011302). Figure 1: Service Area Map (Appendix A) provides an overview of the Bank Site in relation to the area for which the Project will provide compensatory mitigation. The Bank Site is located along the Susquehanna/Wayne County line in Northeastern Pennsylvania (PA). It is approximately one-mile northeast of the town of Thompson, and along the eastern border of Thompson Township, Susquehanna County and the western border of Starrucca Borough, Wayne County, PA. The Bank Site is approximately 8.40 miles south of New York/ PA state line, and 8.80 miles west of the PA / New Jersey state line.

The Bank Site is generally bordered to the north by Township Road T671 and to the south by Starrucca Creek Road (State Route 4039), which serves as the main access to the Project. The historic D&H (Delaware and Hudson) Railroad, now a recreational trail, borders the Bank Site along the northwestern border. The proposed Bank Site location is provided as Figure 2: Project Area Map (Appendix A, Figures).

The Project address and approximate center coordinates are listed below.

| | |
|---|---|
| **ADDRESS** | 73 Starrucca Creek Road<br>Susquehanna, PA 18847 |
| **APPROXIMATE CENTER COORDINATES** | 41° 52' 43.26" North (41.878683)<br>75° 28' 47.91" West (-75.479975) |

Driving directions from the intersection of Interstate 80 (I-80) and I-81 near Drums, PA:

1. Head east on I-80 East.);
2. Use the left land to take exit 260B to merge onto I-81 North toward Wilkes-Barre (60.0 mi.)
3. Take exit 211 for PA-106 toward Lenox (0.2 mi.)
4. Turn left onto PA-106 West (0.3 mi.)
5. Turn right onto PA-92 North (9.0 mi.)
6. Turn right onto State Route 2046. (0.8 mi.)
7. Continue onto State Route 1001 (5.2 mi.)
8. Slight left onto PA-171 North/Jackson Street (1.1 mi.)
9. Continue onto State Route 1005/Starrucca Creek Road (1.8 mi.)
10. Continue onto Starrucca Creek Rd (0.3 mi.)
11. The Bank Site will be on the left.

Arrangements should be made with the Bank Sponsor prior to visiting the Bank Site.

## 2.2 Objectives

The goal of the Project is to restore and preserve self-sustaining, functional environmental resources identified within the Project area. In accordance with these goals, the Project strives to replace the functions and values lost as a result of adverse impacts to streams and wetland

areas due to various Section 10 and/or Section 404 authorized projects occurring within the Upper Susquehanna River Subbasin (Pennsylvania State Water Plan Subbasin 4).

Restoration efforts will focus on the creation of a stable stream and floodplain system, which will result in multiple functional/ecological improvements within and downstream of the Project's limits.

Functional gains from the restoration activities are anticipated to include:

- reestablishment of streams and wetlands;
- reestablishment of stream and floodplain connectivity;
- improvement of hydrologic connectivity of onsite stream channels to their historical flood prone areas (specifically the interaction of channel flow with the floodplain)
- improvement of onsite flood capacity, storage, and attenuation;
- improvement of onsite stream stability and appropriate channel geometry;
- improvement of aquatic and riparian terrestrial habitat;
- improvement of the vegetative diversity throughout all habitats within the system;
- elimination of invasive species; and
- perpetual protection of the Bank Site through appropriate legal protections to ensure the continuity and evolution of the functional improvement goals once achieved.

Larger-scale environmental objectives of the Bank Site will:

- support the national goal of no-net-loss of wetlands;
- enhance and create wildlife habitat;
- provide compensation for wetland and stream losses in a manner that contributes to the long-term sustainable ecological function of the Starrucca Creek Watershed; and
- protect the biodiversity from harmful activities and processes, both natural and anthropogenic.

Multiple approaches and alternatives were considered for Bank Site resource restoration. The intensity of restoration proposed in different areas of the Bank Site is directly dependent on the existing degree of resource degradation in those areas. As such, the Project incorporates a variety of active restoration and enhancement activities which will maximize ecological uplift, while minimizing disturbance and construction impacts to existing resources. FPR anticipates that restoration efforts at the Project will result in the establishment and preservation of a long-term self-sustaining and functional stream, wetland, and riparian corridor.

## 3.0 Site Protection Instrument

The restoration site will be protected by a site protection instrument (SPI), such as a declaration of restrictive covenant for conservation, deed restriction, or stormwater easement, etc., that will be placed on the property in advance of the proposed restoration activities, thereby ensuring the long-term protection of the site. The SPI restricts activities that are incompatible with the objectives of the MSP. The SPI will be recorded within 60 days at the county courthouse after receipt of all required permits, clearances, approvals and authorizations and prior to project implementation. An example copy of a SPI that would be filed upon project authorization is included as Appendix B: Site Protection Instrument.

As described in Section VI.H. of the PSUMBI, the Sponsor will act as the initial long-term steward unless another qualified, watershed-focused, entity is willing to assume long-term stewardship responsibilities. FPR's heirs, assigns, or purchasers will be responsible for protecting lands contained within the Bank Site and in accordance with the terms of the approved MSP, unless the

lands are transferred or sold to a third-party long-term steward such as a local, state, or federal resource agency or non-profit conservation organization. Entrusting the Bank Site to a third-party long-term steward may commence only when FPR and the IRT have mutually concluded that the Bank Site has achieved all its objectives and sufficiently satisfied performance standards. The third party may transfer the Bank Site protective instrument to a conservation easement if they so wish with the review and approval of the USACE.

## 4.0 Site Selection

The site selection process prioritized the long-term self-sustaining ecological suitability of a site to provide desired aquatic resource functions as a result of compensatory mitigation activities. The factors that were used in selecting the proposed Bank Site include the following:

(i) Hydrological conditions, soil characteristics, and other physical and chemical characteristics,
(ii) Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape-scale functions,
(iii) The size and location of the compensatory mitigation site relative to hydrologic sources (including the availability of water rights) and other ecological features,
(iv) Compatibility with adjacent land uses and watershed management plans,
(v) Reasonably foreseeable effects that compensatory mitigation may have on ecologically important aquatic or terrestrial resources (e.g., shallow sub-tidal habitat, mature forests), cultural sites, functions and services, or habitat for federally- or state-listed threatened and endangered species, and
(vi) Other relevant factors including, but not limited to, development trends, anticipated land use changes, habitat status and trends, local or regional goals for the restoration or protection of habitat types or functions (e.g., re-establishment of habitat corridors or habitat for species of concern), water quality goals, floodplain management goals, and the relative potential for chemical contamination of the aquatic resources.

Additional key factors FPR considered in determining the site selection include:

(i) the extent of disturbance and restoration feasibility and
(ii) the restoration activities and potential effects to neighboring properties.

The Bank Site includes successional forested habitat, semi-degraded forested habitat, and agriculturally degraded aquatic resources. The Project was selected for the practicability of restoring ecologically self-sustaining aquatic resource functions through the restoration of streams, wetlands, and riparian corridors. Furthermore, the Project's location in proximity to neighboring exceptional value watersheds and ecologically significant landscapes offers great potential to provide a higher level of natural species transfer.

The potential to restore and preserve a large contiguous area of interconnecting streams and wetlands was a strong factor in the selection of the Project. The extent of the existing degradation within the Project combined with the proposed restoration approach will improve over 39 acres of wetland and 17,000 linear feet of stream.

### 4.1 General Watershed Characteristics

The proposed Project is in the Upper Starrucca Creek (USC) watershed (HUC 12: 020501011302), a sub-watershed of the Lower Susquehanna River watershed (HUC 10: 0205010113). The USC has a drainage of 20.72 square miles (10.57 of which contribute directly to the Project site) and begins in Ararat Township, Susquehanna County, PA. The stream flows north and receives

drainage from multiple UNTs. The Bank Site lies within both Susquehanna and Wayne Counties and includes the main Starrucca Creek channel as well as numerous smaller UNTs.

The Project is in the Glaciated Low Plateau section of the Appalachian Plateaus Physiographic Province. The Glaciated Low Plateau Physiographic Province is characterized by rounded hills and valleys with low to moderate relief and elevations ranging from 440 – 2,690 feet. The Glaciated Low Plateau section is primarily made up of low amplitude folded sandstone, siltstone, and shale. Soils within, and surrounding, the Project have depths ranging from 15 to >80 inches. Slopes within the Project area are between 2 and 48 percent, with a majority (80%) of the soil less than 4 percent slope. Additionally, the Project is a mixture of well/moderately well drained soils and poor/somewhat poorly drained soils.

The USC watershed contains a total stream length of 46 miles – 36 miles of which have PA chapter 93 designated use of "Cold Water Fisheries (CSF) and 10 miles of which have a designated and existing use of Exceptional Value Fisheries (EV). Although no streams within the USC are categorized by the state of Pennsylvania as "impaired", the site itself includes multiple sources of degradation including ditches, channelization, agricultural disturbance, berms and riprap which impact downstream water quality within the USC.

Land use within the USC watershed can be characterized by a predominance of forest (69.35%), with substantial agricultural uses (18.23%), wetlands (4.98%) and development (2.92%) (2011 NLCD). Loss of open space and vegetated ground cover immediately surrounding the Project site is evidenced in Figures 3: Existing Conditions Map, 5A-C: Historical Aerials, 6A: 2001 National Land Cover Dataset Map and 6B: 2011 National Land Cover Dataset Map, (Appendix A: Figures). The presence of developed, open space outside the Project site visibly increases from 1992 to 2011. This trend is anticipated to continue as the population continues to grow into headwaters areas of the Starrucca Creek Watershed. Due to the increases in new home construction, roadway installation and oil and gas development, existing forested areas and crucial habitats are suffering from fragmentation and overall loss.

Northeastern PA, along with many other regions in the state, is challenged with balancing the environmental protection of lands and waters with the ever-growing natural gas industry. According to StateImpact PA, a reporting project of the National Public Radio (NPR) (NPR, 2011), Susquehanna County is ranked as the third county with the greatest number of active natural gas wells in PA – hosting approximately 1,079 wells – after Washington and Bradford Counties, which have 1,146 and 1,097 wells, respectively. Susquehanna County is also the top county with the greatest number of natural gas related violations (n=795). The construction and land disturbance required for the natural gas industry has altered land use and harmed local ecosystems by causing erosion and fragmentation of wildlife habitats and migration patterns. Without protection, the region continues to be subject to an ever-growing risk of contamination of underground and surface water resources. With the continued degradation of the regional landscape, the significance and importance of restoring and protecting the region's natural resources is more important now than ever.

## 4.2 Congruence with Watershed Needs

As described above and discussed in this section, existing land uses and pressure from agriculture, development and other natural resource extractions continue to threaten the natural ecosystems within the USC Watershed. Persistent degradation of water quality and habitat not only impacts ecosystem health and fishery value within the watershed, but also contributes to larger reaching ecological and economic impacts downstream to the Susquehanna River and Chesapeake Bay.

The USC Watershed has been classified by the PA Natural Heritage Program (PNHP) Aquatic Community Classification (ACA) as a Tier 2 Restoration Watershed. Tier 2 watersheds tend to have significant water quality and watershed condition issues that could benefit greatly from restoration efforts. Despite impairments and degradation within the watershed, the watershed is host to a vast variety of natural resources and contains multiple Pennsylvania Natural Heritage Program (PNHP) Biodiversity Areas (BDAs) (core habitats and supporting landscapes) and contains Chapter 93 Designated and Existing exceptional value streams (Table 1: Ecological Inventory Descriptions, Figure 4: Ecological Inventory Map (Appendix A: Figures). These BDAs are predominantly glaciated remnants comprised of peatlands, wetlands, ponds, swamps, and lakes. Many of these areas are relatively undisturbed and contain plant, animal, and invertebrate species of concern (SOC). Exceptional value streams exceed levels necessary to support the propagation of fish, shellfish and wildlife and recreation. The Bank Site is centrally located to these surrounding precious natural resources, thereby playing a key role in the protection of land and water within the larger regional landscape.

In recognition of the need to restore water quality and protect unique or high quality lands within the Starrucca Creek Watershed, several organizations work to conserve and protect the distinctive features in the regional landscape. The Susquehanna County Conservation District (SCCD) and Wayne County Conservation Districts (WCCD) are the leading conservation organization in the local region working to provide technical and financial assistance for conservation practices throughout the community within Starrucca Creek Watershed. The Mission of the SCCD is to "assist people and communities in the wise use of their natural resources." The WCCD mission is "to assist the public in conserving Wayne County's natural resources through technical assistance and education." The SCCD and WCCD work closely with various conservation organizations, non-profits, and private citizens to address sediment and nutrient losses both at a local-level and at a national watershed-scale.

Another conservation organization working locally is the Countryside Conservancy, a non-profit organization whose focus is protection of lands and waters within Lackawanna, Susquehanna, and Wyoming Counties. To date, the Countryside Conservancy alone has provided permanent protection to nearly 1,200 acres of lands and waters in northeast PA. Conservation easements with landowners has enabled the protection of 882 acres from development.

With limited areas within the landscape already under conservation and/or protection, the need to bring more resources under protection is still great, as threats of development and other degradative land use changes continue to grow. The proposed Bank Site is central to these existing protected areas and acts as a joining feature in supporting a larger scale protected landscape. The addition of the Bank Site can aid in the formation of a network of protected lands, which may support the deterrence of harmful and incompatible land uses within the region.

Larger watershed initiatives also support the conservation, restoration, and protection of the region in which the Bank Site is located. These larger initiatives, their missions, and their goals are described in more detail, below.

| Table 1: Ecological Inventory Descriptions | | | |
|---|---|---|---|
| **Agency** | **Site Name** | **Approximate Distance (miles) and Direction from Project** | **Description** |
| PNHP | Weir Pond, Shelly Preserve | 1.2, Northwest | Wetland complex includes pond affected by beaver activity over the years. Site contains a "Graminoid Marsh Natural Community" and numerous species of concern. |
| PNHP | Churchill Lake | 4.1, Northwest | An extensive floating bog mat dominated by a Leatherleaf-sedge Wetland Natural Community. Three plant species of concern present. Lake is currently in a relatively undisturbed natural condition. |
| PNHP | Route 171 Wetlands | 2.2, Southwest | Wetland complex along Rt. 171 has diversity of wetland habitats. A dragonfly species of concern documented using shallow water pools within herbaceous openings. |
| PNHP | Spruce Lake | 3.0, Southeast | Wetland habitat supports three plant species of concern. Beaver have degraded the bog and need to be removed. |
| PNHP | Dunn Lake | 2.4, South | A large open-water glacial lake; water level raised slightly by an artificial dam. Good diversity of native aquatic plant species including four species of concern. |
| PNHP | Orson Mud Pond | 3.2, South | Wetland complex contains portions of headwaters of East Branch Lackawanna River. Hosts seven plant species of concern. |
| PNHP | Beaver Pond | 2.7, East | Wetland habitat supports a plant species of concern. |
| PNHP | Shehawken Lake | 4.0, East | Aquatic habitat at this location supports two plant species of concern. Lake turbidity may indicate water quality problems. Discourage new development in watershed and monitor water quality. A small population of an additional plant species of concern occurs in a nearby ravine. |
| PNHP | Holberts Pond | 4.6, East | Good population of a plant species of concern. Problems affecting Shehawken Lake will impact this site. |
| PNHP | Island Lake | 4.2, Northeast | Good to excellent populations of 6 aquatic plant species of concern. |
| PNHP | Hiawatha Lake | 5.0, Northeast | Excellent quality Glacial Lake Natural Community and three plant species of concern. Immediate threat from proposed development. |
| PNHP | Pine Swamp-Wayne co | 4.5, Northeast | Fair population of a plant species of concern occurs in a large wetland. Discourage logging in swamp, encourage landowners to protect watershed. |
| PNHP | Finnegan Corners | 3.8, North | Small populations of two plant species of concern on beaver-impacted site. Maintain in present condition. |
| PNHP | Farrell Corners | 4.7, North | Excellent example of a Many fruited sedge - bladderwort peatland Natural Community and good populations of 3 plant species of concern. Protect from logging and development within primary watershed. |
| PNHP | Maple Grove | 4.6, North | A "Leatherleaf - bog rosemary peatland Natural Community" with a plant species of concern. |
| PNHP | Churchill Lake | 4.1, Northwest | An extensive floating bog mat dominated by a Leatherleaf-sedge Wetland Natural Community. Three plant species of concern present. Lake is currently in a relatively undisturbed natural condition. |

## 4.3 Susquehanna River Basin Commission

The Bank Site is part of the Susquehanna River Basin. According to the information provided on the Susquehanna River Basin Commission website (SRBC, 2015), "The Susquehanna River is the nation's sixteenth largest river and is also the largest river lying entirely in the U.S. that flows into the Atlantic Ocean. The Susquehanna and its hundreds of tributaries drain 27,510 square miles, an area nearly the size of South Carolina, spread over parts of the states of New York (NY), PA, and Maryland (MD)."

The river, from its origin in Otsego Lake near Cooperstown, NY, flows over 400 miles south where it empties into the Chesapeake Bay at Havre de Grace, MD, contributing one-half of the freshwater flow to the Chesapeake Bay.

The river basin borders major population centers of the east coast, and although relatively undeveloped, has experienced problems from water pollution and over usage. In order to address

these problems, the Susquehanna River Basin Compact was signed into law on December 24, 1970. The Compact, as adopted by the Congress of the U.S. and the legislatures of NY, PA, and MD provides the mechanism to guide the conservation, development, and administration of the water resources of the vast river basin. The Compact also established the Susquehanna River Basin Commission (SRBC) as the agency to coordinate the water resources efforts of the three states and the federal government. The mission of the Susquehanna River Basin Commission (SRBC), is to enhance public welfare through comprehensive planning, water supply allocation, and management of the water resources of the Susquehanna River Basin.

To accomplish this mission, the SRBC works to: reduce damages caused by floods, provide for the reasonable and sustained development and use of surface and ground water for municipal, agricultural, recreational, commercial and industrial purposes, protect and restore fisheries, wetlands and aquatic habitat; protect water quality and instream uses, and ensure future availability of flows to the Chesapeake Bay.

The proposed mitigation activities at the Bank Site directly support the SRBC's efforts to accomplish this mission, specifically with respect to protection and restoration of fisheries, wetlands, and aquatic habitats.

The activities of the SRBC are further guided by multiple goals, some of which are also directly supported by the proposed Bank Site mitigation activities. These goals include the following:

1) To be a leader in issues concerning the conservation, utilization, allocation, development, and management of water resources within the Susquehanna River Basin;
    - The proposed Bank Site mitigation activities may support the leadership as it is anticipated to provide an exemplary example of conservation and natural resource management.
2) To provide public information and education about the water resources of the basin.
    - The proposed Bank Site mitigation activities may also provide a location where education about the conservation and restoration of natural resources can occur.

SRBC staff develops and implements the programs as directed by the commissioners and as found in SRBC's comprehensive plan, Comprehensive Plan for the Water Resources of the Susquehanna River Basin (SRBC Comprehensive Plan), (http://www.srbc.net/planning/comprehensiveplan.htm). The SRBC Comprehensive Plan identifies six priority management areas along with goals to be used to guide management efforts. Of the six, below are two management areas that will be directly supported by the mitigation activities that may be proposed at the Bank Site

1) Water Quality
    - Monitor and assess the biological, chemical, and physical quality of the basin's waters to support restoration and protection efforts.
    - Develop, support, and implement plans and projects to remediate and enhance the basin's water quality.
    - Protect the quality of the basin's biological resources and sources of public drinking water supply.
2) Ecosystems
    - Perform ecosystem monitoring and assessment to provide data needed for effective watershed management.

- Protect and restore biological resources throughout the basin and in each of the major subbasins.
- Restore populations of migratory fish throughout the Susquehanna River system.

Proposed restoration activities at the Bank Site will support a subset of the management areas and the goals of both the Chesapeake Bay Watershed and the SRBC.

## 4.4 Susquehanna Greenway Partnership

The Susquehanna Greenway (SGP) links natural, cultural, historic, and recreational resources along the 500-mile corridor of the Susquehanna River in PA. The SG has established a basin-wide organization for resource management and community conservation - factors of lasting importance to the economies and quality of life of river communities.

The SGP works to advance public and private efforts to connect people with their natural and cultural resources and promote a sustainable and healthy environment. In an effort to accomplish this mission, the SGP has laid out six initiatives. Of the six, the following two are directly supported by the Bank Site restoration activities:

1) Conserving & Enhancing Natural Resources
   - The Bank Site proposes to restore the natural resources on-site and protect them. As stated by the SGP, "Conserving critical wetlands, forestlands, farmlands and riparian areas…will enhance our water resources and the quality of life for all living things." In support of this statement, the SGP also works to preserve and enhance riparian corridors along the river and its tributaries in addition to advocating for priority conservation projects.
2) Interpreting Natural and Cultural Assets
   - Interpreting natural and cultural assets along the river promotes the critical connection between the Susquehanna River Corridor and the Chesapeake Bay. Interpretation emphasizes the preservation and conservation of the Susquehanna's many diverse natural and cultural resources, and historic communities and increases pride in the community and ownership of its resources. The Bank Site will become a natural asset that will improve the health of the landscape as well as the improve aesthetics and could potentially become a part of a greenway driving tour, similar to the SGP's Middle Susquehanna Driving Tour.

## 4.5 Chesapeake Bay Watershed

The Bank Site is located in the Chesapeake Bay Watershed. The Chesapeake Bay, spanning parts of six states and draining 64,000 square miles of land, is the largest estuary in the U.S. It is a complex ecosystem made up of the Bay itself, its feeding network of waterbodies, and all the plants and animals it supports. Starrucca Creek, which ultimately flows into the Susquehanna River, is one of the over 150 freshwater streams that drain into the watershed. As evidenced by the bulleted list below, the Bay plays a critical role in the health of the regional watershed.

- The Bay supports more than 2,700 species of plants and animals, including 348 species of finfish and 173 species of shellfish.
- The Bay produces about 500 million pounds of seafood per year.
- The Chesapeake region is home to at least 29 species of waterfowl. Nearly one million waterfowl winter on the Bay – approximately one-third of the Atlantic coast's migratory

population. The birds stop to feed and rest on the Bay during their annual migration along the Atlantic Flyway.

- Nearly 80,000 acres of bay grasses grow in the shallows of the Chesapeake Bay and its tributaries. Young and molting blue crabs rely on bay grass beds for protection from predators.
- Approximately 284,000 acres of tidal wetlands grow the Chesapeake Bay region. Wetlands provide critical habitat for fish, birds, crabs and many other species.
- Forests cover 58 percent of the Chesapeake Bay watershed. The region loses about 100 acres of forest each day to development.

Due to the multitude of pollutions threats to this precious resource, the Bay was the first estuary in the nation to be targeted for restoration as an integrated watershed and ecosystem.

The Bay Program partnership implements and tracks progress toward goals to reduce pollution, restore habitats, manage fisheries, protect watersheds, and foster stewardship. The health of local streams and waterbodies, including those within the Bank Site depend on how the land surrounding them is used, protected, and preserved. The restoration and protection of the waters within the Bank Site therefore align with the restoration goals of the Bay Program partnership in its effort to restore the overall health of the Chesapeake Bay. Specifically, restoration efforts at the Bank Site will involve reducing sediment pollution, restore wetlands and re-establish fish passage, manage and enhance a naturally reproducing trout stream, planting and/or seeding of native wetland, riparian, and upland vegetation, and protection of these resources.

# 5.0 Bank Site Description

## 5.1 Existing Conditions

The Bank Site includes a portion of the main stem of Starrucca Creek, multiple unnamed tributaries (UNTs) to Starrucca Creek, man-made ditches, and degraded Palustrine Emergent and Palustrine Scrub Shrub wetlands (PEM and PSS, respectively). The Bank Site exhibits a mixture of mixed, evergreen, and deciduous forest in addition to open agricultural land used for hay/cropland in and around the wetlands and streams.

The Bank Site is surrounded by large tracts of forested land. North of the Project and immediately surrounding Starrucca Creek, land use is characterized by agricultural pasture and hay fields. A fragmented landscape comprised of small agricultural pastures and open fields, in addition to large tracts of forested landscape surround the Bank Site. Remnants of a once glaciated landscape are evidenced by the glacially formed ponds and lakes that are present within the region.

The topography of the stream channel consists of a wide active stream valley surrounded by steep slopes to the north and south. The stream's headwaters are located to the west and the floodplain drops in elevation as the main stem traverses its way east through the steep upland ridges. In some sections, the stream appears to have moved over time within the floodplain, changing its path during storm events. Multiple tributaries and drainages exist both from the north and south, emptying the uplands into the floodplain. Vegetation is thick within the stream valley, with tall grasses, thick brambles, and saplings.

The majority of streams and wetlands identified on-site have been degraded to varying degrees through anthropogenic alterations including historic and current agricultural activities and the introduction of non-native pasture grasses. The extent of degradation is directly related to time elapsed since land use change (i.e. abandonment of farm uses) and/or since incidental impacts

(i.e. those areas near roadways or cultivated lands have continued exposure to erosive conditions and invasive species propagules).

At multiple locations along the main stem, the banks of Starrucca Creek are armored such that the stream is now channelized along the valley wall.

It is also readily apparent that two ditches were installed to drain the central portion of the existing PEM wetland. Both of these ditches join with the unnamed tributary (UNT) to Starrucca Creek at the northwestern border of the channel. The previously farmed wetland surrounding these ditches is significantly disturbed and is dominated by reed canarygrass (*Phalaris arundinacea*). Major direct and indirect anthropogenic impacts along Starrucca Creek and the surrounding waterbody features include historic agricultural activities (i.e. cultivation of non-native herbaceous species) and direct channel impacts (i.e. ditching). These activities resulted in an unnatural landscape as evidenced by the forcing of the main stem of Starrucca Creek against the valley wall. Additional impairments include the following: in stream straightening and widening, bank instability, floodplain detachment, the generation of excessive sediment, and the lack of adequate aquatic and terrestrial habitat along the main stem of Starrucca Creek.

Representative site photographs are included as Appendix C: Representative Site Photographs. Appendix A, Figure 3: Existing Conditions Map shows the existing streams and wetlands the Bank Site, as delineated by FPR and BluAcres, LLC in July 2015.

## 5.2 Physiographic and Geographic Setting

The Project is in the Catskill Formation geologic units of the Devonian age, containing major lithologic constituents of sandstone and siltstone and minor lithologic constituents of the shale, conglomerate, and mudstone. Soil units include Shohola-Edgemere complex, Basher silt loam, Bath very stony loam, Lackawanna very stony silt loam, Mardin channery silt loam, Mixed alluvial land, Oquaga and Lordstown extremely stony loams, Volusia channery silt loam, Wyalusing silt loam and Wellsboro channery loam. All these soils (Except for Basher silt loam) are characterized as predominately prime agricultural land. As such, the Project has been heavily impacted by historic and existing agricultural practices. Additionally, Shohola-Edgemere complex, Basher silt loam, Mixed alluvial land, Volusia channery silt loam, and Wyalusing silt loam are categorized as either soils in aquic suborders/subgroups, frequently flooded or ponded.

## 5.3 Degradation Summary

Streams and wetlands identified onsite have been degraded due to historic and ongoing agricultural activities. Sources of degradation include:

- ditching, tiling, and channelization
- channel incision and bank erosion
- berms and rip/rap
- beaver control/management
- dewatering,
- sedimentation
- limited floodplain connection and continuity
- high peak flows and flashiness
- limited flood storage and capacity
- reduced baseflows
- excessive nutrient runoff
- instable/infrequent aquatic and terrestrial habitat elements, and

- low native vegetative diversity and coverage.

Representative site photographs are included as Appendix C: Representative Site Photographs.

## 5.4 Background Research and Natural History

The Bank Site is located within an irregular landscape characterized by hills and valleys which are remnants of a once glaciated region. Currently, the resources on site are in varying stages of ecological degradation and recovery because of historical anthropogenic influences, many of which are consistent with historic land use trends in the Northeast. As can be seen from Appendix A, Figure 5A: 1939 Historic Aerial Map, the central area of the Starrucca Creek floodplain was predominantly composed of an open PEM dominated wetland complex made up of multiple natural highly sinuous stream and drainage channels. The 1959 Historic Aerial (Appendix A: Figures, Figure 5B) shows the beginning of significant on-site manipulation, including ditching and channelization which maximized farmable land in the central area of the Project. FPR learned through interviews with current landowners that during the 1930s, the previous landowners had the open field located in the central southwestern portion of the Bank Site tiled. The current landowners farmed the land under those conditions until the early 1970s when the Soil Conservation Service (SCS), now the Natural Resource Conservation Service (NRCS), paid them cost-share to develop more agriculturally productive land. It was after this that more extensive ditched waterways were established to drain the fields.

Currently, the Bank Site is comprised mostly of an old agricultural field, with numerous streams and ditches draining into Starrucca Creek. Starrucca Creek flows in a southwest to northeast direction. At its most southwesterly reach within the Bank Site, and at different areas within the Bank Site, the banks of Starrucca Creek are armored with large rocks, which were historically installed to stabilize and channelize the stream along the valley wall.

As shown in Figures 6A and 6B (Appendix A, Figures), which show the National Land Cover Datasets (NLCD) for 2001 and 2011, respectively, the dominant land cover within the Bank Site is agriculture, specifically hay/pasture use. This is substantially more agricultural land than within the watershed as a whole. Significant portions of the Bank Site are composed of deciduous and mixed forest types; however a 13% reduction of forest was observed between 2001 and 2011 (Table 2: 2001 to 2011 NLCD Comparisons).

**Table 2: 2001 to 2011 NLCD Comparisons**

| Land Cover Type | 2001 | 2011 | Net Change |
|---|---|---|---|
| Cultivated Crops | 1% | 0% | -1% |
| Pasture/Hay | 45% | 55% | +10% |
| Developed[1] | 0% | 4% | +4% |
| Forest[2] | 54% | 41% | -13% |

Notes:
1. Includes developed open space and low-intensity land cover types.
2. Includes all forest/tree cover types.

No evidence exists indicating that underground or surface mining activities have occurred within the Bank Site. No major subsidence features or remnant mining features have been observed during site investigations or through historic research.

As discussed above, the Bank Site's biological integrity has been ecologically and physically altered. Historically, the valleys across the region were characterized by a mosaic of floodplain

wetland types, with anastomosing stream channels that continually evolved while migrating across the valley bottom laterally, as shown in Appendix A: Figure 5A: 1939 Historic Aerial Map. These systems were highly influenced and regulated by the activities of the North American beaver (*Castor canadensis*), which is described as an "ecosystem engineer" due to its unique ability to build dams and its role in physically modifying habitat structure and resource availability for themselves and other species (Batzer and Sharitz 2006; Jones et al. 1994). Currently, streams are trapped along the valley margins and remain in a static condition due to installed berms, ditches, channelization, and armored banks. This has reduced hydrologic interaction with the system's floodplain and neighboring wetlands while also increasing geomorphic instability and reducing habitat diversity. In addition, the active management of beavers by landowners has impeded their ability to modify the stream corridor, which over a long period of time (>100 years) may have returned to a dynamic and stable, multi-thread, braided stream and floodplain complex, as illustrated in Diagrams 1 and 2 provided below.

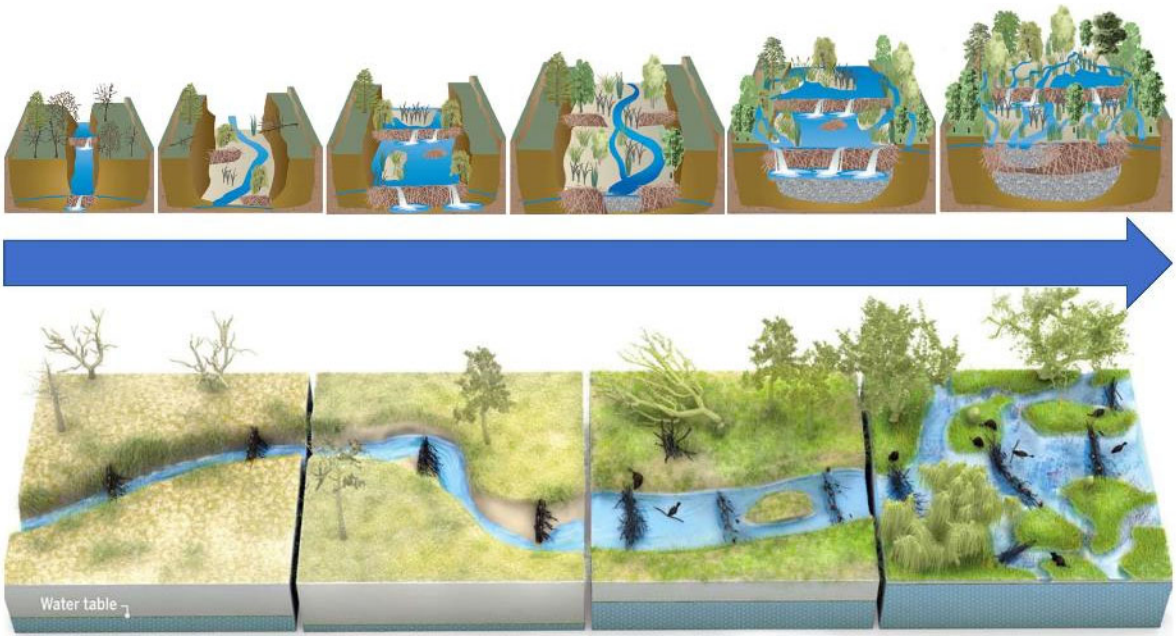


**Diagram 1: Sequence of channel evolution of an incised stream due to beaver activity, adapted from Pollock et al. 2014 and B. Goldfarb 2018.**

*Incised Channel* | *Stream Rebuilding-Beaver Activity* | *Beaver Control No Incision*

**Diagram 2: Photo series of channel evolution of an incised stream as beaver activity progresses, Northeast PA**

Researchers, government agencies, and other environmental professionals have recently begun to understand and employ the ability of beavers to improve ecosystem functions at a landscape scale (Pollock et al. 2014; Law et al. 2017; Wright et al. 2001, Brown and Fouty 2011). Documented benefits include improvements to hydrology, geomorphology, water quality, habitat

complexity/heterogeneity, and biodiversity as summarized in Diagram 2: Ecological Benefits of Beaver Activity (Correll et al. 2000, Rosell et al. 2005).

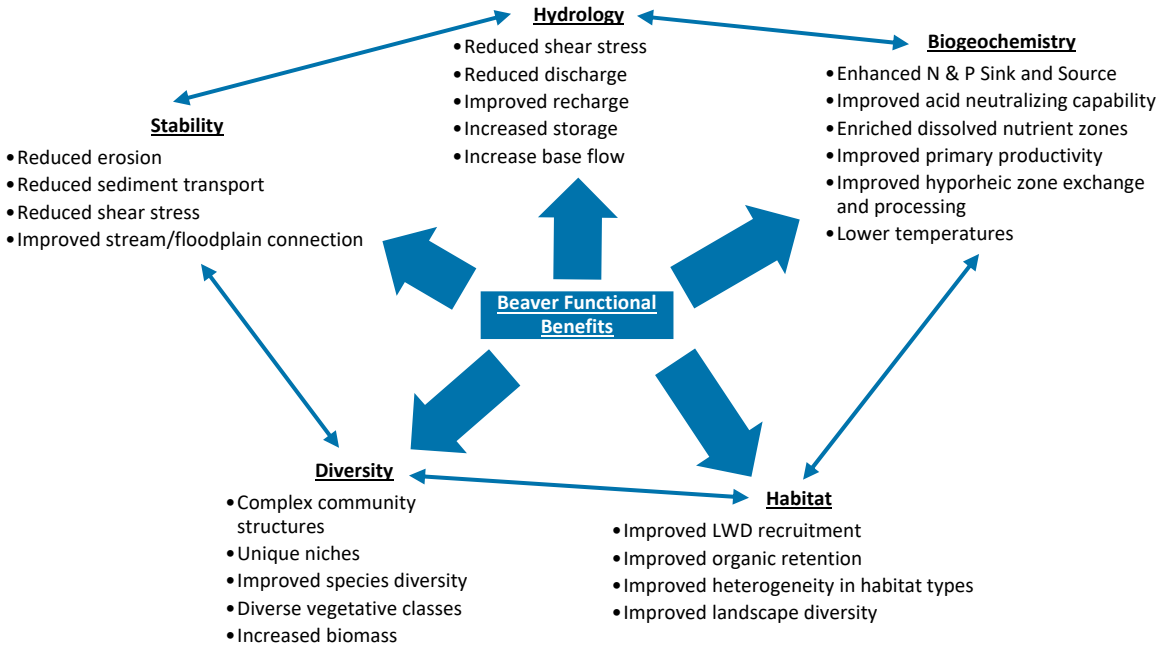


**Diagram 3: Ecological Benefits of Beaver Activity**

Beaver dams reduce shear stress by spreading water over a larger surface area while also increasing water storage, reducing discharge, and increasing groundwater recharge, all of which contributes to increases in baseflow during dryer periods of the year. The reduction in discharge and shear stress effectively reduces existing erosive potential and sediment-carrying capacity. Furthermore, beaver ponds function as sediment traps, allowing the accumulation of organic matter and sediment. As such, beaver ponds also influence water chemistry by storing Nitrogen and Phosphorus (N & P) and later acting as a long-term N & P source while also acting as an acid neutralizer. Anaerobic zones in beaver ponds are enriched in dissolved nutrients which stimulates primary production that is linked to the retention and processing of organic matter in the hyporheic zone. These ponds also create hydraulic pressure drops causing a sharp upwelling zone of cooler water at the downstream end of the dam.

Beaver activity significantly increases the recruitment and accumulation of LWD which offers additional ecological and geomorphic benefits. Rosell et al. 2005 states that "the woody debris accumulated by beavers in streams also increases the patchiness of bed sediment and represents an important in-channel morphological feature. This woody debris controls the transport of sediment and particulate organic matter, and creates conditions for the formation of braided channel, pools and islands. By importing woody debris into streams, beavers play a considerable role in the stabilization of low-order (mainly 1st-5th order) streams." This statement emphasizes how the Project resources would have naturally functioned and appeared in an unimpeded state.

The formation of beaver dams and ponds increases habitat diversity in the riparian corridor by creating alternating zones of open water, mud flats, wet meadows and dry meadows, as well as in the streams themselves through the creation of a "stair-step profile" with heterogeneity in channel depth and width (Naiman et al 1988). Long-term beaver foraging and elevated water tables from dam creation drive a replacement of the wooded tree stands along the stream's immediate corridor with a shrub-dominated zone. Migrating to the valley margins, wooded stands develop when appropriate hydrologic conditions are present to encourage their establishment.

Just as the formation of beaver dams create open water environments, their eventual abandonment will result in the formation of beaver meadows, dominated by sedges and grasses. Limited tree establishment has been documented in these meadows, due in part to hydrologic/biogeochemical constraints and/or reduced availability of ectomycorrhizal fungi caused by extended anaerobic conditions (Terwilliger and Pastor 1999).

Given the documented sequence of succession in these systems, wetland areas are dynamic and evolving. Wetland areas exhibit a mosaic of cover types that will continue to change. Radiocarbon dating of wood and seeds in the soil profile of a historic stream/floodplain wetland complex of a tributary to the Susquehanna River revealed that the system was dominated by a wet meadow herbaceous wetland (*dominated by Carex, Polygonum, Eleocharis, and Scirpus spp*) that existed for at least 3,200 years prior to European settlement (Voli et al. 2009). The study substantiates that a wet meadow or graminoid marsh may have been the dominant wetland class within the Starrucca Creek drainage basin. Graminoid marshes are associated with low gradient gently flowing streams with groundwater influence and are usually formed as successional communities associated with beaver activity within Susquehanna County (The Nature Conservancy 2006). These systems, where complex and diverse, offered important habitat and landscape heterogeneity that was utilized by a plethora of organisms, including macroinvertebrates, fish, amphibians, turtles, snakes, ducks, birds, semiaquatic mammals, bats, and terrestrial animals. The diversity of habitat created varying levels of biodiversity, shifted community structures, and improved biomass throughout the system in both terrestrial and aquatic organism populations. In addition, the systems created an environment that improved channel stability, increased floodplain connection/continuity, promoted the stabilization of bed sediment, enhanced LWD/fine-carbon/sediment retention, improved hydrologic connectivity, increased water storage capacity/ground water recharge, and improved biogeochemical cycling.

# 6.0 Baseline Information

## 6.1 Baseline Data Review

Extensive baseline site investigations were completed at the Project site (Appendix D: Baseline Data). Baseline investigations and data collected include:

- geotechnical surveys
- hydrologic data collection
- hydrologic modeling
- wetland delineation and waterbody identifications
- flora community composition characterizations
- PA Natural Diversity Inventory Review (PNDI)
- channel substrate and particle analysis
- geomorphic assessments
- fish and macroinvertebrate sampling

- topographic surveys
- large woody debris surveys, and
- photo and field observations.

The following discussions present the findings of the baseline data review. The data was assessed and used to guide the restoration approaches proposed at the Project Site, as described in Section 8.0 Mitigation Work Plan.

## 6.2 Environmental Resource Identification

Wetland and stream delineations of the proposed Bank Site were initiated in the Summer of 2015. Wetland delineations were completed following the 1987 Army Corps Wetland Delineation Manual (USACE, 1987) and the Eastern Mountains and Piedmont Regional Supplement Version 2 (USACE, 2012). Streams were identified and geographically located using handheld global positioning satellite systems (GPS) technology. Results from the environmental survey are described briefly herein. Detailed descriptions, data forms, photographs and additional mapping are included in the wetland report, provided in Appendix E: Wetland Report and the watercourse identification report, provided in Appendix F: Watercourse Identification Report.

A preliminary jurisdictional determination (PJD) requested was submitted to USACE Baltimore District on November 17, 2015. The PJD letter issued by the USACE Baltimore District, dated March 31, 2016 is provided in Appendix E. Wetland Report.

### *Streams*

Starrucca Creek and the unnamed tributaries to Starrucca Creek within the Bank Site are designated as Cold-Water Fisheries, Migratory Fisheries (CWF, MF) according to the PA Code; Title 25; Chapter 93.9a to 93.9z, Water Quality Standards. Both Starrucca Creek and UNT 32274 to Starrucca Creek at their confluence just outside the proposed Bank Site are designated as Exceptional Value (EV) waters according to the PA Code; Title 25; Chapter 93.9a to 93.9z, Water Quality Standards. The length of Starrucca Creek located in the Bank Site and within Susquehanna County is considered a Trout Natural Reproduction stream according to the PA Fish and Boat Commission (PFBC). All waterways delineated within the Bank Site are listed as attaining for aquatic life use attainment according to the Clean Water Act Section 305(b) reporting and Section 303(d) Integrated Streams List in PA. This is not congruent with FPR's macroinvertebrate monitoring which indicates impairment at three separate macroinvertebrate sampling locations within the Bank Site.

Approximately 17,265.37 lf of cumulative stream is present within the Bank Site. Of this, 16,303.08 lf are perennial, 935.85 lf are intermittent, and 26.44 lf are ephemeral. Approximately 5,273.29 lf of water is considered ditched (Table 4: Summary of Existing and Proposed Resources and Appendix A, Figure 3: Existing Conditions Map).

The main stem of Starrucca Creek within the proposed Bank Site is classified as a perennial stream. In its historic state, the stream likely existed as a highly mobile, meandering channel with multiple braids throughout its floodplain. In many locations however, the banks have been armored and/or bermed with large rock or fill to stabilize and channelize the stream against the valley wall and to keep additional braids from forming (Appendix A, Figure 3: Existing Conditions Map). This channelization is most evidenced in the central portion of the Bank Site. It is probable that this was done to increase the acreage of agriculturally productive land within the Bank Site. Upstream from this central area (or southwest of the central region), the main stem is more heavily armored, however, multiple braids (a depositional feature) exist, suggesting the

deposition process is regularly occurring in this area. The presence of isolated PEM wetlands in this area also suggests that the main stem once flowed through those wetlands, developing an oxbow over time, and that the PEM wetlands are now all that remain.

A set of headwater UNTs to Starrucca Creek were identified at the southwestern portion of the Bank Site (Appendix A: Figures, Figure 3: Existing Conditions Map). These UNTs are predominantly perennial with only a few classified as intermittent. One ephemeral stream feature was identified opposite of Starrucca Creek to the aforementioned group of UNTs. Due to the size and extent of the streams within the Bank Site, streams have been categorized into three groups, Starrucca Creek Main Stem, Ditched Waterways, and Headwaters Tributaries, and are described below.

### Starrucca Creek Main Stream

Starrucca Creek is a glacially influenced perennial cold-water fishery flowing through the Catskill formation of Susquehanna and Wayne Counties, PA. The streambed is dominated by gravel and cobble material made of sandstone and siltstone. The main stem of Starrucca Creek enters the Bank Site in the southwest corner at the confluence of an intermittent channel that flows from the north. At this intersection, the main stem continues to flow northeast through a moderately dense hemlock-dominated forested area. The main stem exits the forested zone approximately one-fifth of Bank Site's length downstream near the confluence of the first headwater tributary. At this location, the stream transitions into an early successional woody/scrub shrub wetland zone. Historical imagery shows evidence of multi-threaded braided channels accessing the entire floodplain in this transition zone, continuing to the confluence of the first major tributary flowing into the central point of the Bank Site from the south. The current state of this transition zone remains in a degraded status. Historic bank armoring was utilized to divert flow into the valley wall of the stream's downstream southern bank, effectively constricting the stream's ability to access the floodplain and naturally braid (Appendix A: Figures, Figure 3: Existing Conditions Map). Downstream of the first armored bank the stream was diverted into younger forested zone. In this area, the stream begins to flow through a clay-lined channel, exiting at a large unstable headcut where the system begins to braid. Installation of a historic berm and the downstream armored bank were constructed to prevent the migration of the stream into the northern valley wall. A short distance downstream from the berm, the stream was successfully diverted into a heavily armored channel pinned against the northern valley wall. The channelized section of the main stem flows through the remainder of the Bank Site's length, where it meets the confluence of an exceptional value (EV) tributary at the end of Bank Site's limits.

### Ditched Waterways

Near the center of the Bank Site, the floodplain of Starrucca Creek widens to become what is now a significantly modified and degraded PEM wetland. Within this large floodplain/PEM wetland area, historical imagery from 1959 (Appendix A: Figures, Figure 5B: 1959 Historic Aerial) shows the beginning of the installation of three large ditches which were used to drain the wetland to optimize agricultural productivity.

Additionally, the historically recognized tributary that once flowed north under Starrucca Creek Road and across the Bank Site (Appendix A: Figures, Figure 4: Ecological Inventory Map) was diverted and now flows across the southern border of the Bank Site, channelized in a parallel fashion to Starrucca Creek Road, eventually turning north and channelized in a very linear fashion to reconnect with Starrucca Creek. The two major ditches located in the center of the Bank Site consist of deep, silt-lined channels that exhibit low to no flow, ultimately holding warm stagnate water that eventually discharges into Starrucca Creek during heavier storm events.

A third large ditch flows parallel the main stem of Starrucca Creek. This deeply incised ditch has degraded into the gravel aquifer of Starrucca Creek and currently exhibits typical characteristics of a modified perennial stream, such as bed, banks, channelization, flow, riffle/pool sequence, and macroinvertebrate/fish communities. This manipulated channel flows across a pea gravel bed discharging cold clear groundwater directly into the main stem of Starrucca Creek.

### Headwaters Tributaries

The remainder of the site consists of large historic agricultural fields, small wetlands, and coldwater cobble/silt springs and seeps that are scattered throughout the Project area.

#### *Wetlands*

A wetland delineation was performed by BlueAcres, LLC (BlueAcres) on July 22, 23, and 24, 2015. Wetland delineation efforts at the Bank Site uncovered multiple PEM and PSS wetlands. Table 3: Summary of Existing Resources provides a breakdown of the classes and approximate sizes of the wetlands within the Bank Site. Figure 3: Existing Conditions Map (Appendix A: Figures), shows the locations of the wetlands by Cowardin classification within the proposed Bank Site.

**Table 3: Summary of Existing and Proposed Resources**

| Resource Type | Classification | Existing | Proposed | Units |
|---|---|---|---|---|
| Watercourses | Perennial | 16,303.08 | 17,655.44 | Linear Feet |
| | Intermittent | 935.85 | 1,155.63 | |
| | Ephemeral | 26.44 | 26.44 | |
| | Ditches | 5,273.29 | - | |
| | **Total** | **22,538.66** | **18,837.51** | |
| Wetlands | PEM | 35.05 | *55.23 | Acres |
| | PSS | 4.36 | *1.70 | |
| | PFO | - | *3.72 | |
| | **Total** | **39.41** | **60.65** | |
| Uplands | UPL | 61.19 | 40.69 | |
| **Total Acreage** | | **104.95** | **104.95** | |

Notes:

1. Pre-restoration resources are based on the resource delineations within the Bank Site.
2. *As detailed in Section 5.4., wetland cover types are not anticipated to be static due to natural evolutionary processes and constraints. However, a PEM cover type may be dominate based on the natural history of the system.

The Bank Site consists predominantly of PEM wetlands, with some PSS wetlands within the southwestern portion of the Project Boundary (Appendix A: Figures, Figure 3: Existing Conditions Map). While a larger portion of wetlands onsite were characteristic of a floodplain complex hydrogeomophic (HGM) wetland class, some wetlands were classified as slope wetlands while the remaining were characterized as depressional. Specific acreages for each wetland are outlined in the wetland delineation report provided as tables within Appendix E: Wetland Report.

All wetlands are assumed to be designated as "exceptional value" according to PA Code Chapter 105.17 1(iii), due to their location within the floodplain of Starrucca Creek, a PFBC-designated naturally reproducing wild trout stream.

Primary and secondary hydrology indicators consistently documented across the Project Site include: surface water (A1), high water table (A2), saturation (A3), oxidized rhizospheres on living roots (C3), stunted or stressed plants (D1), geomorphic position (D2), micotopographic relief (D4) and FAC-Neutral Test (D5).

Dominant vegetation consistently found at the wetlands across the Bank Site include: red maple (*Acer rubrum*), silver maple (*Acer saccharinum),* green ash (*Fraxinus pennsylvanica*), Eastern

hemlock (*Tsuga canadensis*), river birch (*Betula nigra)*, Japanese barberry *(Berberis thunbergii),* common hawthorn *(Crataegus monogyna),* black willow *(Salix nigra),* bog goldenrod *(Solidago uliginosa),* giant goldenrod *(Solidago gigantea),* reed canarygrass *(Phalaris arundinacea),* rough bedstraw *(Galium asprellum),* sensitive fern *(Onoclea sensibilis),* fox sedge *(Carex vulpinoidea),* broadleaf cattail *(Typha latifolia),* green arrow arum *(Peltandra virginica),* soft rush *(Juncus effusus),* arrow-leaved tearthumb *(Persicaria sagittata)* and spotted joe-pye weed *(Eutrochium maculatum)*.

Dominant indicators of hydric soils found include depleted below dark surface (A11) and depleted matrix (F3).

## 6.3 Soils

The U.S. Department of Agriculture Natural Resource Conservation Service (USDA-NRCS) identifies 11 distinct soil series/complexes within the Bank Site. The soil identities and summary attributes are included in Table 4: Soil Series within the Bank Site, below. The mapped locations of the soils are shown on Appendix A, Figure 7: Soils Map.

**Table 4: Soil Series**

| Soil Series Symbol | Soil Series Description | Soil Series Setting (Landform) | Farmland Classification | Soil Limitations | | | | Hydrologic Soil Group |
|---|---|---|---|---|---|---|---|---|
| | | | | Depth to Restrictive Features | | Natural Drainage Class | Hydric Rating Percentage (%)[2] | |
| | | | | Depth to Any Soil Restrictive Layer (in) | Depth to Water Table (in) | | | |
| 7B | Shohola-Edgemere complex, 0 to 8 percent slopes, very rubbly | Drainageways | Not prime farmland | 18-30 | 6-18 | Somewhat poorly drained | 29 | C/D |
| Bc | Basher silt loam | Flood plains | All areas are prime farmland | >80 | 18-36 | Moderately well drained | 5 | C |
| BsF | Bath very stony loam, 30 to 60 percent slopes | Mountains | Not prime farmland | 21-38 | 21-36 | Well drained | 0 | C |
| LgF | Lackawanna very stony silt loam, 30 to 50 percent slopes, very stony | Hills, mountains | Not prime farmland | 17-36 | 16-36 | Well drained | 0 | C |
| MgD | Mardin channery silt loam, 8 to 25 percent slopes, very stony | Mountains, hills | Not prime farmland | 14-26 | 13-24 | Moderately well drained | 0 | D |
| Mn | Mixed alluvial land | Flood-plain steps | Not prime farmland | >80 | 12-60 | Moderately well drained | 20 | C |
| OyF | Oquaga and Lordstown extremely stony loams, 25 to 70 percent slopes | Hillslopes | Not prime farmland | 20-40 | >80 | Well drained | 0 | C |
| VsB | Volusia channery silt loam, 0 to 8 percent slopes, extremely stony | Hills, mountains | Not prime farmland | 10-22 | 6-18 | Somewhat poorly drained | 5 | D |
| Wy | Wyalusing silt loam | Flood plains | Not prime farmland | >80 | 0-6 | Poorly drained | 100 | A/D |
| Bh | Basher silt loam | Flood plains | All areas are prime farmland | >80 | 18-24 | Moderately well drained | 5 | B/D |
| WoD | Wellsboro channery loam, 8 to 25 percent slopes, rubbly | Hills, mountains | Not prime farmland | 14-30 | 13-24 | Moderately well drained | 0 | D |

Notes:

1. Soils data obtained from the following: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed (July 21, 2017).
2. This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit

## 6.4 Baseline Evaluations

FPR conducted hydrologic, geomorphic, and habitat evaluations at the Bank Site to gain an understanding of the current state of the existing resources onsite. A summary table of the baseline evaluations performed and whether it is meeting project specific goals is provided in Appendix D: Baseline Data. All data was collected in the summer of 2015.

A combination of degradation indices and biological indices were employed to measure the overall degradation and physical impairment at three (Main Stem: S-1, Stream 13: S-2, and Stream 14: S-3) baseline monitoring locations (Appendix A: Figures, Figure 10: Baseline Monitoring Location Map). Following a data-driven restoration approach, results of the degradation indices were used to guide the overall restoration approach for the Bank Site.

As shown in the Baseline and Performance Summary table provided in Appendix D: Baseline Data, baseline evaluations are either not being met or are only being partially met for all of the monitoring locations (all of which are proposed for relocation). As shown in the baseline and performance summary sheet, only the functional goal for hydrologic interaction is being partially met. At each monitoring location, wetlands can be found within the floodplain. However, the wetlands within the floodplains have been historically influenced by agricultural impacts and contain a high percentage of invasive species. Because of this, the functional goal of wetlands in the floodplain is categorized as "Partially Met."

## 6.5 Physical and Morphological Conditions

## 6.6 BEHI

FPR utilized the Bank Erosion Hazard Index (BEHI) procedure to determine stream bank erosion conditions and potentials within the Bank Site. The BEHI procedure assigns point values to several aspects of bank condition and provides an overall score that can be used to inventory stream bank conditions and prioritize eroding banks for restorative action.

The BEHI assessments were completed at each of the three baseline monitoring locations within the Bank Site (Appendix A: Figures, Figure 10: Baseline Monitoring Location Map). Preliminary results of the BEHI calculations indicate an average BEHI rating across the Project Site to be 'Moderate', meaning the bank conditions show moderate erosive potential. It should be noted that these results are higher due to the armoring which has artificially stabilized the banks and to the extensive stands of invasive species which have developed along the corridor. The channel geometry is not natural and is not indicative of a stable and naturally resilient stream.

## 6.7 LWD

Large-woody debris (LWD) indices were also collected at each of the four baseline monitoring locations. Hedman et al. (1996) studied in-stream LWD loading for various riparian forest serai stages in the southern Appalachian Mountains. The results that generated from this study were used to compare LWD loading at the Bank Site to assess the degree of impairment at the selected baseline monitoring locations. Hedman et al. (1996) defined LWD as woody debris greater than

1.5 meters in length and greater than or equal to 10 centimeters (cm) in diameter. For accurate comparison, the previous definition was used for the assessment of LWD loading at the Bank Site. Channel widths were collected to calculate the approximate area of the channel. The collected LWD data and channel dimensions were then used to calculate the approximate LWD volume per channel area. Results show that LWD was absent at both S-2 and S-3, while amounts were negligible at S-1. The lack of LWD presence negatively affects the vertical and horizontal stability, bed stability, habitat availability, and carbon retention for fish and macroinvertebrate habitat within the stream system.

### 6.8 Habitat Pebble Counts

Reach bed substrate composition (Habitat or Reach Pebble Counts) was evaluated using a Wolman Pebble Count sampling scheme: collecting 100 pebbles from the wetted parameter of 100-meter sampling reaches. Data collected from the performed pebble counts were analyzed via cumulative frequency distributions, bed particle type distributions, and grain size analysis.

Habitat pebble count analyses show that S-1 is largely gravel dominated (63%). However, S-2 has very little gravel, and it dominated by silt/clay (84%). S-3 has a more evenly distributed pebble size from silt/clay (35%) to sand (21%) to gravel (41%). These higher levels of silt/clay are contributing to the system's larger degree of impairment. Summary data is located in Appendix D.

### 6.9 Biological Indices

### 6.10 Fish Community Survey

Semi-quantitative fish surveys were conducted at the three designated sampling stations on 07/23/2015. Fish were collected using a backpack electrofishing unit and team of dip-netters. Semi-quantitative sampling efforts followed protocols established in *Wadeable Semi-Quantitative Fish Sampling Protocol for Streams* (PADEP, December 2013). Individuals were identified to the species level in the field and released upon proper identification. The collected data was utilized to calculate appropriate biological metrics, which included: Species Richness, Percent Piscivore, Percent Herbivore, Percent Omnivore, Percent Insectivore, Percent Generalist, Percent Invertivore, Percent Filter Feeder, Percent Intolerant, Percent Intermediate, Percent Tolerant, Shannon's Diversity Index, and Shannon's Evenness Index.

Electrofishing efforts yielded a total of 363 individuals and 12 species. *Semotilus atromaculatus* (Creek Chub), *Rhinichthys atratulus* (Blacknose Dace), *Salvelinus fontinalis* (Brook Trout), and *Luxilus cornutus* (Common Shiner) were the dominate species caught at the proposed mitigation site. Other species caught included: *Cottus bairdi* (Mottled Sculpin), *Etheostoma nigrum* (Johnny Dater) Exoglossum maxillingua (Cutlips Minnow), *Rhinichthys cataractae* (Longnose Dace), *Ameiurus natalis* (Yellow Bullhead), *Catostomus commersoni* (White Sucker), *Lepomis gibbosus* (Pumpkinseed) and *Notemigonus crysoleucas* (Golden Shiner).

S-1 and S-2 sampling locations exhibited higher Shannon's Diversity and Evenness Index values. However, these sampling locations were dominated by generalist and pollution tolerant species. Shannon's Diversity and Evenness Index values were poor at the S-3 sampling location but dominated by 100 % intolerant species. Appendix D provides a detailed list of fish survey results and biotic index values.

## 6.11 Benthic Macroinvertebrate Sampling

Macroinvertebrate samples were collected on 07/24/2015 from three initial baseline sampling locations within the proposed Project's limits. Semi-quantitative macroinvertebrate samples were collected using D-Framed Kick Net Sampling Approach, compositing multiple kick samples form representative habitats throughout a 100-meter reach at each of the respective sampling locations. Protocols established by PADEP's *Bureau of Point and Non-Point Source Management* were used as guidelines for the macroinvertebrate sampling process. Samples were collected on November 17, 2016. All of the macroinvertebrates (200 Individuals +/- 20%) in each of the collected composited samples were identified to the taxonomic rank of family.

Taxonomic level deviations were adopted for monitoring. Three key factors influenced the adoption of the proposed deviations, which include: (1) analytical ability, (2) scientific uncertainty, accuracy, or discrimination, and (3) project efficiency or scale.

Genus and finer level taxonomic classifications can provide additional information for the investigation of fine ecological gradients. However, research conducted by Waite et al., (2004) suggest both family and genus level identification exhibit most of the same correlations to environmental variables, basic distinction between sites, and identify the same relationships to most environmental gradients (Waite et al., 2004). In the same study, Waite et al., (2004) shows family and genus level data generated results that were similar in their ability to distinguish coarse impacts (severe versus non-severe) and most of the same subtler differences (moderate versus high or low impacts). The observed differences in significance levels between family and genus were minor (Waite et al., 2004).

Furthermore, research also suggests that coarser level of taxonomic identification reduces the probability of discriminatory information, inaccurate datasets, and scientific uncertainty (Diagram 4) (Jones, 2008).

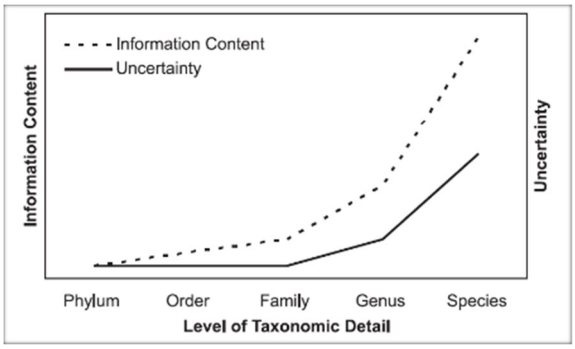


**Diagram 4: Taxonomic resolution comparison to scientific uncertainty and informational context (Jones, 2008).**

Furthermore, the ability to identify macroinvertebrates is reduced at finer taxonomic levels. Table 5 shows a detailed comparison on taxonomic sufficiency from family to finer taxonomic levels using a weighted average analysis.

**Table 5: Taxonomic Sufficiency. Percent of specimens (%) and number of taxa (N) identified to family, genus, and species by macroinvertebrate group (Jones, 2008).**

| | | Family | | Genus | | Species | |
|---|---|---|---|---|---|---|---|
| Group | Total specimens | % | N | % | N | % | N |
| Ephemeroptera | 33886 | 98 | 14 | 77 | 32 | 25 | 57 |
| Plecoptera | 19144 | 98 | 9 | 85 | 38 | 1 | 14 |
| Trichoptera | 9380 | 99 | 18 | 90 | 50 | 17 | 24 |
| Diptera | 48171 | 100 | 18 | 83 | 172 | 29 | 144 |
| Other insects | 11013 | 100 | 29 | 95 | 61 | 38 | 34 |
| Non-insects | 8874 | 97 | 30 | 76 | 60 | 43 | 65 |
| Total | 130468 | 99[a] | 118 | 83[a] | 413 | 25[a] | 338 |

[a]Weighted average.

Similar trends are revealed when analyzing data accuracy, discrimination, and discrimination efficiency (Tables 5 and 6).

**Table 6: Taxonomic Accuracy and Discrimination Estimates. Accuracy is the proportion of taxa that were correctly identified, and discrimination is the proportion of taxa in the dataset that were identified to the taxonomic level specified by a given taxonomic treatment (Jones, 2008).**

| Level of taxonomic aggregation | Accuracy (%) | Discrimination (%) |
|---|---|---|
| Species | 91 | 50 |
| Genus | 95 | 86 |
| Family | 99 | 98 |
| EPT species | 96 | 62 |

**Table 7: Taxonomic-scale Effects on Metric-specific Discrimination-efficiencies. The proportion of sites for which a given combination of metric and taxonomic level distinguished impacted and non-impacted sites (Jones, 2008).**

| | Discrimination efficiency | | |
|---|---|---|---|
| Metric | Species | Genus | Family |
| Richness | 83 | 100 | 100 |
| EPT richness | 92 | 92 | 100 |
| % Oligochaeta and Diptera | 92 | 92 | 42 |
| % Gathering collectors | 100 | 92 | 92 |
| EPT and Oligochaeta Richness | 58 | 58 | 42 |
| Shannon diversity | 83 | 67 | 83 |
| Margalef diversity | 75 | 75 | 92 |
| % Rheophilic[a] | 83 | 67 | 92 |
| % Hypocrenal[b] | 92 | 83 | 92 |

[a]Current-loving.
[b]Preferring spring-brook habitats.

Lastly, project efficiency and scale were considered for benthic macroinvertebrate monitoring. Effectiveness in identifying organisms to the genus level is approximately seven times greater than identifying organisms to family (Diagram 4) (Jones, 2008). This can result from problematic macroinvertebrate taxa, size classes, and various life stages.

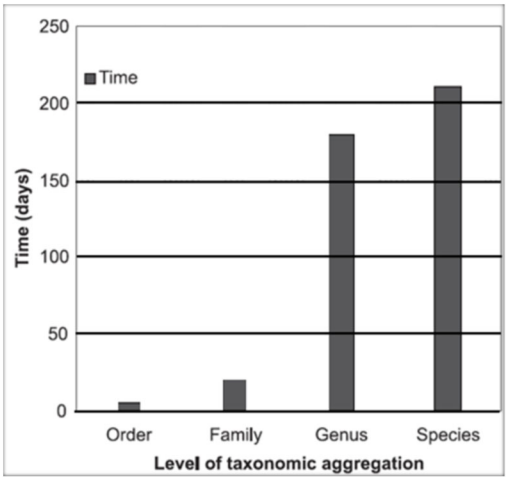


**Diagram 5: Benthos identification time for 29 samples in Australian lowland-river (Modified from Jones, 2008).**

In summary, the proposed taxonomic level deviation was adopted for the purpose of capturing differences in typical environmental gradients that were intended to be adequately monitored as the resource progresses, while also reducing scientific uncertainty and discrimination and increasing accuracy and project efficiency.

Based on the findings of Waite et al., (2004), in which similar analytic abilities could be generated from family level analysis when compared to genus level analysis, adequately distinguishing between coarse impacts and subtler differences. In addition, these samples are one of several baseline criteria used in the development of the sites restoration plan, and are not the sole determinant of the cause of degradation within the different reaches on-site. As such, FPR determined identification and sampling processes for the proposed PRM Site appropriate.

The resulting family level taxonomic data was used to calculate the modified index of biotic integrity (IBI) and aquatic life use attainment benchmarks, derived from the following metrics: Taxa Richness, EPT Richness (PTV 0-4), Beck's Biotic Index Version 3, Hilsenhoff Biotic Index, Shannon's Diversity Index, Percent Sensitive Individuals (PTV 0-3), BCG 123/BCG 456 Taxa, BCG 123/BCG 456 Individuals, Mayfly Taxa, and Mayfly Percent. Macroinvertebrate results for each monitoring location are provided in Appendix D: Baseline Data, Benthic Macroinvertebrate Survey Data.

Table 8: Summary of Macroinvertebrate Sampling Results is provided below. IBI metrics failed to reach the designated aquatic life use attainment benchmark at all sampling locations. Low IBI scores can be attributed to higher quantities of pollution tolerant taxa.

**Table 8: Summary of Macroinvertebrate Sampling Results**

| Monitoring Locations | IBI Score | Attaining/Non-Attaining |
|---|---|---|
| Main Stem (S-1) | 41.83 | Impaired |
| Stream 13 (S-2) | 25.88 | Impaired |
| Stream 14 (S-3) | 13.63 | Impaired |

## 6.12 Upland Assessment

Upland resources vary in ecological quality from forested areas with nearly 100% tree canopy closure to sparsely forested hillsides and floodplains, dominated by multiflora rose (*Rosa*

*multiflora*), reed canary grass (*Phalaris arundinacea*), purple milkweed (*Asclepias purpurascens*) or various Eurasian pasture grasses (Appendix D: Representative Site Photographs). Some portions of upland areas fall within floodplain areas that were likely wetlands prior to European settlement. This is supported by the presence of partially hydric soils and gravel layers found within these floodplains (Appendix A: Figure 7: Soils Map; Appendix D: Baseline Data).

Along the Starrucca Creek Main Stem and the perennial tributaries, a large portion of the uplands are open fields used for agricultural or recreational activities. Agricultural fields surrounding and partially within the Project area that were farmed at the turn of the century continue to be used to produce corn and soybeans, and livestock grazing.

### 6.13 Threatened and Endangered Species

A PA Natural Diversity Index Environmental Review (PNDI) was completed on January 14, 2019. PNDI records indicate that there are no known impacts to threatened and endangered and/or special concern species and resources within the PRM Site. Therefore, no further coordination is required with the jurisdictional agencies including the of the PA Game Commission (PGC), the PA Department of Conservation and Natural Resources (PADCNR), PA Fish and Boat Commission (PFBC) and the U.S. Fish and Wildlife Service (USFWS). A copy of the draft PNDI receipt is provided as part of Appendix G: Jurisdictional Agency Coordination.

### 6.14 Cultural Resources

Circa-Cultural Resources Management, LLC, (Circa~) completed a Phase I cultural resources survey to determine whether any potential cultural, historical, or archaeological resources may be present within the Bank Site. The Phase I shovel testing did not locate any archaeological resources or surface deposits of artifacts within the Bank Site. No architectural resources were identified within the Bank Site. Circa~ recommended that no further work be required for the stream and wetland mitigation areas. There should also be no effect to any viewsheds as the Bank Site is limited to restoration.

FPR initiated consultation with the PA Historical Museum Commission (PHMC) Bureau of Historic Preservation (BHP) to determine the potential presence of historic and archaeological resources within the Project site on December 11, 2018 (Appendix G: Jurisdictional Agency Coordination). Additional information was requested by PHMC on December 27, 2018 and submitted online through the PA ARCGIS website in January 2019. A clearance letter stating that the project will have no effect on significant cultural resources was received on April 3, 2019.

## 7.0 Determination of Stream and Wetland Credits

The crediting totals based upon the USACE-sponsored Ratio Model are included in Table 9: USACE Ratio-Based Crediting Summary Table. Please reference the Resource Development Map ("RDM") for a visual perspective of stream and wetland restoration approaches proposed across the Bank Site (Appendix A: Figures: Figure 9: Resource Development Map.

Separate calculations based on the proposed PADEP Aquatic Resource Compensation Protocol and Riverine/Wetland Rapid Assessments (Compensation Protocol) were also completed. The results of these calculations are provided in Appendix D: Baseline Data.

Impact calculations are provided in Table 10: Impact Summary. Locations of the anticipated impacts are shown in Figure 12: Impact Location Map (Appendix A: Figures).

The following section provides a description of the physical work proposed to deliver functional gain.

| Table 9: USACE Ratio-Based Crediting Summary Table | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Resource Type** | **Restoration Type** | **Classification** | **Mitigation Ratio** | | **Proposed Value** | **Proposed Value Total** | **Generated Credits** | **Generated Credits Total** | **Units** |
| **Streams** | Relocation | Perennial | 1.0 | :1 | 10,386.05 | 10,693.05 | 10,386.05 | 10,693.05 | Linear Foot |
| | | Intermittent | | | 307.00 | | 307.00 | | |
| | | Ephemeral | | | - | | - | | |
| | Rehabilitation | Perennial | 1.5 | :1 | 5,626.15 | 5,626.15 | 3,750.77 | 3,750.77 | |
| | | Intermittent | | | - | | - | | |
| | | Ephemeral | | | - | | - | | |
| | Preservation | Perennial | N/A | | 1,643.24 | 2,518.31 | - | - | |
| | | Intermittent | | | 848.63 | | - | | |
| | | Ephemeral | | | 26.44 | | - | | |
| | **Grand Totals** | | | | **18,837.51** | **18,837.51** | **14,443.82** | **14,443.82** | |
| **Wetlands** | Reestablishment | *PEM | 1.0 | :1 | 19.94 | 22.54 | 19.94 | 22.54 | Acres |
| | | *PSS | | | - | | - | | |
| | | *PFO | | | 2.60 | | 2.60 | | |
| | Rehabilitation | *PEM | 1.5 | :1 | 32.91 | 33.93 | 21.94 | 22.62 | |
| | | *PSS | | | - | | - | | |
| | | *PFO | | | 1.02 | | 0.68 | | |
| | Enhancement | *PEM | 2.5 | :1 | 2.38 | 4.18 | 0.95 | 1.67 | |
| | | *PSS | | | 1.7 | | 0.68 | | |
| | | *PFO | | | 0.1 | | 0.04 | | |
| | **Grand Totals** | | | | **60.65** | **60.65** | **46.83** | **46.83** | |

* As detailed in Section 5.4., wetland cover types are not anticipated to be static due to natural evolutionary processes and constraints. However, a PEM cover type may be dominant based on the natural history of the system.

| Table 10: Impacts Summary | | | | |
|---|---|---|---|---|
| **Resource Type** | **Classification** | **Permanent Beneficial** | **Temporary** | **Unit** |
| Streams | Perennial | 9,037.29 | 5,747.11 | Linear Feet |
| | Intermittent | 106.21 | - | |
| | Ephemeral | - | - | |
| | Ditches | 5,273.29 | - | |
| | **Total** | **14,416.79** | **5,747.11** | |
| Wetlands | PEM | 1.26 | 31.89 | Acres |
| | PSS | 0.06 | 2.57 | |
| | PFO | - | - | |
| | **Total** | **1.32** | **34.46** | |

# 8.0 Mitigation Work Plan

The Project utilizes a floodplain restoration approach to optimize the functional uplift to the existing on-site resources. The Project proposes to re-establish an integrated stream and wetland complex which restores localized groundwater aquifers and reconnects floodplains to the water table and streams. This approach optimizes and diversifies habitat and creates a hydrologic system that allows for the retention of nutrients, stream bed material, and organic carbon. This design approach will provide the basis for the continued evolution of ecological complexity and long-term stability at the Project. In accordance with the PSUMBI, the Design Plan for the Bank Site is attached as Appendix H: Design Plans.

## 8.1 Determination of Restoration Designations & Approaches

Best professional judgment, experience, and data driven decision-making were used for determining restoration approaches across the Bank Site. All streams were assigned a restoration approach based upon the degree of impairment and following the decision tree listed below. Table 11: Stream Restoration Approach by Monitoring Location summarizes the results of the data driven decision-making process in relation to the restoration designation for data-sampled reaches within the Bank Site.

**Diagram 6: Project Decision Tree**

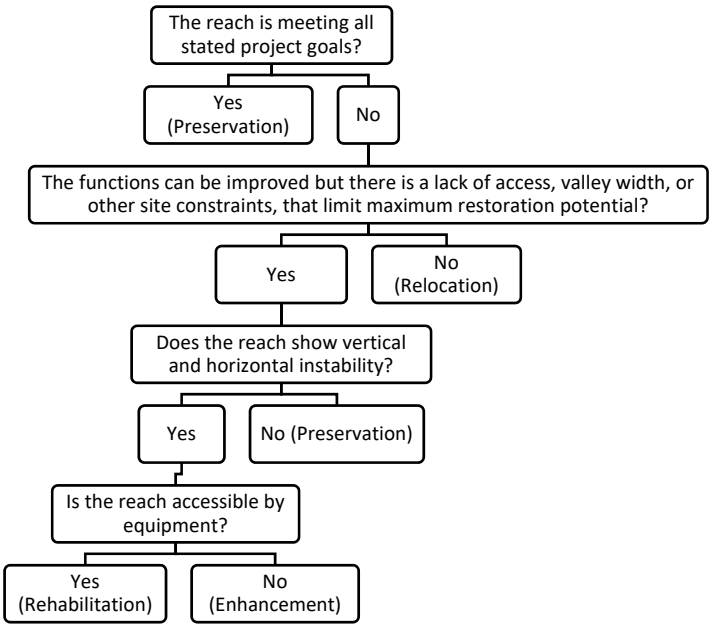


**Table 11: Stream Restoration Approach by Monitoring Location**

| Baseline Monitoring Location | Proposed Restoration Approach |
|---|---|
| Main Stem (S-1) | Relocation |
| Stream 13 (S-2) | Relocation |
| Stream 14 (S-3) | Relocation |

## 8.2 Stream Restoration Approach

Restoration activities will focus on a floodplain restoration approach using a combination of channel relocation and floodplain grading. The restoration of the channel pattern and floodplain will promote the spread of high flow events through the reconnected floodplain and dissipate high kinetic energy. These efforts will improve hydrologic connectivity, water storage capacity, and biogeochemical cycling through the restoration of the hyporheic zone. Because the valley is underlain by a thick glaciated cobble layer the installation of grade control structures is not warranted as this cobble layer will service as natural grade control which is further enhanced by reducing channel shear stress that will be accomplished through the restoration of the channel pattern and floodplain. In addition to floodplain restoration efforts, a channel block will be installed at the upstream end of the Project where Starrucca Creek is channelized along Starrucca Creek Road. The channel block will service restoration efforts by directing the flow of water through the historic anastomosing channel of Starrucca Creek in this portion of the Project, which will require minimum disturbance but maximize functional benefits and restore the stream to a historic and natural condition. The extent of stream restoration efforts and restoration types is displayed in Figure 9: Resource Development Map (Attachment A: Figures).

The goal of the restoration approach is to enable the stream corridor to recover to a functioning and self-sustaining system. The proposed floodplain restoration technique is designed to restore the stream at or near its original elevation by removing the accumulated sediment that sits atop the historic floodplain layer. In different locations at the Bank Site, the floodplains will be cut down to reduce shear stresses while keeping the stream near the gravel layers throughout valley bottom, which will improve hyporheic zone exchange, recharge the floodplain gravel aquifer, and enhance base flow conditions. In other areas, the floodplain design will raise the streambed up to an elevation where field indicators show the valley floodplain was historically at, or to keep an overall stable profile while transitioning across the Project. These restoration activities will result in a system characterized by a stable channel with low shear stresses under normal and frequent storm events with a high degree of stream and floodplain interaction.

The purpose of the proposed design is to keep shear stresses within the floodplain below 2.5 pounds per square foot (lbs/sf) during 100-year RI events, and shear stresses within the channel below 1.5 lbs/sf during 100-year RI events. These target parameters are based off stability criteria as presented in the peer-reviewed published article *Stability Thresholds for Stream Restoration Materials* (Fischenich, 2001). Designing to these parameters optimizes the stability of the epifaunal substrate within the stream and the long-term stability of the floodplain. In the future, ruts may form within the floodplain during high magnitude storm events, and secondary channels may even form within the floodplain from these events and/or beaver activity, however these evolutions are not anticipated to threaten the stability or functional value of the restored system, but rather, increase the ecological complexity and functional values offered at the Bank Site.

Harvested on-site woody material will be used to create stream habitat elements and surface features. Live-stake plantings will occur along the outside bends of stream banks within relocation and rehabilitation reaches.

In summary, the relocation design approach will improve channel stability and increase floodplain connection and continuity. The design will promote the stabilization of bed sediment and provide habitat for aquatic communities. In addition, restoration efforts will enhance LWD and fine carbon retention, providing additional food sources and unique niches that will promote the further enhancement of aquatic biological communities. The restoration of stream habitat and floodplain diversity will also provide new habitat for amphibians and terrestrial organisms and aid in the

reestablishment of historic wetland plant communities. Furthermore, floodplain restoration efforts will improve hydrologic connectivity, water storage capacity, and biogeochemical cycling through the reestablishment of the hyporheic zone.

## 8.3 Wetland Restoration Approach

Wetland restoration efforts will focus on improving and/or reestablishing hydrologic, biogeochemical, and habitat diversity ecosystem services through the associated stream/floodplain restoration efforts described above. The restoration of stream and floodplain connectivity will result in the reestablishment of a dynamic stream and wetland complex that maximizes groundwater recharge and capture, habitat diversity, carbon and nitrogen cycling, and long-term system stability.

Primary wetland re-establishment will be accomplished through the re-establishment of the stream and floodplain connection. The topography of the re-established wetlands at the site will be variable with pockets of emergent, shrub-scrub and forested sections. Over time the wetlands will form a mosaic of vegetative classifications. The habitat heterogeneity will result in increased biological diversity and habitat within the Project. By grading the floodplain to the restored gravel aquifer, water will be within 12 inches of the new floodplain surface for most of the growing season, ensuring adequate hydrology. In addition, the re-meandering the stream through the restored wetland/floodplain areas will promote stream/floodplain exchange and recharge gravel aquifers that drive floodplain wetland hydrology.

Rehabilitation wetlands will be restored through intensive grading associated with the proposed floodplain restoration efforts and inherent improvements to existing hydrology tied to those efforts. Wetland acreage surrounding these wetlands will increase, as wetland re-establishment occurs in adjacent areas. Restoration efforts will significantly improve hydrology/biogeochemistry, creating a larger well-functioning wetland floodplain complex. This will provide ecological and hydrological benefits, resulting in habitat benefits for both aquatic and terrestrial species, as well as increased storm water retention and gravel aquifer recharge.

Wetland enhancement will be accomplished through vegetative maintenance - primarily controlling invasive species, including reed canary grass (*Phalaris arundinacea*), Japanese knotweed (*Fallopia japonica*), multiflora rose (*Rosa multiflora*), Eurasian pasture grasses, thistles (*Cirsium* spp.), and teasel (*Dipsacus* sp.), by re-establishing native diversity through planting and/or seeding.

All wetland restoration efforts will incorporate the planting and/or seeding of native woody and herbaceous species. However, planting efforts will occur within zones outside of a 50-meter set back to prevent beaver damage, as published data has revealed that 95% of woody plants cut by beavers occur within 50 meters (~164 feet) of the water's edge (Stoffyn-Egli and Willison, 2011). Approximately 60.65 acres of wetlands will be seeded, and 3.72 acres of wetlands will be planted.

The extent of wetland restoration efforts and restoration types is displayed in Figure 9: Resource Development Map (Attachment A: Figures).

## 8.4 Upland Restoration Approach

The upland areas are currently a mix of agricultural/field edge areas and mature non-harvested areas. The upland restoration sequence will vary slightly for each area.

Upland forests in a healthy mid-successional forested state will be immediately preserved, allowing them to mature into high quality upland resources, providing important habitat for terrestrial/avian species while also supporting aquatic resource functions. The remaining portion of the uplands will undergo grassland to forested conversion or forest restoration.

Upland restoration areas are located along the edge of proposed floodplain grading corridors and/or as existing pasture. Soil excavated from the valley bottom during the floodplain restoration will be returned to the valley side slopes. Existing trees falling within proposed grading extents will be harvested and re-used for habitat structures and surface features. These areas will be seeded and/or replanted. Selected trees may be left standing but girdled and buried around the base to create standing snags, increasing the immediate post restoration habitat diversity and vertical heterogeneity within the restored uplands. Seeding these restored valley side slopes with native prairie grasses will increase groundwater infiltration during storm events over the existing pasture habitat, create high quality grassland habitat, and provide valuable wildlife habitat for early successional species like the golden winged warbler (*Vermivora chrysoptera*) while the planted/volunteer tree species mature. Areas currently existing as agricultural fields will receive both invasive species control, upland herbaceous seeding, and/or woody plantings. Again, plantings will occur within zones outside of a 50-meter set back to prevent beaver damage.

Proposed upland restoration efforts based on proposed conditions are summarized in Table 12: Upland Restoration Activities. The table details restoration types, amounts, and proposed activities.

**Table 12: Upland Restoration Activities**

| Restoration Type | Acres | Activities |
|---|---|---|
| Preservation | 28.82 | None |
| Restoration | 11.87 | Seeding (11.87 acres), planting (4.12 acres), and invasive control |
| **Total:** | 40.69 | |

# 9.0 Maintenance Plan

## 9.1 Extensive Management

The Bank Sponsor agrees to perform all necessary maintenance to ensure the continued viability of Project once initial construction is complete. The need to perform maintenance will be assessed in the monitoring reports and during monitoring site visits. If deemed necessary by the Bank Sponsor or the IRT, the appropriate required maintenance will be conducted. Areas reserved for wetland and stream preservation will not be impacted directly or indirectly by any of the proposed work on other portions of the Project.

Invasive species management is a key component of the Maintenance Plan. Given that the Sponsor is attempting to restore damaged lands and waterways to a state of high ecological integrity, it is in the interest of the Sponsor to minimize negative impacts resulting from the control of invasive species. As such, a mixture of extensive and intensive management practices will be followed, with manual, species-specific treatments being preferred if and where possible. The maintenance methodology depends on the state of degradation and invasion within a given area of the Bank Site, as well as on the phenology, vegetative group, reproductive technique, and life span of the plant species to be controlled.

## 9.2 Intensive Management

Within the heavily degraded areas, following the development phase of the Project, intensive maintenance will occur during the first three years of establishment. This maintenance will involve a combination of species-specific manual, mechanical and chemical control to support the establishment of a diverse herbaceous native plant community while controlling invasive species on-site.

Mechanical control will involve timed mowing, trimming, or cutting of invasive or undesirable species, such as European forage graminoids, to prevent these species from setting seed and to allow light filtration for developing herbaceous material, trees, and shrubs. In addition, supplemental manual plantings and mechanical seedings of native species may be used to reduce the competitive dominance of specific invasive species.

Chemical control using an aquatic approved herbicide will be utilized to control aggressive invasive species (Table 13: Invasive Species Management Timeline). Minimizing broadcast spraying is a priority. If broadcast spraying becomes a necessity on-site, pre-emergent spraying will be preferred to minimize the amount of herbicide used. If pre-emergent spraying is not available for a particular target species, then timed spraying will be utilized to maximize impact on the species in question. Supplemental seedings or plantings will be done with native species following the spraying if there are any native species impacted by the spraying.

**Table 13: Invasive Species Management Timeline**

| Year | Season | Mechanical | Chemical |
|---|---|---|---|
| **Years 1 and 2** | Winter | Cut and paint stump control on woody invasive material | |
| | Spring | Late spring mowing | Early season weed control |
| | Summer | Early summer mowing/trimming as needed | |
| | Fall | Late fall mowing, if needed | Late-season weed control |
| **Year 3** | Winter | Cut and paint stump control on woody invasive material, if needed | |
| | Spring | Spot mowing or trimming, if needed | Early season weed control |
| | Summer | Trimming, if needed | |
| | Fall | Spot mowing or trimming, if needed | Late-season weed control |
| **Year 4** | Winter | | |
| | Spring | | Early season weed control |
| | Summer | | |
| | Fall | | Late-season weed control |
| **Year 5+** | Winter | Species-specific maintenance conducted on an as-needed basis | |
| | Spring | | |
| | Summer | | |
| | Fall | | |

In areas of stream relocation, grading activities will provide a head start on invasive weed control, as the actual plants themselves, and their root systems will be excavated and placed on the bottom of the soil stockpile locations to stop them from re-sprouting. This will also bury most of the invasive species seed bank. There is little to no risk of reducing the native seed bank, since almost all these areas are highly degraded and do not have a high quality native plant community. Additionally, past project experience has shown that there is often a high quality native seed bank

within the gravel layer of the Project, which is accessed during construction, and assists in native species re-establishment in the restored stream and floodplain locations.

Maintenance events based on the schedule above will be started immediately following the completion of construction. The time of year that construction is completed will determine at what point in the schedule the maintenance activities begin.

As these are dynamic systems, maintenance activities will be modified as needed on an annual basis to best suit the Bank Site's needs. Yearly maintenance activities and proposed activities for future years are discussed in yearly monitoring reports. If properly maintained and managed, maintenance requirements are expected to drastically drop off between years five and seven, mainly requiring one to two events a year that are highly targeted to specific areas and/or specific species. Upon Bank Closure, all of the terms and conditions set forth in the Long-Term Management and Maintenance Plan, described in Section 12.0 of this document, will take effect.

# 10.0 Performance Standards

In accordance with both standards developed in PSUMBI and commentary from the IRT, the performance standards for the Bank Site have been developed with consideration to site-specific features of the Bank Site and are outlined in Table 14: Performance Standards and Percent Credit Release by Stage. The proposed performance standards follow guidance received from the CELRP and take into consideration the design approaches proposed and level of work, type of resource and key indicators of functions or features desired. Of note, LWD performance standards were included to address the retention of organic debris, and a pebble distribution change performance standard was added to address and ensure limited bedload transport.

Achievable performance standards were selected based upon the natural history and evolutionary processes that have been documented to occur within systems like the Starrucca Creek Watershed as elaborated in Section 5.4 Background Research and Natural History. Given the documented sequence of succession in these systems, the proposed stream/wetland areas are anticipated to be dynamic and evolving, with the understanding that the system may not follow the successional trajectory of a traditional mitigation.

Wetland areas will likely exhibit a mosaic of cover classes that will continue to change. This will increase habitat diversity and improve biogeochemical functions without the expectation of a significant forested component in the near future. This is supported by various studies of planting efforts within mitigation sites that emphasized that establishing late successional woody species before environmental site conditions have matured which often results in high mortality and ultimately leads to the natural replacement early successional species (Matthews et al. 2009b; DeBerry and Perry 2015; Deberry 2015). As such, wetland performance standards that limit the Project to a strictly PFO trajectory were not selected for this Project based on the rational described above and in Section 5.4 Background Research and Natural History.

As in wetland areas, stream channels may evolve into dynamic but stable multi-threaded braided reaches that increase habitat diversity, complexity, and quality. Again, performance standards that restrict channel evolution by a set amount of vertical or lateral migration were not selected for this Project based on the rational elaborated in Section 5.4 Background Research and Natural History.

## 10.1 Credit Release Schedule

As shown in Table 14: Performance Standards and Percent Credit Release by Stage, five credit release stages are proposed as part of the credit release schedule for the Bank Site. In general,

credit releases are tied to achievement of performance standards. A description of each stage and the effect of monitoring results on mitigation credit releases are provided in this section.

The Administrative credit release stage represents the first 15 percent of the bank's total mitigation credits that are released and available for sale upon the following: approval of the final MSP, implementation of the financial assurances, and recordation of the SPI. These three items must be completed before any credits can be released during this stage.

The Construction credit release stage represents 15 percent of the bank's remaining total mitigation credits that can be made available for sale upon the following: completion of Bank Site construction, which includes the initial physical and biological improvements to the Bank Site pursuant to the MSP, and approval of the as-built plans that reflect the final grading and planting of the Bank Site.

The remaining 70 percent of the Bank Site's mitigation credits are tied directly to performance-based milestones. Performance standards are measurable criteria for assessment achievement of the Banks's goals and objectives. The performance standards for the Bank Site are detailed in Table 14: Performance Standards and Percent Credit Release by Stage.

The release of mitigation credits, as authorized by the USACE, occurs throughout the establishment and maintenance and monitoring period of the Bank, which typically lasts between 7 and 10 years, and as the suite of performance standards for each credit release stage is met. Once a stage's performance standards are met, the Sponsor will submit a monitoring report documenting achievement of the performance standards in addition to a credit release request letter requesting release of that stage's percentage of credits to the USACE. For example, there are four stream performance standards and five wetland performance standards that must be met in Stage 1 before 35 percent of the Bank's stream mitigation credits and 25 percent of the Bank's wetland mitigation credits can be released. Once the credits are released for Stage 1, the Bank then progresses to achieving performance standards in Stage 2.

During the maintenance and monitoring phase of the Bank Site life cycle, if for any reason the performance standards are not achieved in any given monitoring year, FPR may fall back to the Tiered level of monitoring and reporting as described in Exhibit B: Monitoring Plan of the PSUMBI.

The process to be used to review and approve any reduction in the financial assurances, including payments for expenditures is generally as follows:

1) Determine if the Bank Site is meeting performance standards.
    a) If yes, request approval for bond reduction with annual monitoring report submittal/credit release request letter.
    b) If not all performance standards are attained, FPR may still request a bond reduction, understanding that a reduction must be approved by the IRT/USACE.

Along with the annual monitoring report submittals and credit release requests, FPR will provide a statement of deposit to show that funds have been deposited into the LTM endowment account. FPR understands that this documentation is required as part of the IRT/USACE credit release request approval. Section 14.0 provides additional details regarding the process for LTM financial assurances.

The results from the annual monitoring events determine whether the Bank Site has achieved the performance standards for the bank in a given credit release stage. The credit release stages are not tied to monitoring years. Please note that results of the monitoring, and therefore achievement of the vegetation-based performance standards, represent an aggregate for the

entire site. As such, some plots may not achieve all performance standards in each credit release stage. A performance standard may still be met, and credits awarded, if the average results for the vegetation-based performance criteria meet the performance standard. The applicable performance standards for this approach are indicated in Table 14. Performance Standards and Percent Credit Release by Stage. If the Bank Site is not meeting performance standards, the IRT/USACE may not grant entire credit release per the credit release schedule as described in Table 14: Performance Standards and Percent Credit Release by Stage. The Sponsor may also adjust credit release requests based on the percentage of the Bank Site that is meeting performance standards.

## 10.2 General Credit Release Process

General Process/Steps for Requesting and Releasing of Mitigation Credits:

1. The Bank Sponsor will submit the annual monitoring report containing documentation supporting achievement of performance standards for a given Stage. This submittal is accompanied with a letter requesting release of the credits for that stage, and a request for performance bond reduction, if appropriate.
2. Within 60 days of package receipt, the IRT should review the submittal. The IRT may request, schedule, and conduct a site inspection following review of the monitoring report. In lieu of a site visit and upon request, the Bank Sponsor can provide drone footage of the site.
    a. The Bank Sponsor acknowledges that additional review time may be needed should the USACE/PADEP/IRT determine that additional information or a site inspection is needed for monitoring report evaluation and credit release approval.
3. Based on the submittal and site inspection or review of drone footage (if conducted/provided) the co-chair will notify the Bank Sponsor via e-mail or letter whether the submittal is approved, or if additional information is needed.
4. If the submittal package is approved, the co-chair will respond with a letter authorizing release of the requested credits and bond reduction (if appropriate).
5. The Sponsor will update the credit ledger with the addition of the newly released credits and will submit the updated ledger to the IRT within 30 days.

The IRT/ USACE can delay credit release if insufficient information is reported or if the information does not accurately represent on-the-ground conditions. This delay in credit release can continue until FPR submits the requested information and the IRT/USACE approves of the revised documentation.

Based on the information provided in the performance standard documentation, the IRT/USACE can conduct a site inspection to confirm information or to answer any questions raised during their review. The co-chairs may schedule the Bank Site inspection after receipt and review of the performance standard documentation.

The Bank Sponsor reserves the right to request an adjustment to this credit release schedule in the future to promote consistency with RGL 19-01.

## 10.3 Credit Ledger

Credits and debits will be accounted for by way of a mitigation bank ledger (Appendix G: Bank Ledger) that is maintained by the Bank Sponsor. Following each approved credit transaction, an

updated copy of the bank's ledger will be submitted to the USACE. A project-specific transaction statement, or 'Affidavit of Credit Sale', which documents the that a permittee has secured the appropriate number and type of credits and establishes the legally enforceable transfer of compensatory mitigation responsibility from the permittee to the mitigation sponsor, will be provided to the IRT and USACE for each credit transaction. Any additional credit changes (additions and/or subtractions) affecting credit availability will eb provided to the IRT and USACE for review. The resulting mitigation credit availability will be updated in the USACE Regulatory In lieu fee and Bank Information Tracking System (RIBITS).

| Table 14: Performance Standards and Percent Credit Release by Stage | | | | | | |
|---|---|---|---|---|---|---|
| **Activity/ Monitoring Type** | **PADEP Classification** | **15% Administrative Credit Release Objectives** | **15% Construction Credit Release Objectives** | **Stage 1: 35% Credit Release Performance Standards (35% for Streams, 25% for Wetlands)** | **Stage 2: 25% Credit Release Performance Standards (25% for Streams, 25% for Wetlands)** | **Stage 3: 10% Credit Release Performance Standards (10% for Streams, 20% for Wetlands)** |
| **Streams** (Reestablishment, Rehabilitation) | RS1, HYD1, BGC1, HAB1 | - Approval of MSP<br>- Issuance of Corps Permit<br>- Implementation of Financial Assurances<br>- Recordation of Site Protection Instrument | - Completion of construction and As-Built approval | - BEHI of "Low" or "Very Low"<br>- Channel access to floodplain a minimum of twice during Stage 1<br>- No visual instability noted across site<br>- Increase in pre-construction large woody debris and/or visual accumulation of carbon/sediment | - BEHI of "Low", "Very Low", or "Moderate"<br>- D50 particle size remains in the same size class as previous Tier 2 or 3 monitoring<br>- Channel access to floodplain a minimum of twice during Stage 2<br>- No visual instability noted across site<br>- Increase in pre-construction large woody debris and/or visual accumulation of carbon/sediment | - BEHI of "Low", "Very Low", or "Moderate"<br>- D50 particle size remains in the same size class as previous Tier 2 or 3 monitoring<br>- Channel access to floodplain a minimum of twice during Stage 3 (for a cumulative of 6 total events across the 3 credit release stages)<br>- No visual instability noted across site<br>- Increase in pre-construction large woody debris and/or visual accumulation of carbon/sediment<br>- Increase in quality or quantity of macroinvertebrate and/or fish |
| **Wetlands** (Reestablishment, Rehabilitation, Enhancement) | HYD2, BGC2, HAB2 | - Approval of MSP<br>- Implementation of Financial Assurances<br>- Recordation of Site Protection Instrument | - Completion of construction and As-Built approval | - No more than 10% of total wetland area existing as unvegetated open water<br>- No more than 20% invasive species coverage, with no colony exceeding 5%<br>- Increase in habitat diversity and heterogeneity<br>- Native non-invasive plant coverage at least 60%<br>- Saturation of the upper 12 inches of the surface soil profile for at least 12.5% of the growing season and/or 12 consecutive days in reestablishment areas. | - No more than 10% of total wetland area existing as unvegetated open water<br>- No more than 15% invasive species coverage, with no colony exceeding 5%<br>- Increase in habitat diversity and heterogeneity<br>- Native non-invasive plant coverage should be at least 70%<br>- Species richness increase of at least 10%<br>- Saturation of the upper 12 inches of the surface soil profile for at least 12.5% of the growing season and/or 12 consecutive days in reestablishment areas. | - No more than 10% of total wetland area existing as unvegetated open water<br>- No more than 10% invasive species coverage, with no colony exceeding 5%<br>- Increase in habitat diversity and heterogeneity<br>- Native non-invasive plant coverage should be at least 85%<br>- Species richness increase at least 10%<br>- Saturation of the upper 12 inches of the surface soil profile for at least 12.5% of the growing season and/or 12 consecutive days in reestablishment areas. |
| **Upland[4]** | NA | NA | NA | - Less than 20% invasive species | - Less than 15% invasive species | - Less than 10% invasive species |

Notes:

- Credit release stages build upon the previous stage and are not directly linked to a set monitoring year. If the site reaches the necessary performance standards in a given year, a credit release can be requested. During a year where performance standards are not met, and no credit release is requested, FPR will follow the Tiered level of monitoring and reporting as described in Exhibit B: Monitoring Plan of the PSUBMI. In addition to Performance Standards, credit releases are also contingent on the incremental funding of the endowment account detailed in Table 17: Long Term Management Funding Deposits.
- Achievement of performance standards aimed at assessing vegetative development across the site will be determined based on the site-wide average of each vegetative parameter. As such, some individual plots may not achieve all vegetative performance standards in each stage but the performance standard can still be met, and credit awarded, if the average results meet the performance standard. The Bank Sponsor may request either a full or a partial credit release under these premises, recognizing that credit release requests must be approved by the IRT/USACE.
- Implementation of Financial Assurances includes: submittal the executed performance bond (to be fully executed by the USACE upon receipt), issuance of the Corps permit, proof of Declaration recordation at the appropriate county courthouse, and documentation that the Long-Term Management endowment account was established. Please note that the performance bond covers the full funding for the construction and maintenance and monitoring of the Bank Site.
- Refer to Section 5.4 Background Research and Natural History and Section 10. Performance Standards for explanation of rationale for proposed performance standards.
- Although upland areas within the Bank Site will be restored and protected, no credit is awarded or released for upland performance within the Bank Site. Evaluating the development of vegetation in the surrounding uplands provides valuable information about the trajectory and overall health of the Bank Site, and therefore will be assessed during the active and interim M&M phase(s).

# 11.0 Monitoring Requirements

FPR will monitor the Bank Site following the principles detailed in Section 6.5 Baseline Methodology, as well as those outlined in Table 15: Monitoring Requirements. Monitoring of the Bank Site will demonstrate compliance with the performance standards detailed in Section 10: Performance Standards and outlined in Table 14: Performance Standards and Percent Credit Release by Stage. Immediately following construction, permanent monitoring cross-sections will be established at or near the baseline data cross section locations in conjunction with proposed additional monitoring stations and/or cross-sections as detailed in Appendix A: Figures: Figure 13: Monitoring Locations Map. In conjunction with the wetland plots established within the permanent monitoring cross sections, and additional 14 wetland vegetative monitoring plots will be assessed on an annual basis. Eight of the wetland vegetative monitoring plots will be fixed, or static, and will be established across the rehabilitated and/or reestablished wetlands. The remaining 8 plots will be randomly selected every monitoring year during the maintenance and monitoring phase of the Bank Site. All plots will be assessed, and results provided and discussed in the annual monitoring reports to be submitted to the agencies for review.

Please note that the monitoring requirements detailed in PSUMBI provide the framework or basic structure for which monitoring, and reporting may occur. The monitoring requirements detailed in Table 15: Monitoring Requirements do not follow the exact framework provided in PSUMBI due to site-specific requirements.

### *As-Built Survey and Report*

Following construction, the Bank Sponsor will complete an as-built survey of all stream relocation and rehabilitation reaches. This will include stream cross-sections and a full longitudinal profile of all relocation/rehabilitation reaches. The as-built survey will include a topographic survey of all graded areas as well an as-built planting plan sheet that displays the general locations and quantities of all vegetative material that was planted. The as-built report will be submitted to the IRT following Bank Site construction and planting completion.

### *Annual Monitoring Reports*

Following construction completion, annual monitoring reports will be submitted to the IRT by December 31 each year monitoring occurs, for a minimum of seven years, or five years if early release is requested and approved by the IRT. If performance standards have not been achieved by Year 7 of monitoring, the monitoring period may be extended, and/or additional mitigation may be required.

The monitoring report will include all data collected from the year's monitoring and maintenance site visit(s), which will be used for comparison to the Bank Site's progress towards the performance standards. If the Bank Site achieves all its performance standards prior to Year 7, an early release may be requested.

Additionally, reports will include a brief discussion of the maintenance and management activities conducted during that year and may include a proposed maintenance schedule for the following year based upon the results of the yearly monitoring. The report will also include a brief discussion of the restoration-related activities that took place at the Bank Site. At a minimum, monitoring reports will include the following:

For the entire site:

- A description of the general condition of all stream, wetland, and upland areas, including a general status on plantings and the herbaceous seeding, and visual observations.
- A description of all maintenance work that was completed throughout the year.
- Representative site photos.
- Proposed maintenance activities for the next year, and if needed a corrective action plan or explanation to address any Performance Standards that have not been achieved, if applicable.
- Monitoring results and data as listed in Table 15: Monitoring Requirements.

| Table 15: Monitoring Requirements | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | | | | | | Monitoring Year | | | | | | |
| Resource Type | Restoration Type | Monitoring Method | Sampling Parameters | Sampling Sizes | Amount | 0 | 1 | 2 | 3 | 4 | 5 + |
| Streams | Relocation/Rehabilitation | Cross-sections (XS) | Survey of XS | Length of Permanent XS | 5 | Install and survey of XS for as-built report | X | X | X | X | X |
| | | Stream Monitoring Stations (Reach Assessment) | Survey of Stream Longitudinal Profile | 50 meters above and below each monitoring station | 7 | Full longitudinal profile survey for as-built report and install monitoring stations | X | X | X | X | X |
| | | | Reach Pebble Count (100 total pebbles) | Wolman pebble count 50 meters above and below each monitoring station | | | X | X | X | X | X |
| | | | BEHI Evaluation | 1 per monitoring station | | | X | X | X | X | X |
| | | | Stream Water Level Logger | 1 per monitoring station | | | X | X | X | X | X |
| | | | LWD Survey | 50 meters above and below each monitoring station | | | X | X | X | X | X |
| | | | Fish and Macroinvertebrate Surveys | 50 meters above and below each monitoring station | | | | | X | X | X |
| | | | Photo Documentation | Upstream, downstream, right bank, and left bank | | | X | X | X | X | X |
| Wetlands | Re-establishment | Wetland Monitoring Stations | Vegetation Plot | Herbaceous (3' by 3') and Woody (20' Radius) | 8 | Install permanent monitoring stations, list species planted and the number of each species | X | X | X | X | X |
| | | | Wetland Water Level Logger | 1 per monitoring station | | | X | X | X | X | X |
| | | | Photo Documentation | North, South, East, West, and Center | | | X | X | X | X | X |
| | Rehabilitation/Enhancement | Wetland Monitoring Stations | Vegetation Plot | Herbaceous (3' by 3') and Woody (20' Radius) | 8 | Install permanent monitoring stations, list species planted and the number of each species | X | X | X | X | X |
| | | | Photo Documentation | North, South, East, West, and Center | | | X | X | X | X | X |
| Uplands | Restoration/Preservation | Upland Monitoring Stations | Vegetation Plot | Herbaceous (3' by 3') and Woody (20' Radius) at each permanent XS location | 5 | Install permanent monitoring stations, list species planted and the number of each species | X | X | X | X | X |
| | | | Photo Documentation | North, South, East, West, and Center | | | X | X | X | X | X |

Notes:

- Year '0' represents the year of Bank Site construction and development of the as-built drawings. Locations for all cross-sections and monitoring stations to be identified, installed, surveyed in and included as part of the as-built report, which will be submitted to the IRT following completion of all the work required to restore the Bank Site.
- Monitoring events will occur once a year at any time during the growing season.
- The shape of monitoring plots may be modified as appropriate to adapt to site conditions. In locations where the floodplain is less than 20 feet wide, the monitoring plot shape will be modified to represent the same square footage.
- One wetland delineation per the USACE Eastern Mountains and Piedmont Region (EMP) v2 Regional Supplement will be completed prior to site close-out.
- These monitoring requirements are specific to the Starrucca Creek Mitigation Bank. The monitoring requirements detailed in PSUMBI provide the framework or basic structure under which monitoring, and reporting may occur. The monitoring requirements detailed in this table do not follow the exact framework provided in PSUMBI due to site-specific requirements.
- 22 wetland monitoring locations will be installed in total, 14 of which will be fixed locations, and the remaining eight will be randomly selected across the site each monitoring year.

# 12.0 Long-Term Management Plan

Per the provisions identified in PSUMBI, FPR has provided the following Long-Term Management and Maintenance Plan (LTMM Plan) to ensure that the Bank Site is managed, monitored, and maintained in perpetuity following achievement of all performance standards and site sign-off from the USACE. The Bank Sponsor has set aside a Long-Term Management Fund to fund the LTMM Plan, as described below in Section 12.1 LTM Funding. This value was derived using the Stewardship Costs Calculator developed by the Pennsylvania Land Trust Association (PALTA, Loza & Richman, 2017). The long-term steward will be responsible for requesting USACE approval prior to performing any activity(ies) that may incur costs exceeding the annual budgeted expenditures. This plan, described below, establishes objectives, priorities, and tasks to monitor, manage, maintain, and report on the jurisdictional waters of the U.S. within the Bank Site.

An annual report will be submitted to the IRT by December 31st containing photographs and a brief discussion of any maintenance needed to keep the property in a mature non-threatened state. If a Long-Term Steward is not identified prior to Bank closure, FPR will act as the initial Long-Term Steward and will be responsible for long-term maintenance and monitoring, until an alternative Long-Term Steward is identified and approved by the IRT, in advance of assignment.

At minimum, during the Long-Term Management period, one maintenance event is to be conducted annually in perpetuity. Please note that the Long-Term Management (LTM) and maintenance events are separate from the anticipated 7-to-10-Year active and interim maintenance and monitoring period described in Section 9.0 Maintenance Plan, Section 10.0 Performance Standards, and Section 11.0 Monitoring Requirements. During the Long-Term Management period, maintenance events are Bank Site assessment opportunities that allow for the assessment of general Bank Site conditions, including general topographic conditions, hydrology, vegetation cover and composition, invasive species presence, bank stability, erosion/incision observations, and any additional observations. Below is a discussion of the list of observations to be made during the annual Long-Term management period maintenance events.

## 12.1 LTM Funding

A Long-Term Management Fund (LTMF) will be established to provide funding for the long-term steward's maintenance, monitoring and management responsibilities for the Bank Site. The LTMF was developed using the Pennsylvania Land Trust Association Stewardship Calculator (PALTA, see references for citation). The LTMF assumes that the conservation area will be held by a local, non-profit land conservancy, and that minimal staffing and efforts will be necessary to complete annual monitoring, reporting, and maintenance activities. The LTMF accounts for one site visit per year to assess and document site conditions. Site maintenance is assumed to be necessary every 2 to 3 years. The LTMF also considers landowner communications, legal costs, and costs to respond and defend the site against minor and major violations.

The Bank Sponsor will also establish a Catastrophic Event Fund (CEF) to be available, if necessary, to address unanticipated and/or unforeseen catastrophic events. The CEF can include replacement of an off-site mitigation site in the event of surface impacts to the Bank Site from existing utility-related encumbrances, invasive species outbreaks, and rehabilitation activities associated with damage resulting from 100-year or greater storm event. Please note that as stated in PSUMBI, "Should a catastrophic event or event of Force Majeure occur, an Adaptive Management Plan will be developed to correct the problem. The Bank Sponsor will not be responsible for Mitigation Bank Site failure that is attributed to a natural catastrophe, such as flood, drought, disease, regional pest infestation, etc., which the IRT, acting through the Chairs,

determines is beyond the reasonable control of the Bank Sponsor to prevent or mitigate. The Bank Sponsor is, however, required to take corrective actions associated with catastrophic events and events of Force Majeure that do not result in Mitigation Bank Site failure and to use the Financial Assurances to fund corrective measures required to repair the Mitigation Bank Site from such events."

The CEF will be included as a separate endowment fund and will be managed by the same third-party endowment manager as the LTM Fund. Funding of the CEF will be similar to the LTM funding schedule, whereby 25% of the total fund amount will be deposited annually over a four-year period (see Table 17: Long-Term Management Funding Deposits).

If the long-term steward believes additional funding is required beyond what will be placed into the account(s), the Sponsor will coordinate with the steward to ensure adequate funding is available in perpetuity.

## 12.2 Funding Approach

Prior to submitting the Year 1 monitoring report, the Sponsor will deposit 15% of the total long-term management funds into an endowment account, that will be held and managed by a third-party financial institution according to the terms of the example endowment agreement provided as part of Appendix J: Financial Assurances. The Sponsor will deposit the remaining 85% of the long-term management funds into the endowment account over a period of 4 years (the fund will be 40% funded in Year 2, 70% funded in Year 3, and fully funded in Year 4). To document implementation of long-term financial assurances, the Sponsor will provide the executed endowment agreement with the administrative credit release request package and will provide statements of deposit with annual monitoring reports until the endowment account is fully funded in Year 4. The Catastrophic Event Fund will be established as a separate endowment account to be managed by the same third-party endowment manager as the LTM fund, and will be funded similar to the LTM funding schedule, whereby 25% of the total fund amount will be deposited annually over a four-year period (see Table 17: Long-Term Management Funding Deposits). If a long-term steward believes additional funding is required, FPR will coordinate with the steward to ensure adequate funding is available in perpetuity.

## 12.3 Financial Assurances Funding Reporting Requirements

The Long-Term steward will be responsible for financial assurances reporting, including beginning and ending balances, deposits into and debits from the maintenance, monitoring, long-term management, and catastrophic event financial assurance funds. The Long-Term steward will be responsible for coordinating with the IRT/USACE to ensure adequate financial assurance reporting is completed.

## 12.4 General LTM Management Activities

### *Periodic Patrols*

At least one annual walk-through survey will be conducted to qualitatively monitor the general condition of these habitats in perpetuity. General topographic conditions, hydrology, general vegetation cover and composition, invasive species, and erosion will be noted, evaluated and mapped during a site examination. Notes to be made will include observations of species encountered, general extent of wetlands and streams, and any occurrences of erosion, structure failure, or invasive or non-native species establishment. The report should provide a discussion of any recent changes in the watershed.

### *Invasive Species Monitoring*

Each year's annual walk-through survey (or a supplemental survey) will include a qualitative assessment (e.g. visual estimate of cover) of invasive species. Additionally, during each maintenance event, the project manager and field crew will actively evaluate the condition of the project and will note any additional maintenance activities that are needed. At the end of the year, the observations made during the year will be used to formulate the maintenance schedule for the following year, which will be presented to the IRT in the yearly monitoring report.

### *Signage*

Bank Site boundaries will be marked with a metal post with signage that clearly identifies the conservation area to prevent casual trespass while also allowing necessary access. During site visits, notes will be made as to the condition of signs, crossings, and property boundaries. Recommendations to implement repair or replacement to signage, crossings, or property boundary markers will be made, if applicable.

### *In-Stream Structures*

All in-stream structures will be visually monitored during the annual monitoring event. Any active erosion around in-stream structures will be noted, and remedial actions recommended as needed.

### *Forestry Management Practices*

Vegetation will be reduced in any areas recommended by authorities, and as approved by the IRT, for fire control. Any practices to reduce diseased or dead vegetation will be allowed if the vegetation compromises the long-term viability of the Project or any installed structure within the Bank Site.

### *Trash and Trespass*

At least once yearly, trash will be removed and any necessary measures to prevent or repair damage from vandalism and trespass impacts will be taken.

### *Right to Inspection*

The IRT and its authorized agents shall have the right to inspect the Bank Site and take actions necessary to verify compliance with the Long-Term Management Plan. The Long-Term Management Plan herein shall be enforceable by any proceeding at law or in equity or administrative proceeding by the IRT, including the Corps or PADEP. Failure by any agency (or owner) to enforce the Long-Term Management Plan contained herein shall in no event be deemed a waiver of the right to do so thereafter. If the Long-Term Steward fails to succeed to adhere to the requirements of the Long-Term Maintenance and Monitoring Plan, the IRT Chairs may identify a new Long-Term Steward or request that the Sponsor assists in the process after Bank Closure.

### *Enforcement*

The Long-term Steward will be responsible for the enforcement of the terms of the Bank Site deed restriction.

## 13.0 Adaptive Management Plan

Adaptive management will be used to address uncertainties that may potentially affect compensatory mitigation activities. By their very nature, adaptive management actions are implemented on an "as needed" basis and are informed by maintenance and monitoring of the Bank Site. Maintenance and monitoring site visits will determine the degree to which issues and

events adversely affect or limit proposed compensatory mitigation activities. It is anticipated that the range of uncertainties will narrow as monitoring of the Bank Site progresses throughout the monitoring phase.

The Bank Site will be monitored and maintained yearly to assess conditions and progression towards meeting performance standard requirements. As part of this process, it is expected that unanticipated conditions will arise which may require adaptive management. Most of the adaptive management needs will be recorded in the annual monitoring reports, along with suggested remedial or corrective actions.

FPR will adaptively manage issues and events that adversely affect, or limit proposed compensatory mitigation by employing corrective or remedial actions to address unsuccessful mitigation activities (e.g., grade adjustments, reseeding, replanting, increased weed control).

Vegetative management will be modified on a yearly basis to address Project needs. Modifications and/or adjustments will be recorded in the annual monitoring reports. If there is any instability noted around the in-stream structures, the instability will be noted in the annual monitoring report, and if needed remedial actions will be recommended. This may include, but not be limited to additional work in or around the structure or work further upstream of the structure to remove the cause of instability at the structure.

Any conditions that arise which may require immediate attention will be brought to the attention of the IRT outside of the regular monitoring reporting period along with remedial actions that were conducted.

A few potential situations that would necessitate an Adaptive Management Plan (AMP) as a result of unforeseen and/or unanticipated performance standard failures are provided below.

### *Stream Stability*

The restoration approach at the Bank Site, which is designed to reduce shear stresses that occur within the channel and floodplain and implements sub-surface grade control structures, decreases the chances for vertical and horizontal stream instability at Bank Site.

As such, the chance for vertical incision is largely removed by the presence of the sub-surface grade control structures because the structures are placed on bedrock or are stacked with a splash log on the downstream end. Additionally, because they extend all the way across the floodplain, there is no way for the channel to cut around the structures, even if the channel were to completely shift its location horizontally. If there were a significant vertical degree of incision, it would have to be based upon one of the sub-surface structures being improperly installed. Under these circumstances, the failure would be evaluated, and remedial construction work would be conducted to correct the deficiency.

Reduced shear stresses significantly reduce the likelihood of horizontal instability. If an extreme storm event occurred (greater than 100-year RI), and the stream did move horizontally, there would still be no risk of vertical incision because of the presence of the sub-surface grade control structures, and therefore, the stream function would not be impaired. The only risk would be if the stream channelized, which would reduce retention time and available habitat, however the presence of LWD installed across the floodplain during construction, and the floodplain plantings create roughness and friction throughout floodplain that would prevent any channel movement from creating a straight channel. If horizontal changes did occur, they would be surveyed, and evaluated to see if they negatively affected the Bank Site design. If they did not, no remedial

action would be needed; if they did, corrective construction work would be done, however this is extremely improbable based upon the project design.

### *Live Stakes*

Based on anticipated groundwater hydrology the live stake plantings are planted on two-foot spacing and should establish well, so should meet all proposed performance standards. If for some unforeseen reason, they did not, the reason for mortality would be evaluated, and replanting would be conducted.

### *Increase in the quality or quantity of macroinvertebrates or fish*

Increased substrate within the channel bed, and increased habitat in the smaller tributaries should provide a basis for an expansion in the range of fish species, and increased macroinvertebrate habitat. The additional retained carbon in the floodplain should provide an increase in detritus for macroinvertebrate species to feed on. Because the macroinvertebrate and fish populations may take time to respond to these changes, no corrective actions will be taken if these metrics are not being met in the first two years.

In Year 3, if the Bank Site is not showing a trend of increasing either the quality or quantity of macroinvertebrates or fish, the previous year's water quality data will be examined to identify factors that may be limiting quality increases. Additionally, carbon retention within the floodplain can be visually evaluated to determine if the floodplain is capturing fine carbon material such as twigs and leaf litter. Lastly, stream elevation data, rainfall data, and floodplain hydrology data would be evaluated to determine if lower than average rainfall and associated hydrology was limiting both the macroinvertebrate and fish populations.

Of the three metrics: water quality, carbon, and flow, if a determining factor can be identified, a corrective action plan will be developed to attempt to address the limitation. In certain instances, corrective action may not be possible - for example, the sponsor cannot influence the weather to increase rainfall and flow at the site. A corrective action that could be taken is if the floodplain is found to be lacking carbon, additional fine carbon material can be brought into the restoration site; and placed within the stream and floodplain complex to provide additional food sources.

### *Invasive Species and Native Dominance*

If at any point there was an intensive colonization of invasive species, which brought the total percent of invasive species well above the allowed performance standards, remedial action would be needed. The management technique used would be dependent on the type of invasive species colonizing the site (i.e. annual, or perennial, primary reproduction through vegetative spread or through seed). If the species are annual, they can be dealt with through maintenance mowing and mechanical weed control methods to stop them from re-seeding into the site. After the seed bank is depleted, they drop out of the vegetative matrix. If they are perennial in nature, chemical herbicides need to be used; mechanical weed control is still used to stop further spreading through seed if they are a species that has high germination rates.

Once the invasive species control has begun, additional seeding or planting would need to be conducted to re-introduce a native plant community into the area of concern. Depending on the type of invasive (i.e. broad leaf or monocot), replanting and reseeding strategies can be used to allow for continued chemical control of the invasive species in the area while still allowing the native species to germinate and develop.

The likelihood of this scenario is low; once established, native plant communities are resilient to invasion by invasive species as long as they are not disturbed or impacted. Invasive species issues on a restoration site tend to be most problematic during the first two years, because there is bare soil immediately available for germination and colonization immediately following construction, and there may be invasive species in the existing seed bank to germinate and establish. As such, maintenance activities are always the most intensive during the first two to three years to control any invasive species before they establish and expand to the point where they are problematic.

If the site were not meeting its performance standards for native herbaceous cover, additional seeding would be conducted. Again, the most important factor for establishing a healthy stand of upland herbaceous species is proper maintenance during the first two to years of establishment, specifically mowing in upland areas. This ensures enough light is reaching the developing seedlings, while also eliminating competition from annual weedy species that may be trying to colonize the site. In the wetland areas, mowing cannot be conducted, but mechanical weed control with weed whips can be used. Based on the anticipated hydrology in the wetland areas at the site, the floodplains will have water within 12 inches of the surface for most of the growing season. These conditions will discourage the growth of most invasive species and annual weedy species usually seen at a restoration site.

# 14.0 Financial Assurances

## 14.1 Performance Bond

A performance bond will be established to ensure that the Bank Site construction is completed and that all performance standards are met. A draft document conforming to PSUMBI's sample document with minor alterations is provided in Appendix J: Financial Assurances. The financial assurance mechanism will be a surety bond that will cover construction, and maintenance and monitoring costs associated with the Bank Site, and will take effect 60 days after approval of the joint permit application. The performance bonding entity has a rating of A+ (A.M. Best Ratings, 2010).

Bond terms are annual and are renewed on an annual basis. The construction bond is anticipated to be in place for the duration of construction. If construction exceeds 12 months, another annual bond will be renewed to cover the remaining duration of construction. Following construction, FPR will request bond reduction in correlation with the maintenance and monitoring costs. If the request is approved by the IRT/USACE, the construction bond will be reduced and be replaced as a maintenance and monitoring bond.

Upon completion of the restoration activities and approval of the as-built plans by the regulatory agencies, the bond will be reduced, as laid out in Table 16 below. The remaining bond amount will be left in place to cover the initial and interim maintenance and monitoring costs. The bond will be reduced proportionately each year the Bank Site meets its performance standards. The steps to be used to review and approve any reduction in the financial assurances is as follows:

1. Determine if the Bank Site is meeting performance standards.
   i) If yes, request approval for bond reduction with annual monitoring report submittal/credit release request letter.
   ii) If not all performance standards are attained, the Bank Sponsor may still request a bond reduction, understanding that the reduction must be approved by the IRT/USACE.

Along with the annual monitoring reports and credit release request, the Sponsor will provide a statement of deposit to show that funds have been deposited into the LTM endowment account.

The performance bond will be released once the Bank Site receives final sign-off from the IRT. The Bank Site will only be closed upon meeting all performance standards and MBI requirements and when all credits have been sold (unless the Sponsor forfeits any remaining mitigation credits).

The bond will be closed once all performance standards are met and released credits are sold and final sign-off on the Bank Site has been provided by the IRT. The following table presents the performance bond release schedule and target milestones.

| Table 16: Performance Bond Release Schedule and Target Milestones | | | | | |
|---|---|---|---|---|---|
| **Financial Instrument Used** | **Project Phase Covered** | **Specific Items Covered** | **Amount Reduced** | **Amount Available** | **Explanation** |
| **Surety Bond** | Construction/ Development | Construction | 0% | 100% | 100% of funds remain in-place until construction is complete |
| | | Approval of As-Built Design Plans | 85% | 15% | Upon submittal of the as-built design plans, 85% of the Bond amount is reduced |
| | Maintenance and Monitoring | Year 1 - 7 Maintenance & Monitoring, Reporting | 15% | 0% | The remaining 15% of the Bond will cover Maintenance, Monitoring, and Reporting for the initial and interim management periods through Bank Site closure.[1] |

Note:

- Pending review/approval by the IRT/USACE, the performance bond may be reduced by approximately 14 percent (or 1/7$^{th}$) each year the Bank Site progresses towards close-out. The bond cannot be closed-out if all performance standards have not been met or if credits remain available. The bond will remain open until the Bank Site is transferred to the long-term steward.

## 14.2 Long Term Management and Catastrophic Event Funds

In addition to the performance bond, the Bank Sponsor will establish a Long-Term Management (LTM) fund to fund long-term maintenance, monitoring, and management of the Bank Site. A separate fund will be established for Catastrophic Events (CE). Both funds will be managed by the same third-party endowment fund manager. As described in Section 12.0 Long-Term Management Plan, the LTM and CE funds can also be used to fund corrective measures pertaining to natural disasters, invasive species outbreaks, or other unforeseen events. One instance in which funding from the CE fund may be used include replacement of an off-site mitigation site in the event of surface impacts to the Bank Site from existing utility-related encumbrances.

As per PSUMBI "Should a catastrophic event or event of Force Majeure occur, an Adaptive Management Plan will be developed to correct the problem. The Bank Sponsor will not be responsible for Mitigation Bank Site failure that is attributed to a natural catastrophe, such as flood, drought, disease, regional pest infestation, etc., which the IRT, acting through the Chairs, determines is beyond the reasonable control of the Bank Sponsor to prevent or mitigate. The Bank Sponsor is, however, required to take corrective actions associated with catastrophic events and events of Force Majeure that do not result in Mitigation Bank Site failure and to use the Financial Assurances to fund corrective measures required to repair the Mitigation Bank Site from such events."

Prior to requesting the initial administrative credit release, the Bank Sponsor will execute a performance bond to cover the construction and active and interim maintenance and monitoring phases. As part of the initial administrative credit release request package, the Sponsor will provide the executed bond to document implementation of the active and interim financial assurances. Prior to submitting the Year 1 monitoring report, the Sponsor will deposit 15% of the total long-term management funds into an endowment account, that will be held and managed by a third-party financial institution according to the terms of the example endowment agreement provided in Appendix I: Financial Assurances. As shown in Table 17: Long-Term Management Funding Deposits, the Sponsor will deposit the remaining 85% of the long-term management funds into the endowment account over a period of 4 years (the fund will be 40% funded in Year 2, 70% funded in Year 3, and fully funded in Year 4). To document implementation of long-term financial assurances, the Sponsor will provide the executed endowment agreement with the

administrative credit release request package and will provide statements of deposit with annual monitoring reports until the endowment account is fully funded in Year 4. Submittal of the statements of deposit are required as part of the credit release process.

The CEF will be established as a separate endowment fund and will be managed by the same third party endowment fund manager as the LTM fund. Funding of the CEF will be similar to the LTM funding schedule, whereby 25% of the total fund amount will be deposited annually over a four-year period (see Table 17: Long-Term Management Funding Deposits).

Additional details, funding amounts, and itemized costs were provided separately to the IRT as proprietary and confidential information.

**Table 17: Long-Term Management Funding Deposits**

| Contribution Year | Long-Term Management Fund Deposits by Sponsor | Catastrophic Event Fund Deposits by Sponsor |
|---|---|---|
| Year 1 | 15% | 25% |
| Year 2 | 25% (for a total 40%) | 25% (for a total of 50%) |
| Year 3 | 30% (for a total 70%) | 25% (for a total of 75%) |
| Year 4 | 30% (100% fully funded) | 25% (100% fully funded) |

Note:

1. Statements of deposit will be submitted with the annual monitoring reports.

### 14.3 Financial Assurance Reporting Requirements

FPR is responsible for submitting financial assurance reporting requirements during the active and interim maintenance and monitoring phase. FPR will submit with the annual monitoring reports statements of deposits that detail deposits made as well as beginning and ending balances during the active and interim maintenance and monitoring phases. If bond reduction release is granted by the IRT/USACE, documentation of those bond adjustments will also be provided to the IRT/USACE. If any debits are made from the financial assurance funds, documentation will be provided to the IRT/USACE accordingly.

During the Long-Term Management phase of the Bank Site, the long-term steward will be responsible for coordinating financial assurance reporting to the IRT/USACE. This reporting may include information on the status of the funding accounts including any credits to or debits from the funds, as well as expenditures exceeding the annual allocated amount.

## 15.0 References

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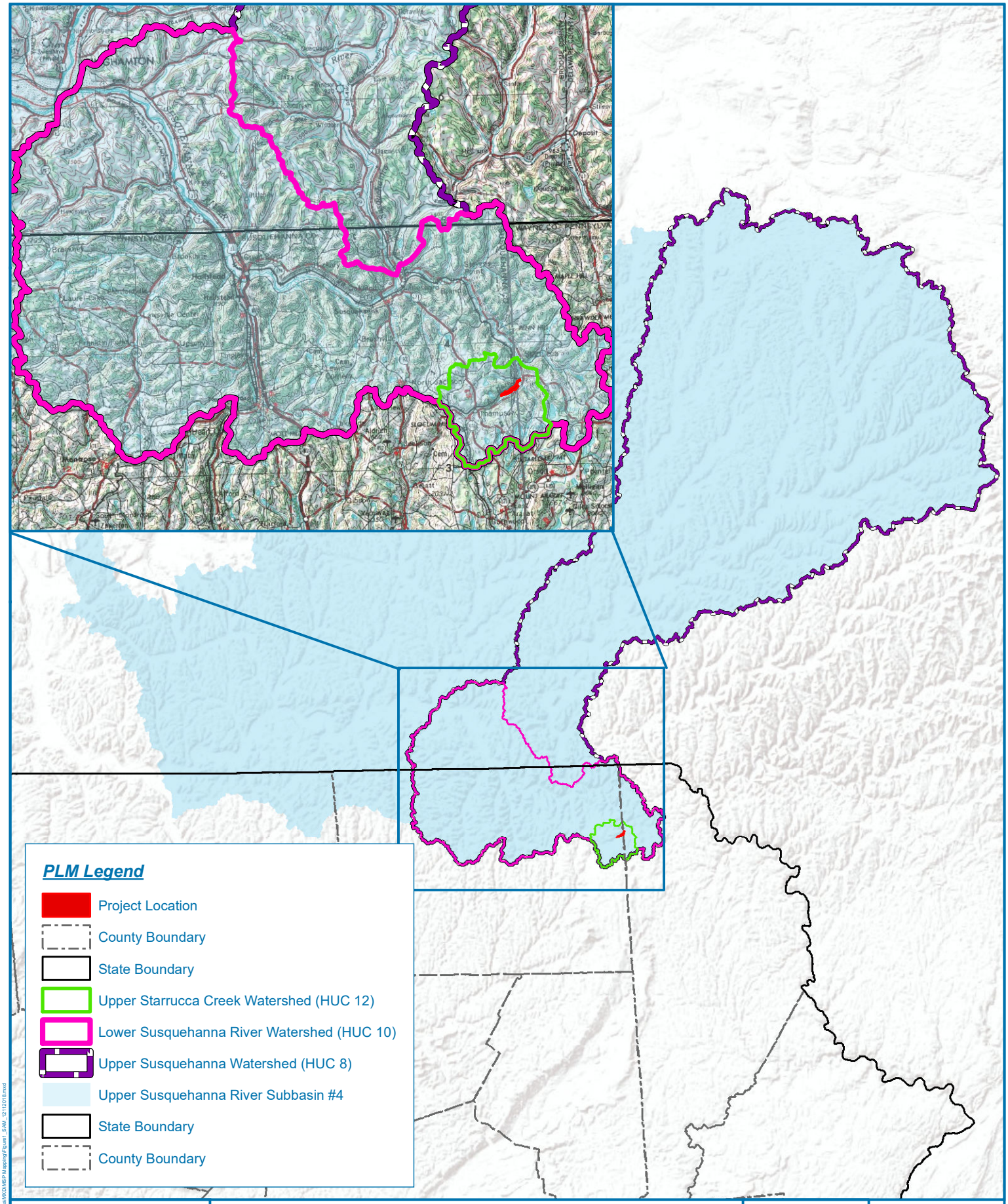
# APPENDIX A
# FIGURES




# SERVICE AREA MAP
# STARRUCCA CREEK MITIGATION BANK

**FIGURE 1**

Date: 12/14/2018
Drawn by: NDR
Checked by: SY

res

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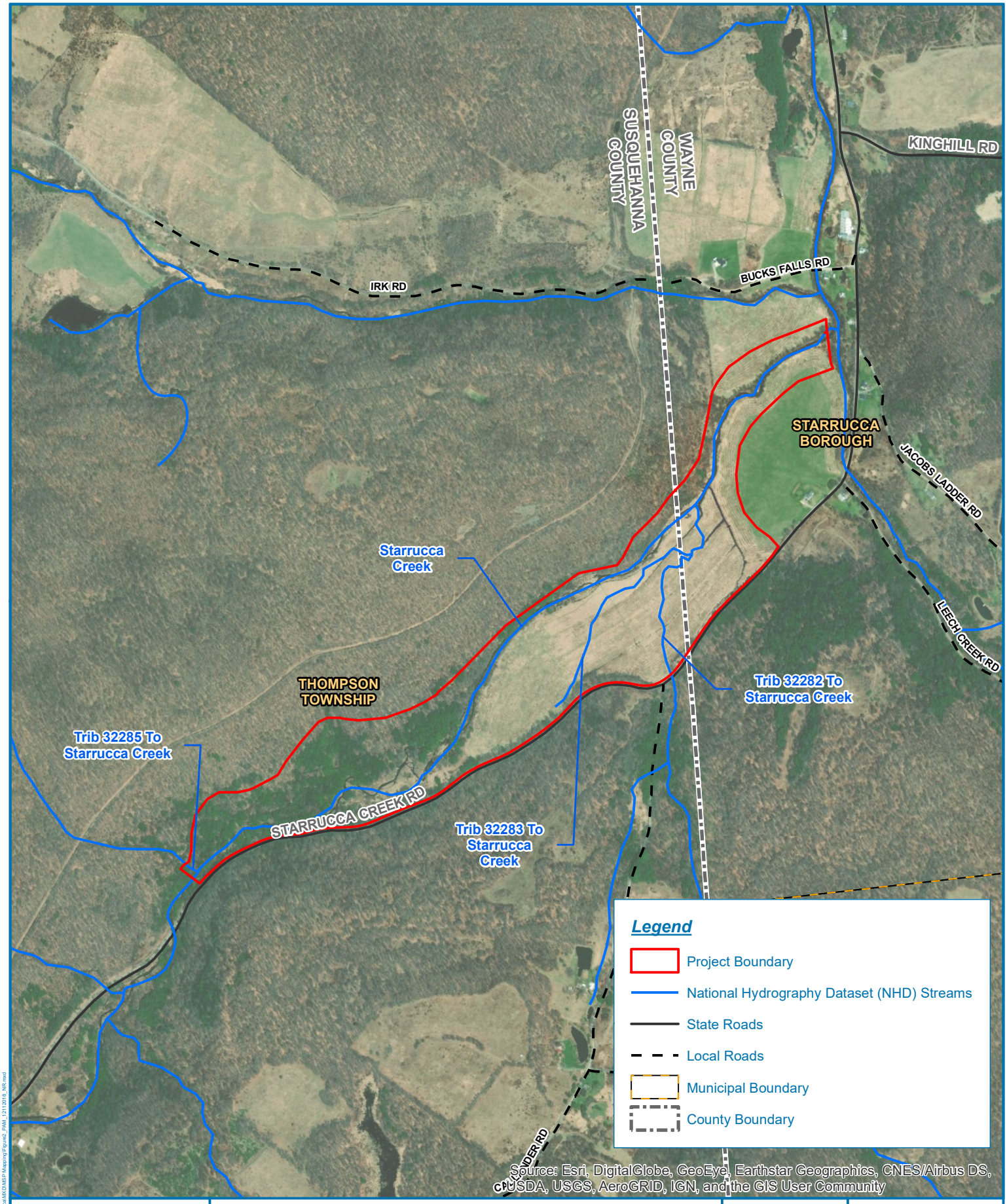


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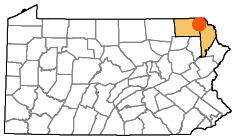

SUSQUEHANNA AND WAYNE COUNTIES, PA

# PROJECT AREA MAP
# STARRUCCA CREEK MITIGATION BANK

Feet
0 500 1,000

**FIGURE 2**

Date: 12/14/2018
Drawn by: NDR
Checked by: SY

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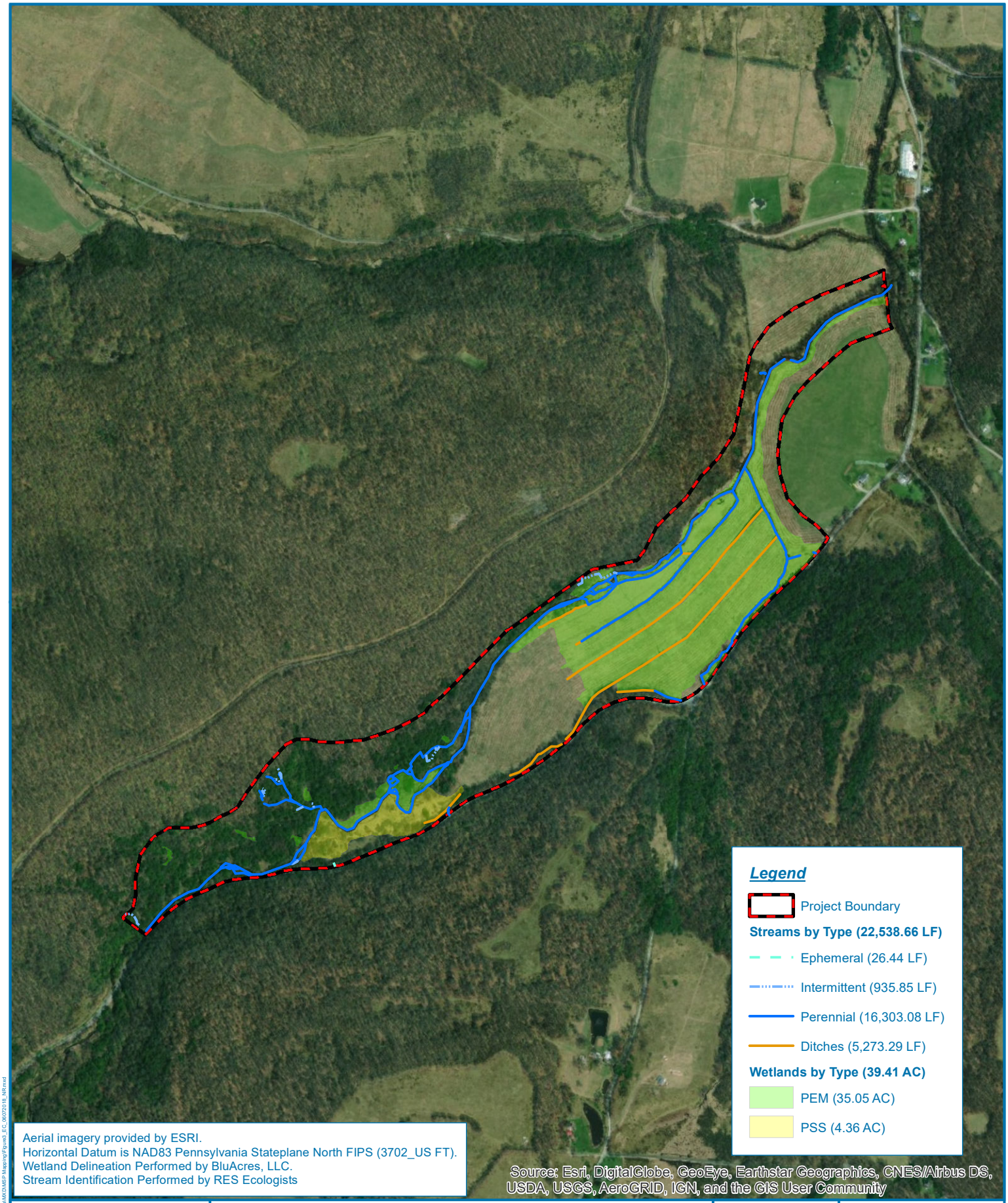
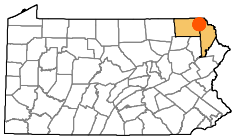
Document Path: S:\@RES GIS\Projects\PA\0217 Starrucca\MXD\MBP Mapping\Figure2_PAM_12112018_NR.mxd




Aerial imagery provided by ESRI.
Horizontal Datum is NAD83 Pennsylvania Stateplane North FIPS (3702_US FT).
Wetland Delineation Performed by BluAcres, LLC.
Stream Identification Performed by RES Ecologists

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**PROJECT LOCATION**



SUSQUEHANNA AND WAYNE COUNTIES, PA

# EXISTING CONDITIONS MAP
# STARRUCCA CREEK MITIGATION BANK

Feet
0 500 1,000

**FIGURE 3**

Date: 12/14/2018
Drawn by: NDR
Checked by: SY

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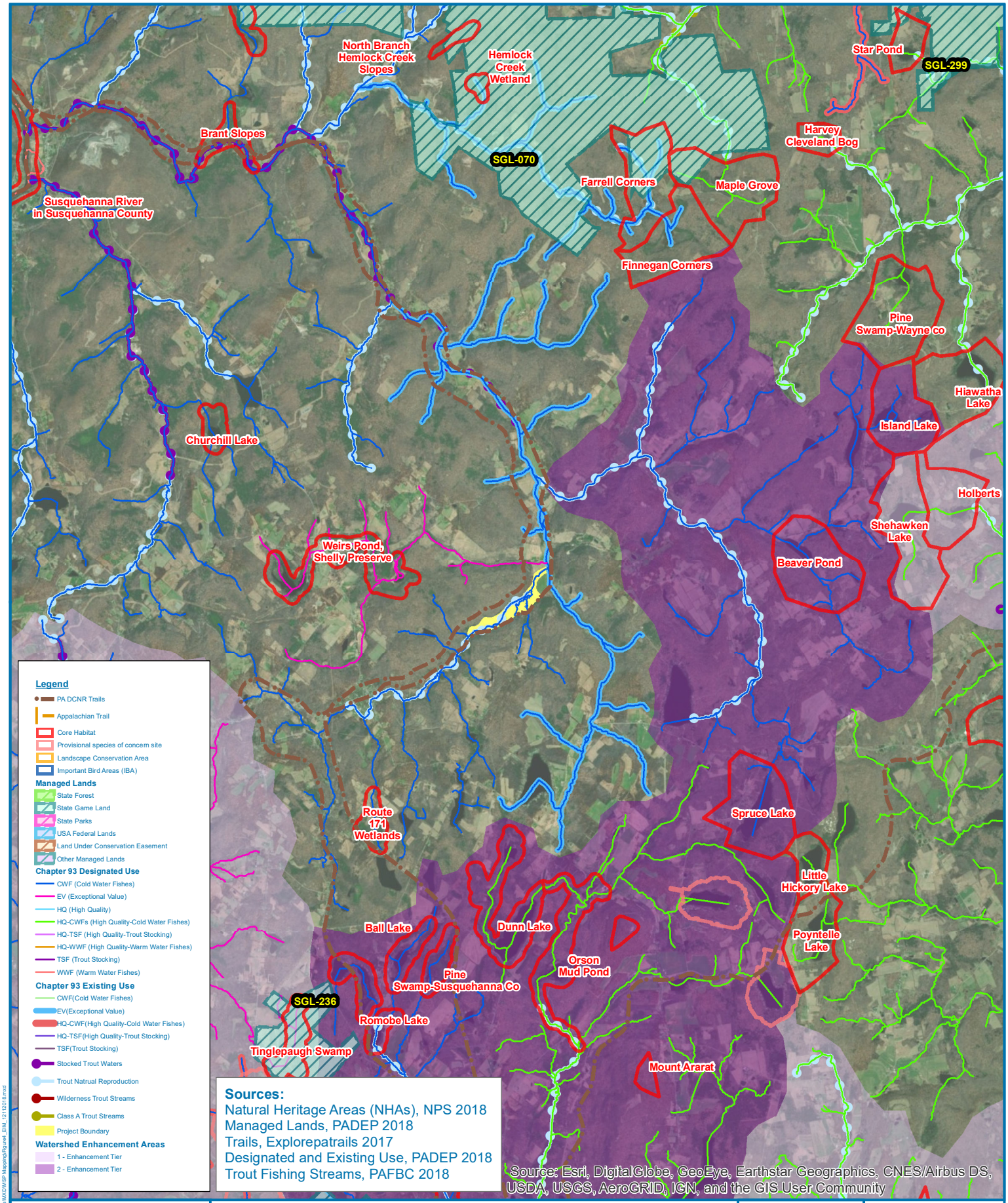


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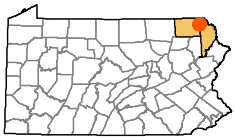

SUSQUEHANNA AND WAYNE COUNTIES, PA

# ECOLOGICAL INVENTORY MAP
# STARRUCCA CREEK MITIGATION BANK

N W E S

0 0.75 1.5 Miles

**FIGURE 4**

Date: 1/15/2019
Drawn by: NDR
Checked by: SY

res

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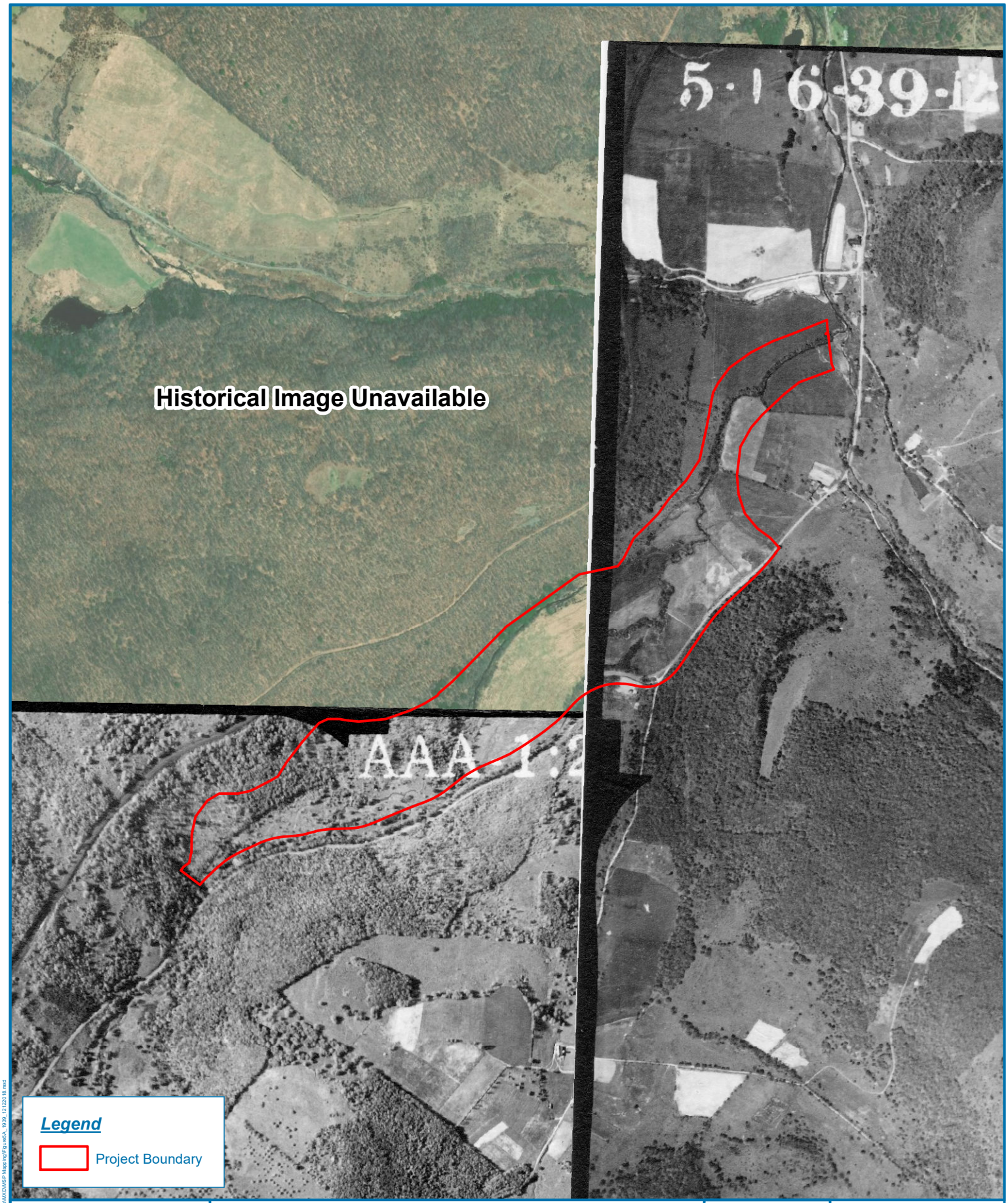


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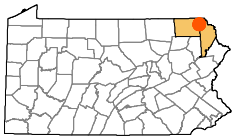

SUSQUEHANNA AND WAYNE COUNTIES, PA

**1939 HISTORIC AERIAL**
**STARRUCCA CREEK MITIGATION BANK**

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Feet
0 500 1,000

Souce: http://www.pennpilot.psu.edu/

**FIGURE 5A**

Date: 12/14/2018
Drawn by: NDR
Checked by: SY

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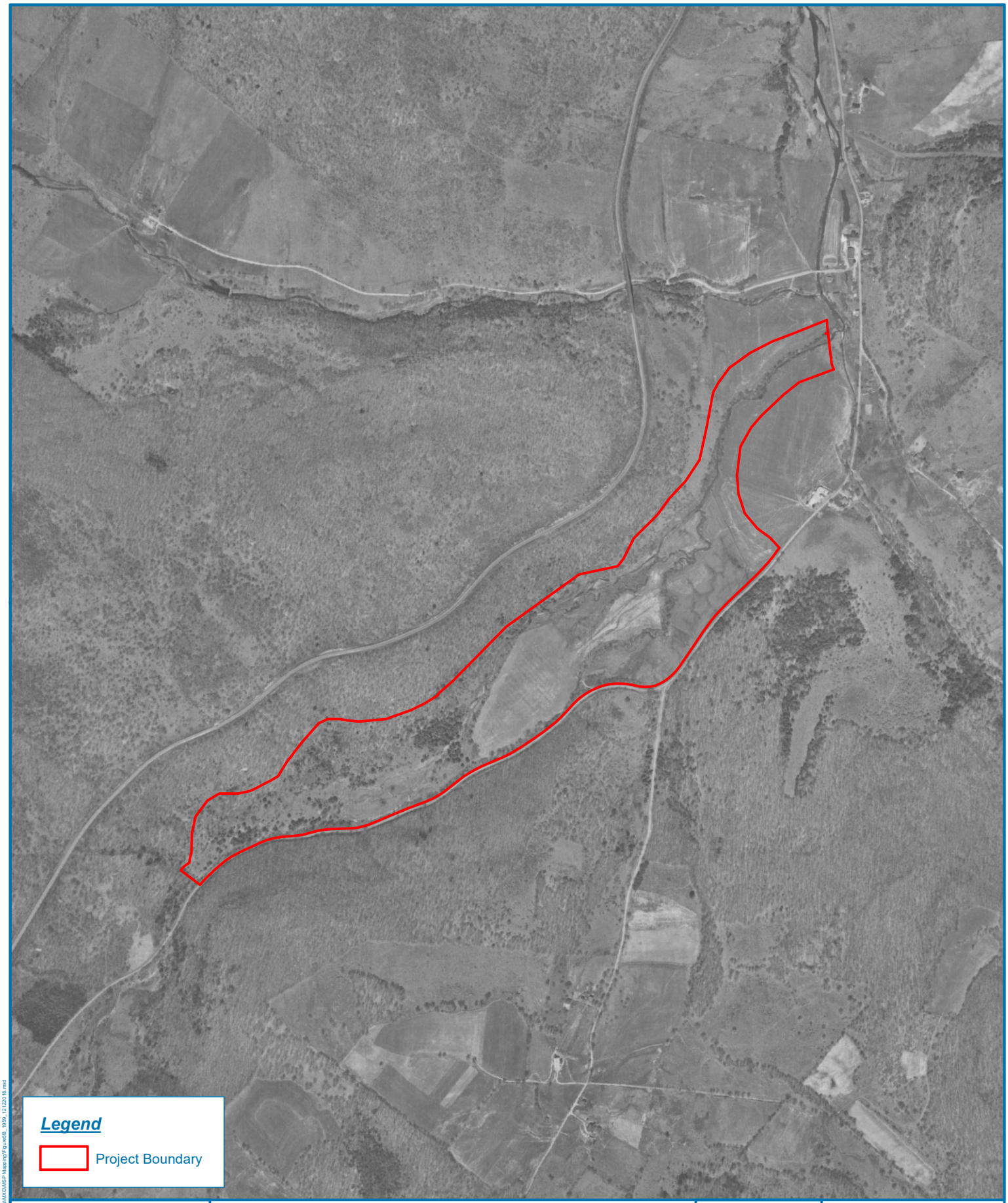


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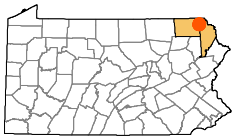

SUSQUEHANNA AND WAYNE COUNTIES, PA

1959 HISTORIC AERIAL
STARRUCCA CREEK MITIGATION BANK

Feet
0 500 1,000

Souce: http://www.pennpilot.psu.edu/

FIGURE 5B

Date: 12/14/2018
Drawn by: NDR
Checked by: SY

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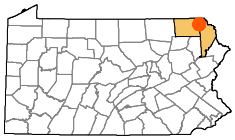
PROJECT LOCATION



SUSQUEHANNA AND WAYNE COUNTIES, PA

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# 1969 HISTORIC AERIAL
# STARRUCCA CREEK MITIGATION BANK

Feet
0 500 1,000

Souce: http://www.pennpilot.psu.edu/

**FIGURE 5C**

Date: 12/14/2018
Drawn by: NDR
Checked by: SY

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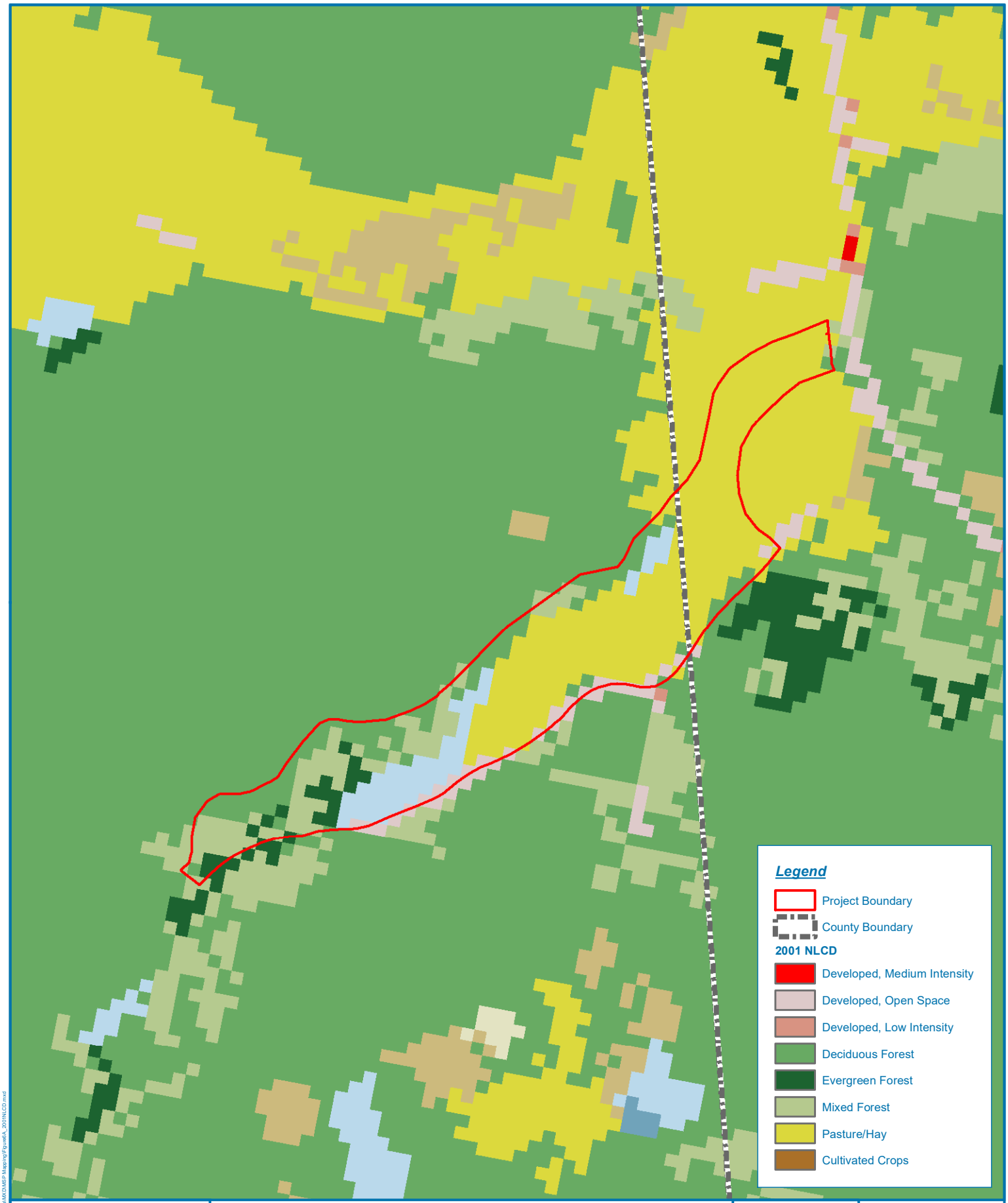


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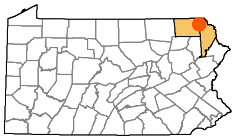

SUSQUEHANNA AND WAYNE COUNTIES, PA

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# 2001 NATIONAL LAND COVER DATASET
# STARRUCCA CREEK MITIGATION BANK

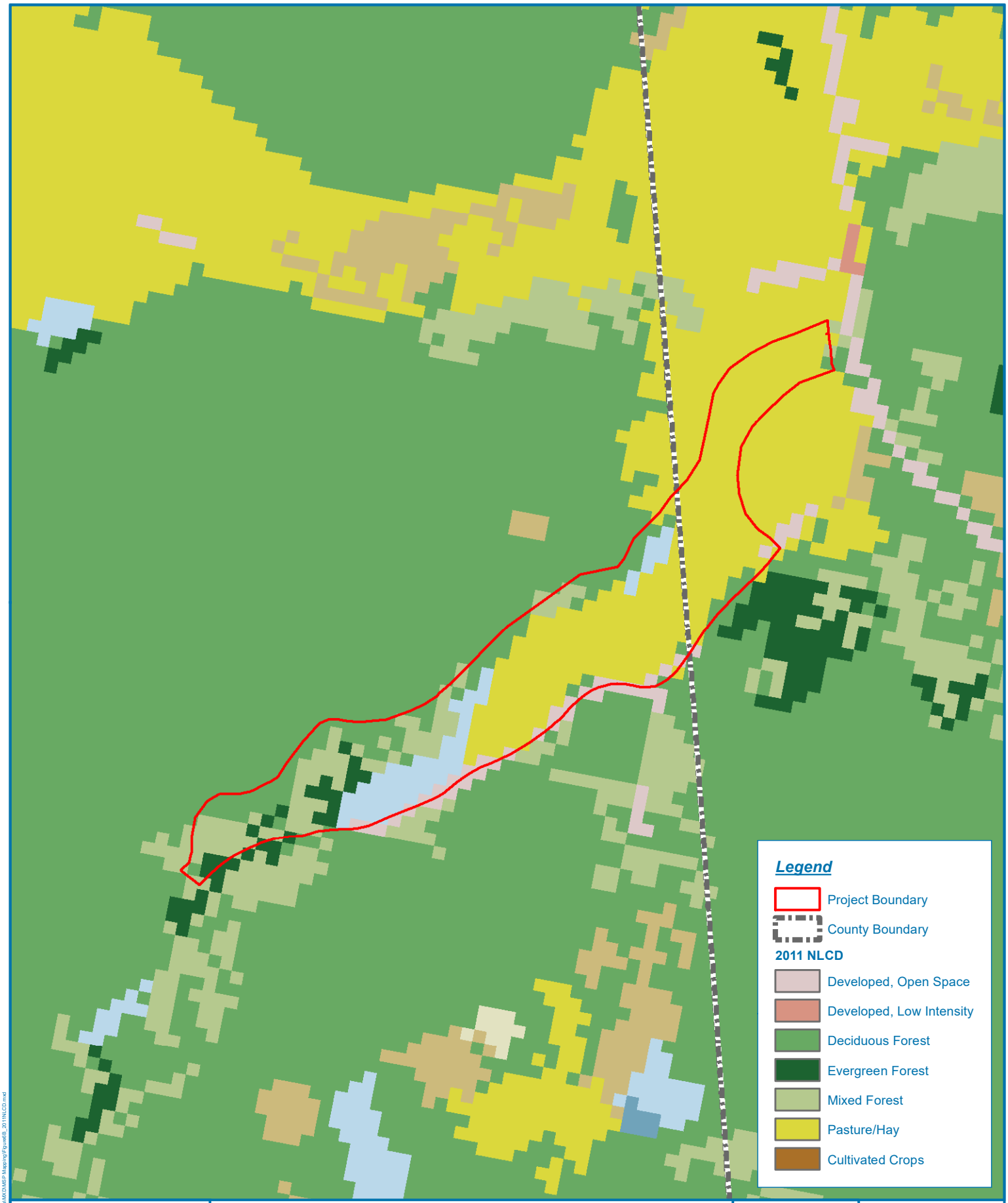
Feet
0 500 1,000

**FIGURE 6A**

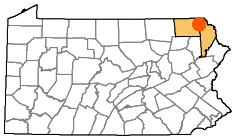
Date: 1/3/2019
Drawn by: NDR
Checked by: SY

res

Document Path: S:\@RES GIS\Projects\PA\0217 Starrucca\MXD\MSP Mapping\Figure6A_2001NLCD.mxd




PROJECT LOCATION



SUSQUEHANNA AND WAYNE COUNTIES, PA

N
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## 2011 NATIONAL LAND COVER DATASET
## STARRUCCA CREEK MITIGATION BANK

Feet
0 500 1,000

**FIGURE 6B**

Date: 12/12/2018
Drawn by: NDR
Checked by: SY

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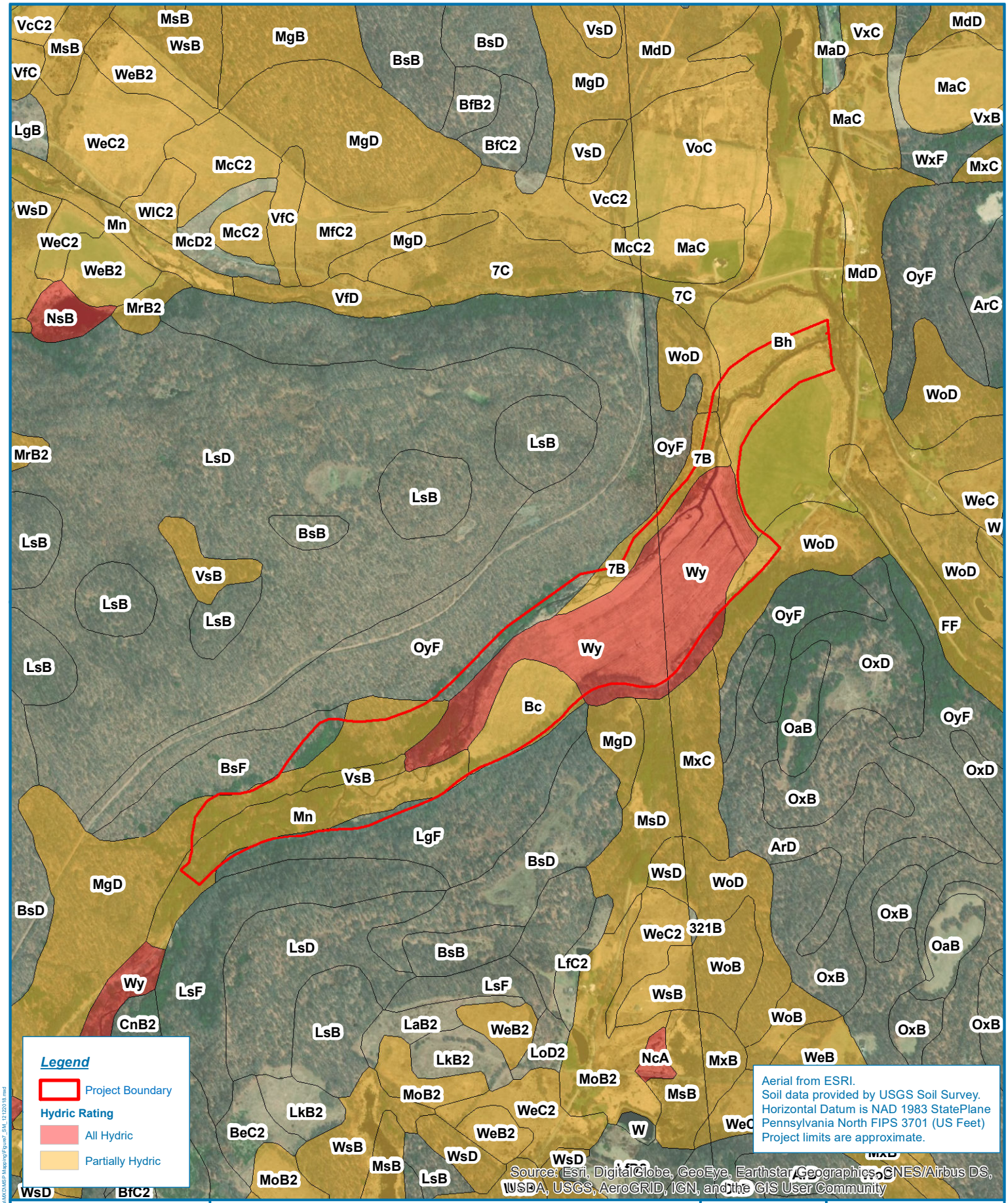
Document Path: S:\GIS\E G\S\Projects\PA\0217 Starrucca\MXD\MSP Mapping\Figure6b_2011NLCD.mxd




Legend

Project Boundary

Hydric Rating

All Hydric

Partially Hydric

Aerial from ESRI.
Soil data provided by USGS Soil Survey.
Horizontal Datum is NAD 1983 StatePlane Pennsylvania North FIPS 3701 (US Feet)
Project limits are approximate.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PROJECT LOCATION

SUSQUEHANNA AND WAYNE COUNTIES, PA

# SOILS MAP
# STARRUCCA CREEK MITIGATION BANK

Feet
0 500 1,000

FIGURE 7

Date: 12/12/2018
Drawn by: NDR
Checked by: SY

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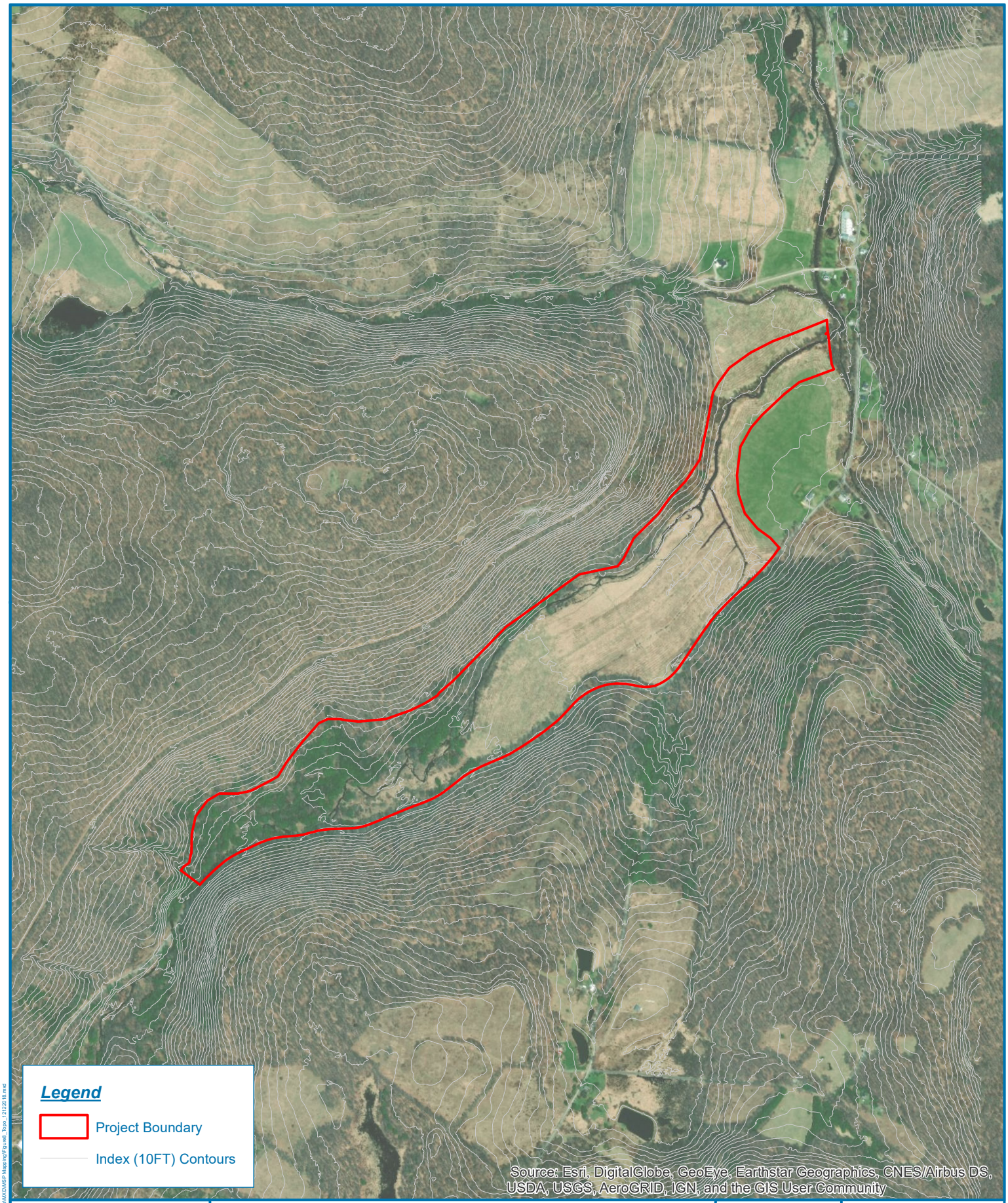


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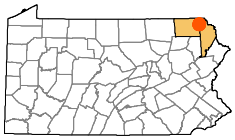

SUSQUEHANNA AND WAYNE COUNTIES, PA

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TOPOGRAPHIC MAP
STARRUCCA CREEK MITIGATION BANK

Feet
0 500 1,000

Source: http://www.pasda.psu.edu/

FIGURE 8

Date: 12/14/2018
Drawn by: NDR
Checked by: SY

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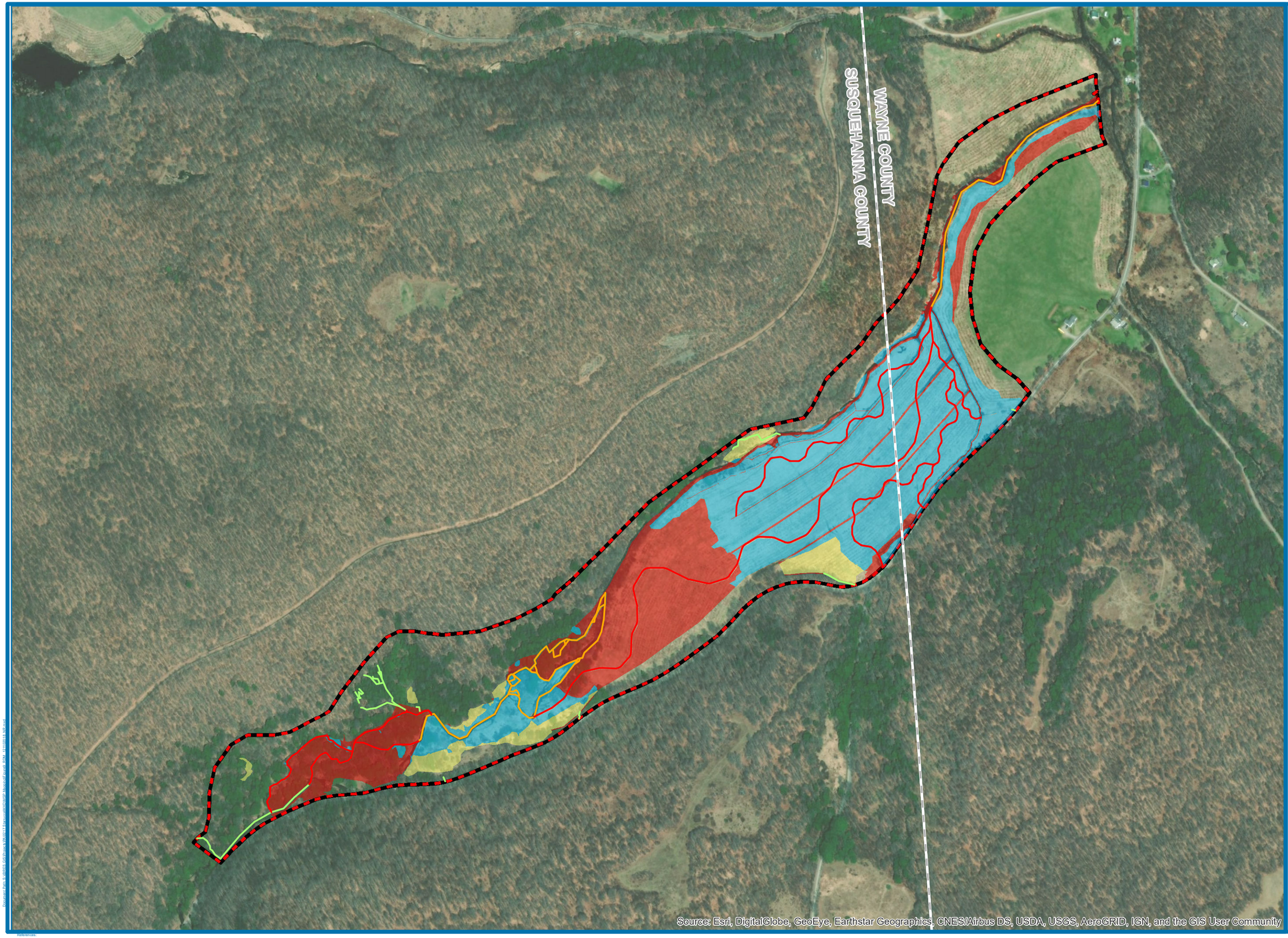
Document Path: S:\@RES GIS\Projects\PA\0217 Starrucca\MXD\MBP Mapping\Figure8_Topo_12122018.mxd

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N
W E
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0 250 500
Feet

# FIGURE 9

Resource Development Map
Starrucca Creek Mitigation Bank

| | |
|---|---|
| Date: 12/14/2018 | Drawn by: NDR |
| Checked by: SY | Project No.: 0217 |

## LEGEND

Project Boundary

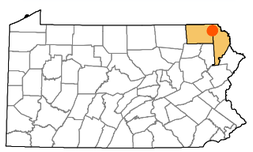
**Wetlands by Restoration Approach (60.65 AC)**

- Enhancement (4.18 AC)
- Rehabilitation (33.93 AC)
- Reestablishment (22.54 AC)

**Streams by Restoration Approach (18,837.51 LF)**

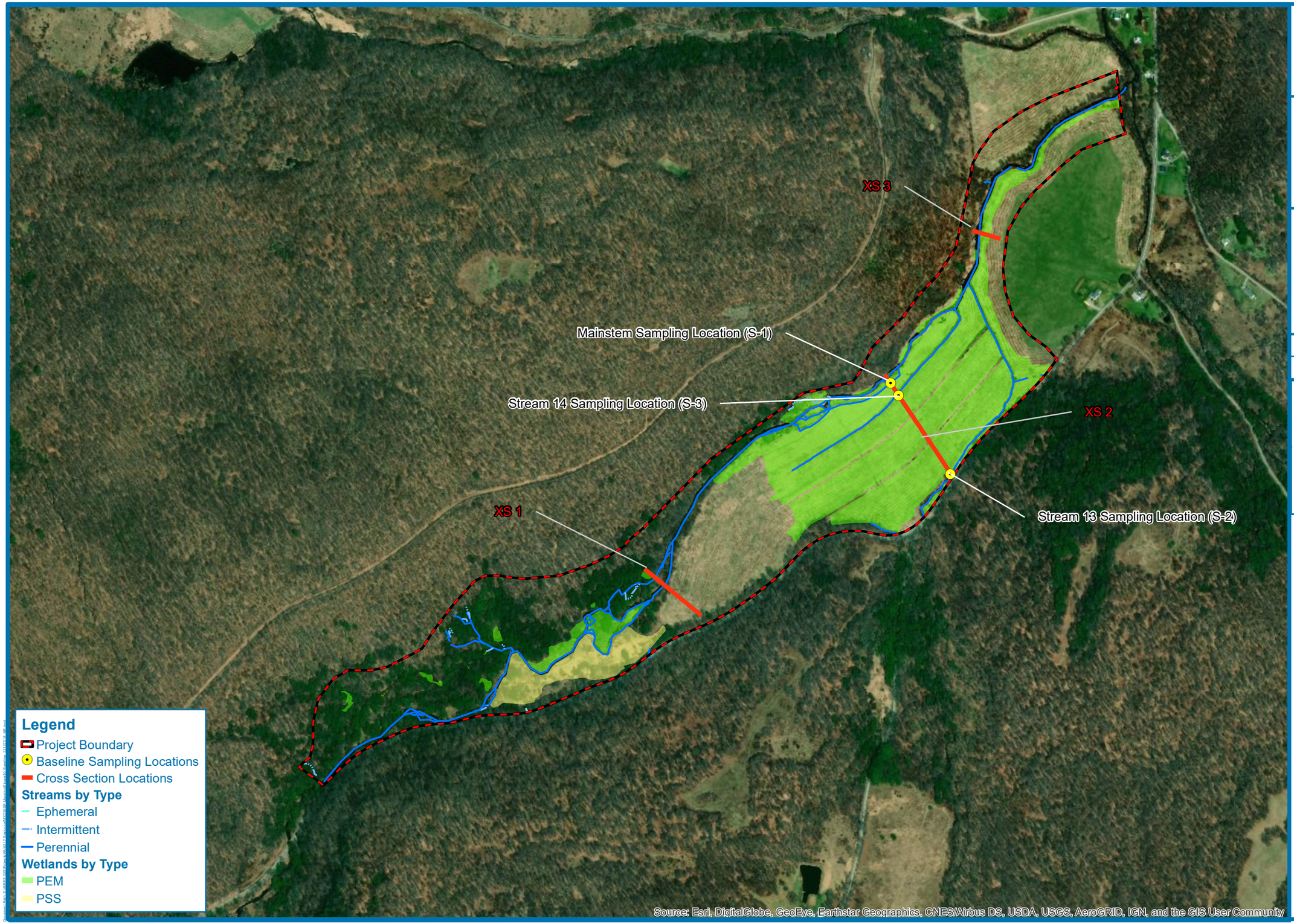
- Preservation (2,518.31 LF)
- Rehabilitation (5,626.15 LF)
- Relocation (10,693.05 LF)

## PROJECT LOCATION



SUSQUEHANNA AND
WAYNE COUNTIES, PA

References.




res

N
W E
S

0 175 350
Feet

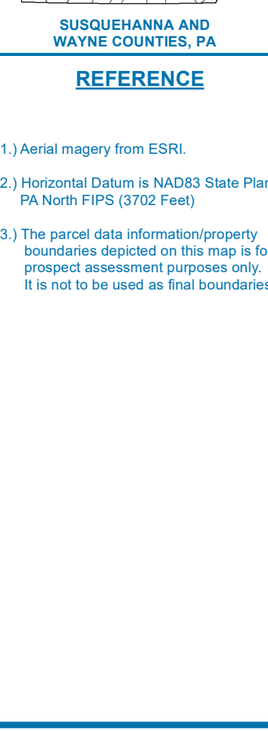
# FIGURE 10

## STARRUCCA CREEK MITIGATION BANK

## BASELINE MONITORING LOCATIONS MAP

| | |
|---|---|
| Date: 1/3/2019 | Drawn by: NR |
| Checked by: SY | |

**PROJECT LOCATION**



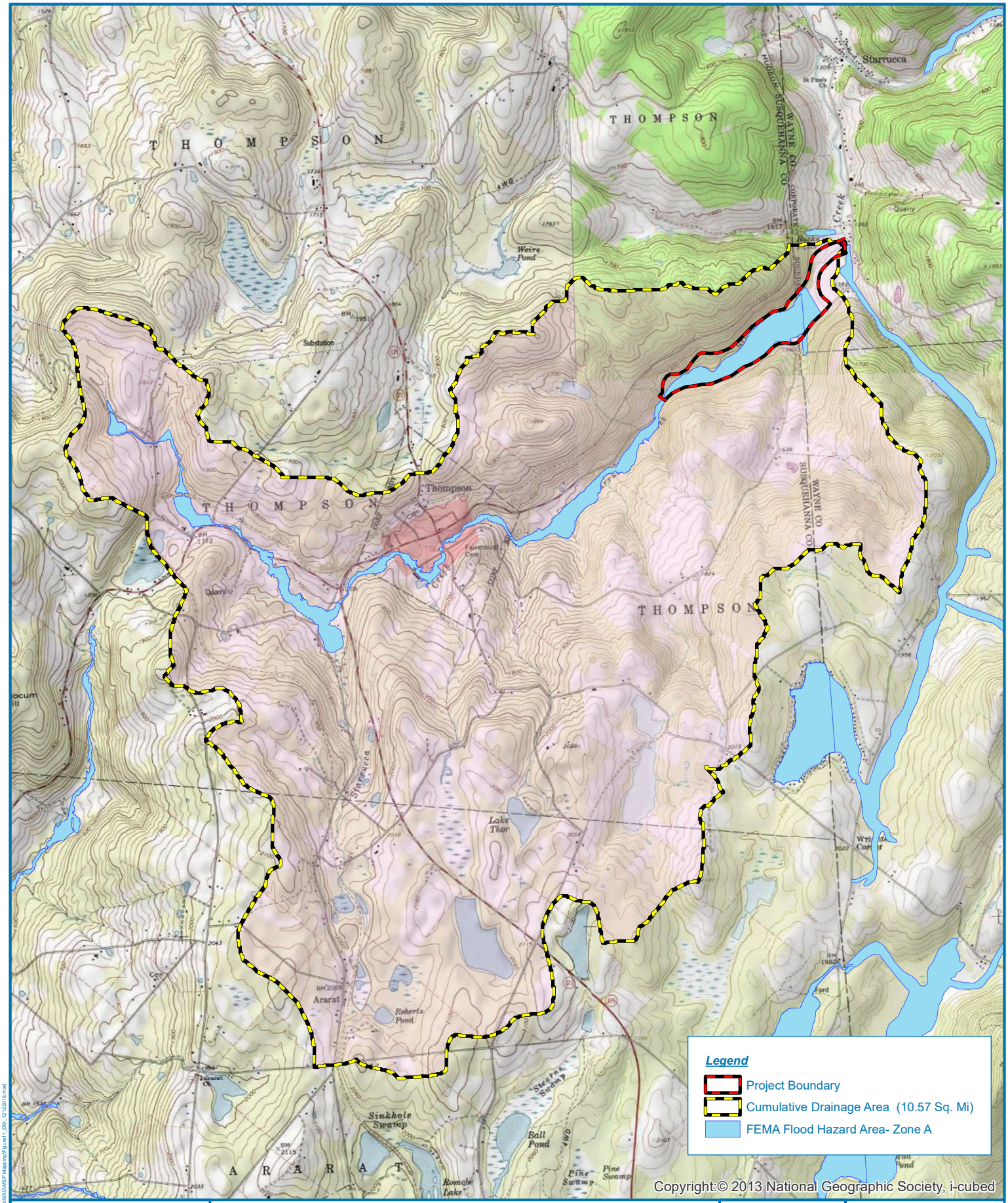
SUSQUEHANNA AND WAYNE COUNTIES, PA

## REFERENCE

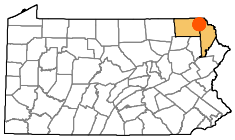
1.) Aerial magery from ESRI.

2.) Horizontal Datum is NAD83 State Plane PA North FIPS (3702 Feet)

3.) The parcel data information/property boundaries depicted on this map is for prospect assessment purposes only. It is not to be used as final boundaries.




**PROJECT LOCATION**



SUSQUEHANNA AND WAYNE COUNTIES, PA

# DRAINAGE AREA AND FEMA MAP
# STARRUCCA CREEK MITIGATION BANK

N W E S

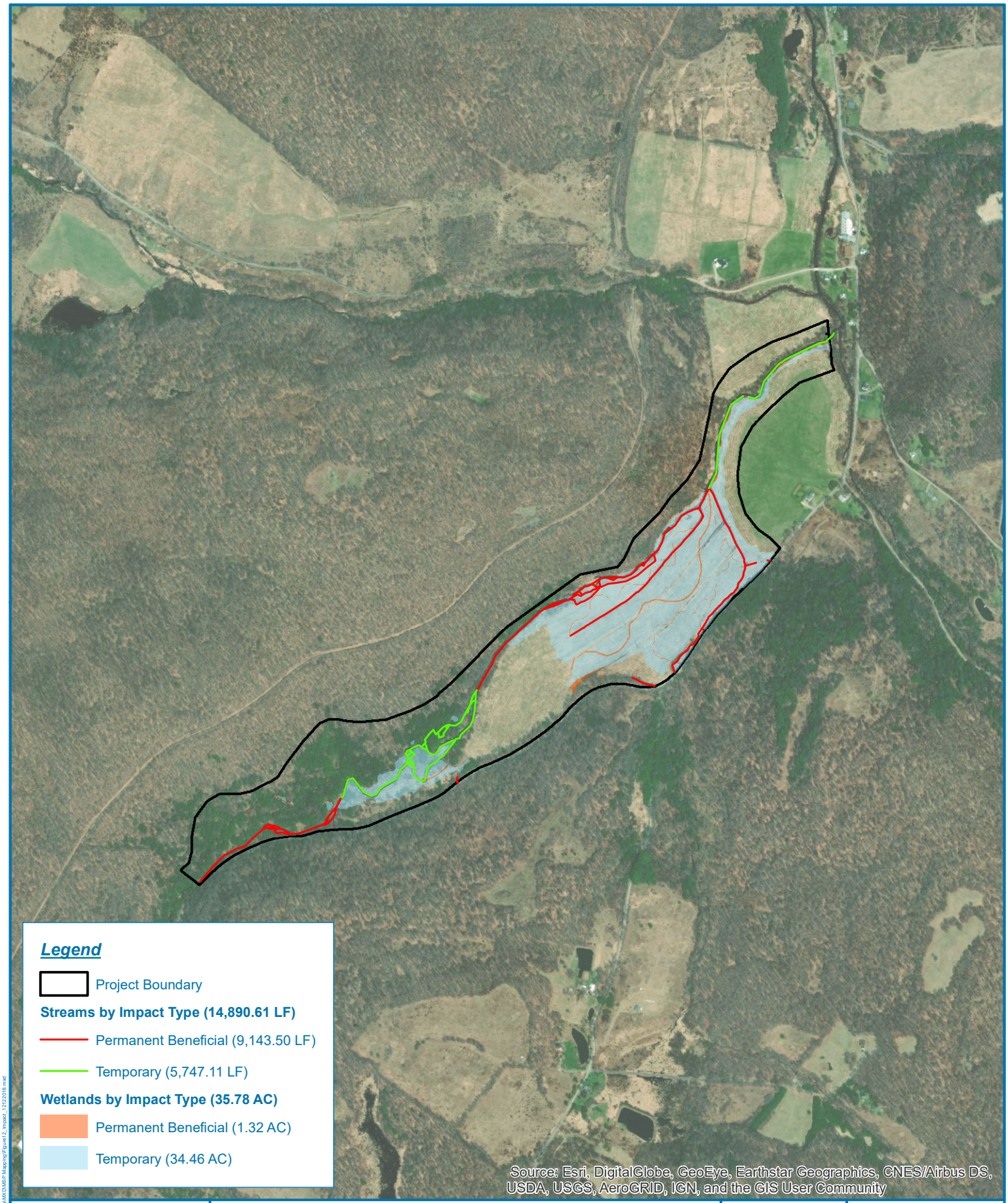
Feet
0 2,500 5,000

**FIGURE 11**

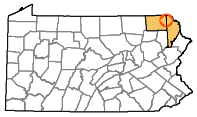
Date: 12/14/2018
Drawn by: NDR
Checked by: SY

res

Document Path: S:\@RES GIS\Projects\PA\0217 Starrucca\MXD\MBP Mapping\Figure11_DM_12122018.mxd




PROJECT LOCATION



SUSQUEHANNA AND WAYNE COUNTIES, PA

# IMPACT LOCATION MAP
# STARRUCCA CREEK MITIGATION BANK

N W E S

0 500 1,000 Feet

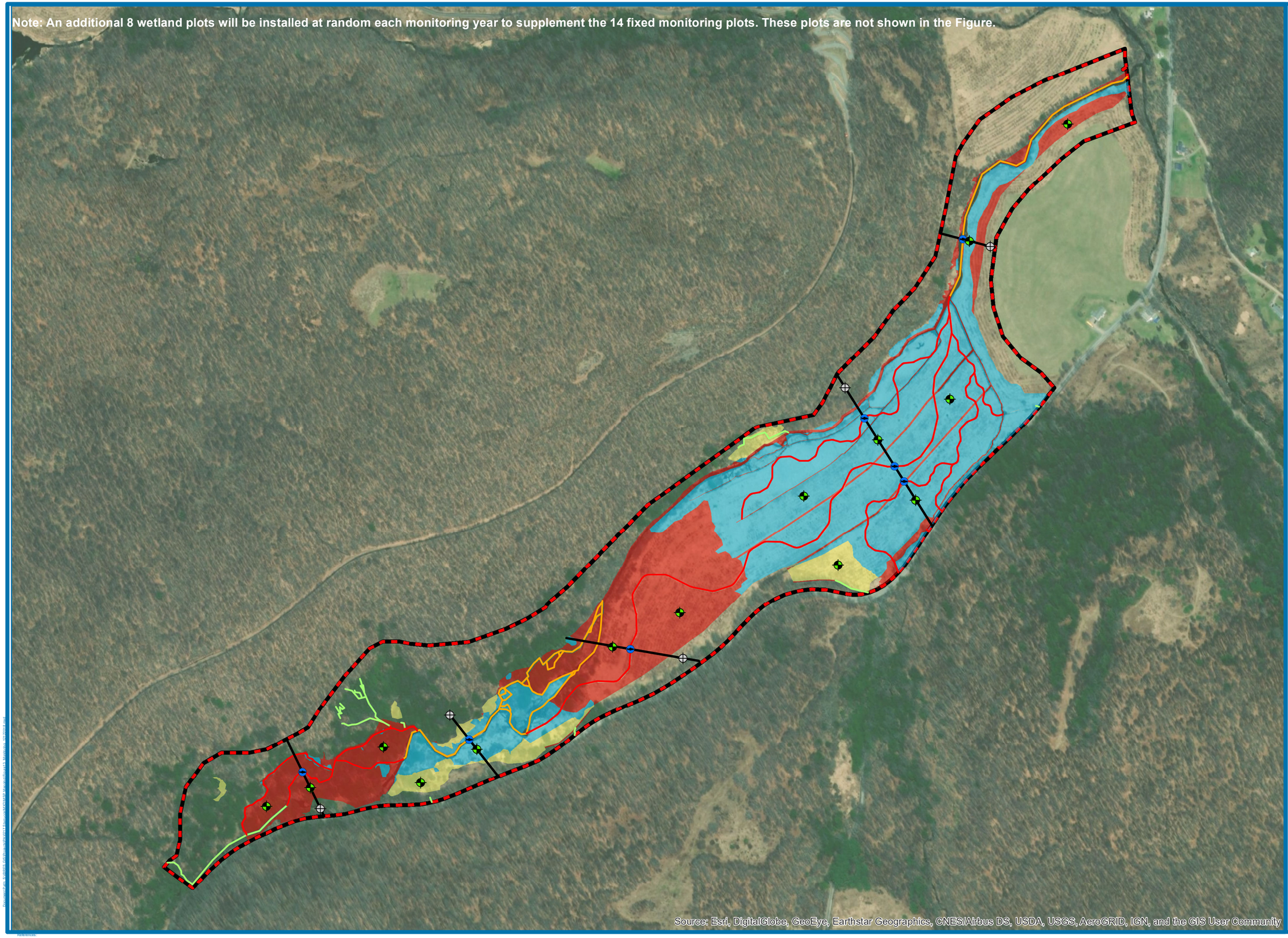
**FIGURE 12**

Date: 12/14/2018
Drawn by: NDR
Checked by: SY

res

Document Path: S:\@RES GIS\Projects\PA\0217 Starrucca\MXD\MBP Mapping\Figure12_Impact_1212018.mxd

Note: An additional 8 wetland plots will be installed at random each monitoring year to supplement the 14 fixed monitoring plots. These plots are not shown in the Figure.




res

N
W E
S

0 250 500
Feet

# FIGURE 13

Monitoring Location Map
Starrucca Creek Mitigation Bank

| Date: 6/24/2019 | Drawn by: NDR |
|---|---|
| Checked by: SY | Project No.: 0217 |

## LEGEND

**Proposed Monitoring Stations**

- Stream
- Wetland
- Upland
- Proposed XS Locations
- Project Boundary

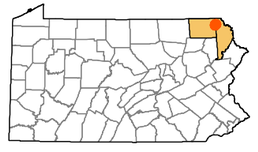
**Wetlands by Restoration Approach (60.65 AC)**

- Enhancement (4.18 AC)
- Rehabilitation (33.93 AC)
- Reestablishment (22.54 AC)

**Streams by Restoration Approach (18,837.51 LF)**

- Preservation (2,518.31 LF)
- Rehabilitation (5,626.15 LF)
- Relocation (10,693.05 LF)

## PROJECT LOCATION



SUSQUEHANNA AND WAYNE COUNTIES, PA

References:

# APPENDIX B
# SITE PROTECTION INSTRUMENT

# DECLARATION OF RESTRICTIVE COVENANT FOR CONSERVATION

This DECLARATION OF RESTRICTIVE COVENANTS FOR CONSERVATION ("Declaration") is made and entered into as of [date] by and between FIRST PENNSYLVANIA RESOURCE, L.L.C., a Pennsylvania limited liability company, with a business address at 33 Terminal Way, Pittsburgh, PA 15219 ("Grantee") and_____, an [individual/ corporation/other organization] with a mailing address at [_____] ("Grantor").

## RECITALS

WHEREAS, Grantor owns certain real estate located in _____ County(ies), Pennsylvania, consisting of _____ acres, more or less, as described more specifically in **Exhibit A** hereto (the "Property"); and

WHEREAS, Grantee is a Pennsylvania company in the business of stream and wetland mitigation in the Commonwealth of Pennsylvania; and

WHEREAS, the Grantor has agreed to make a _____ acre portion of the Property, delineated in **Exhibit B**, where certain [stream and/or] wetland resources exist or may be created and/or enhanced (the "Conservation Area"), subject to this Declaration; and

WHEREAS, the Grantor agrees to the creation of the Conservation Area described herein and intends that the Conservation Area shall be preserved and maintained in perpetuity in an enhanced or natural condition, which will include functioning [streams and/or] wetlands; and

WHEREAS, the Conservation Area, or a portion thereof, is intended to be used in the future as mitigation for impacts to waters of the United States and/or waters of the Commonwealth of Pennsylvania authorized under U.S. Army Corps of Engineers ("Corps" to include any successor agency) or Pennsylvania Department of Environmental Protection ("PADEP" to include any successor agency) permit(s). Before, or at the time a Corps or PADEP permit or verification or a Mitigation Banking Instrument approves using this Conservation Area as mitigation: (1) the Mitigation Plan approved/required by such permit or Banking Instrument must contain a legal description of the portion of the Conservation Area to be used as mitigation or a Mitigation Bank; and (2) Grantee must record an addendum to this Declaration containing a legal description of the portion of the Conservation Area associated with each permit or Mitigation Bank, which references the applicable Corps and/or PADEP permit/verification number(s) or Mitigation Bank Site Name and any associated Corps/PADEP authorization/approval number(s). A form of the addendum to be used is attached to this Declaration as **Exhibit C**; and

WHEREAS, in recognition of the continuing benefit to the Property, and for the protection of waters of the United States and scenic, resource, environmental, and general property values, the Grantor and Grantee have agreed to place certain restrictive covenants on the Property, in order that the Conservation Area shall remain substantially in its natural condition forever; and

WHEREAS, the Grantor and Grantee agree and acknowledge that this Declaration, including the rights authorized to Grantee herein, shall be assignable and transferrable to Grantee's subsequent heirs, successors, and assigns, [if Holder known: including the _____]; and

[If Holder known: WHEREAS, the _____, a 501(c)(3) tax-exempt entity registered with the Bureau of Charitable Organizations of the Pennsylvania Department of State, is a holder of this Declaration] and

WHEREAS, this Declaration is constructed and covenanted to meet the requirements for conservation easements under the Pennsylvania Conservation and Preservation Easements Act, Act 29 of 2001, and as amended thereafter; and

NOW, THEREFORE, for good and valuable consideration and in consideration of the mutually held interests in enhancement and preservation of the environment, as well as the terms, conditions, and restrictions contained herein, and pursuant to the laws of the Commonwealth of Pennsylvania, Grantor does agree to the following terms and conditions:

## A. PURPOSE

The purpose of this Declaration is:

(1) To preserve, protect, and enhance the native flora, fauna, soils, water table, aquifer, drainage patterns, wetland resources and other related environmental functions and values of the Conservation Area;

(2) To maintain the natural view shed of the Conservation Area in its native, enhanced, scenic and open condition;

(3) To assure that the Conservation Area, including its air space, streams and other aquatic resources on or beneath the Conservation Area, and including, but not limited to, subsurface aquifers, springs, and the water table, will be maintained in perpetuity in its natural condition, as that may be enhanced, as provided herein; and

(4) To prevent any use of the Conservation Area that threatens to or will impair, interfere with, or otherwise negatively affect its natural resource functions and values.

Grantor and Grantee [If known: and Holder] intend and agree that this Declaration will confine the use of the Conservation Area to such activities as are consistent with the purposes set forth herein.

## B. ACCESS

In order to achieve the purposes of this Declaration, the following rights are created in accordance with Pennsylvania law:

(1) The Grantee shall have the right and Grantor acknowledges the right of [the holder(s) of this Declaration,] the Corps, the PADEP, and other government agencies with legal authority to enter upon the Property for purposes related to this Declaration, to inspect the Conservation Area at reasonable times to monitor compliance with this Declaration. Except in cases of a threat of a physical or public safety emergency, such entry shall, when practicable, be upon reasonable prior notice to Grantor or its successors and assigns, and such entry shall not unreasonably interfere with the Grantor's or its successors' and assigns' use and quiet enjoyment of the Property.

(2) The Grantor, Grantee, [holder(s) of this Conservation Declaration,] the Corps, the PADEP and other government agencies with legal authority to enter upon the Property for purposes related to this Declaration, each shall have the right to enter upon the Property to access the Conservation Area at reasonable times and upon prior notice to the Grantor; and upon notice and written approval by the Corps may take appropriate environmental or conservation management measures within the Conservation Area consistent with the terms and purposes of this Declaration, including, but not limited to:

(a) planting of native vegetation (i.e. trees, shrubs, grasses, and forbs); and
(b) restoring, altering or maintaining the topography, hydrology, drainage, structural integrity, streambed(s), streambank(s), water quantity, water quality, any relevant feature of a stream, wetland, water body, or vegetative buffer within the Conservation Area.

(3) The Grantor and Grantee, [holder(s) of this Declaration], the Corps, PADEP, and other government agencies with legal authority to enter upon the Property for purposes related to this Declaration, shall each have the right to enforce the terms of this Declaration by appropriate legal proceedings in accordance with applicable law so as to prevent any activity on or use of the Property that is inconsistent with the purposes of this Declaration and to require the restoration of such areas or features of the Conservation Area that may be impaired or damaged by an inconsistent activity or use.

## C. DURATION

This Declaration shall remain in effect in perpetuity, shall run with the land regardless of ownership or use, and is binding upon and shall inure to the benefit of the Grantor and Grantee's [if known – and holder's] heirs, executors, administrators, successors, representatives, devisees, and assigns, as the case may be, as long as said party shall have any interest in any portion(s) of the Conservation Area.

## D. RESTRICTIONS

Any activity in or use of the Conservation Area that is inconsistent with the purposes of this Declaration by the Grantor; subsequent property owner(s); and the personal representatives, heirs, successors, and assigns of either the Grantor or subsequent property owner(s), is prohibited. Without limiting the generality of the foregoing, and except when an approved purpose under B.(2) above, or as necessary to accomplish mitigation approved under the any permit(s) reliant upon this Declaration, the following activities and uses are expressly prohibited in, on, over, or under the Conservation Area, subject to the express terms and conditions below:

(1) **Structures**. The construction of man-made structures including, but not limited to, the construction, removal, placement, preservation, maintenance or alteration of any buildings, roads, utility lines, billboards, or other advertising. This restriction does not include deer stands, bat boxes, bird nesting boxes, bird feeders, duck blinds, and the placement of signs for safety purposes or boundary demarcation.

(2) **Demolition**. The demolition of fencing structures constructed by the Grantee for the purpose of demarcation of the Conservation Area or for public safety.

(3) **Soils**. The removal, excavation, disturbance, or dredging of soil, sand, peat, gravel, or aggregate material of any kind; or any change in the topography of the land, including any discharges of dredged or fill material, ditching, extraction, drilling, driving of piles, mining or excavation of any kind.

(4) **Drainage**. The drainage or disturbance of any aquifer, the surface water level or the water table.

(5) **Waste or Debris**. The storage, dumping, depositing, abandoning, discharging, or releasing of any gaseous, liquid, solid, or hazardous waste substance, materials or debris of whatever nature on, in, over, or underground or into surface or ground water.

(6) **Non-Native Species**. The planting or introduction of non-native or invasive species.

(7) **Herbicides, Insecticides, and Pesticides**. The use of herbicides, insecticides, or pesticides, or other chemicals, except for as may be necessary to control invasive species that threaten the natural character of the Conservation Area. State-approved municipal application programs necessary to protect public health and welfare are not included in this prohibition.

(8) **Removal of Vegetation**. The mowing, cutting, pruning, removal; disturbance, destruction, or collection of any trees, shrubs, or other vegetation, except for pruning, cutting or removal for:

a) safety; or
b) control in accordance with accepted scientific forestry management practices for diseased or dead vegetation; or
c) control of non-native species and noxious weeds; or
d) scientific nature study.

(9) **Agricultural Activities**. Unless currently used for agricultural or similarly related purposes, the conversion of, or expansion into, any portion of the Conservation Area for use of agricultural, horticultural, aquacultural, silvicultural, livestock production or grazing activities. This prohibition also includes conversion from one type of these activities to another (e.g. from agricultural to silvicultural).

(10) **Subdivision of Conservation Area**. Subdivision of real property within the Conservation Area into multiple parcels.

(11) **Other**. Other acts, uses, excavation, or discharges, which adversely affect fish or wildlife habitat or the preservation of lands, waterways, or other aquatic resources mentioned herein and located within the Conservation Area.

## E. INSPECTION, ENFORCEMENT AND ACCESS RIGHTS

As set forth in Section B, above, the Grantee, holder(s) of this Declaration, the Corps, PADEP and other government agencies with legal authority to enter upon the Property for purposes related to this Declaration have the right to enter the Property to observe the Conservation Area and to take actions necessary to verify compliance with and to enforce this Declaration. When practicable, such entry shall be upon prior reasonable notice to the property owner. No violation of this Declaration shall result in a forfeiture or reversion of title. In any enforcement action, an enforcing agency shall be entitled to a complete restoration for any violation, as well as other authorized judicial remedies such as civil penalties. Nothing herein shall be interpreted to limit the right of the Corps to modify, suspend, or revoke any permit issued or authorized by Corps.

## F. RECORDING AND EXECUTION BY PARTIES

Within thirty (30) calendar days of execution of this Agreement, the Grantee shall record this Declaration in the County office where land records are retained and shall provide proof of recordation to Grantor, the Corps, and PADEP within ten (10) business days of execution. Further, if anticipated activities in the Conservation Area are agreed upon for future phases of the site, as set forth in Section H (Reserved Rights) herein, the Grantee must submit plans to the Corps and PADEP for review and approval prior to any work in the Conservation Area.

## G. NOTICE OF TRANSFER OF PROPERTY INTERESTS

No transfer of the rights set forth in this Declaration, or action to void or modify this Declaration, including transfer of title to or establishment of any other legal claims over the Conservation Area or the underlying Property it occupies, shall occur without sixty (60) calendar days' prior written notice to the Corps and the PADEP.

## H. RESERVED RIGHTS

(1) This Declaration will not prevent the Grantor, or any subsequent owner of the Property and/or portions of the Property, from making use of the area(s) outside of the Conservation Area or from uses that are consistent with the purposes of this Declaration, including, but not limited to the following:

(a) **Existing Agreements**. Uses that Grantor is required to allow under valid, existing, recorded agreements are permitted, to the extent they do not interfere with, threaten, or degrade the Conservation Area and only to the extent they are consistent with the purposes of this Declaration. The Grantor[, holder(s) hereof,] and any holders of easements or other property rights for the operation and maintenance of pre-existing or project-related structures or infrastructure, such as roads, utilities, drainage ditches, or stormwater facilities that are present on, over, or under the Conservation Area, reserve the right, within the terms and conditions of their permits, agreements, and the law, to continue with such operation and maintenance. All pre-existing or approved project-related structures or infrastructure, if any, shall be shown on the accompanying plat map or approved plan and attached to this Declaration as **Exhibit D**.

(b) **Subsequent Agreements Allowing Subsurface Activity**. Subject to review by Grantee [if holder known – and holder of this Declaration], and only to the extent they are consistent with the purposes of this Declaration, agreements for the extraction of natural gas (regardless of source) or oil, and injection or release of water and other substances to facilitate such extraction, but excluding injection wells subject to state or federal underground injection control programs. The activities subject to such agreement may only occur at subterranean depths at which there can be no impairment of or detectable impact to water quality or quantity, native flora, fauna, soils, water table, aquifer, drainage patterns, and other related environmental functions and values of the Property, or on other resources described in this Declaration. No surface activities or uses, incident to such extraction are permitted in the Conservation Area. Grantor and Grantee shall provide the Corps and PADEP notice of Grantor's intent to enter into an agreement allowing subsurface activities at least sixty (60) days prior to executing the agreement.

(2) If the success of a compensatory mitigation project required or authorized by the Corps and PADEP requires any related or unanticipated infrastructure modifications, utility relocation, drainage ditches, or stormwater controls within the identified Conservation Area, or if a situation requires measures to remove threat to life or property within the identified Conservation Area, said activities must be approved in writing by the Corps and PADEP subject to terms and conditions set forth in the written approval. Approval is subject to the Corps's and PADEP's discretion. If approved, said activities must be identified on an amended **Exhibit D** and must be recorded and specifically noted as an "amendment" and copies of the recorded **Amended Exhibit D** must be provided to the Corps and PADEP within sixty (60) days of Corps approval. Approval of said activity by the Corps is in addition to any Clean Water Act, Section 404 permit, or other authorization, which may be required in order to legally implement said activity. The Grantor and Grantee accept the obligation to place any other and/or subsequent responsible party on reasonable prior notice of their need to request such Corps approval.

(3) **Enhancements, Maintenance and Repair**. This Declaration is not intended to prohibit future necessary or desired maintenance, repair, or enhancements to the

Property, where such actions are approved by the Corps and PADEP as appropriate, either through an approved mitigation plan (Section K below) or by a separate permit.

[I. The Grantor has mortgaged the Property subject to this Declaration. The lender has executed Subordination of Mortgage instruments related to the parcels subject of this Declaration for the sole purpose of subordinating their respective liens, dignity and priority interests to this Declaration. The executed Subordination of Mortgage instruments are attached hereto as **Exhibit E**: Mortgage Subordination Documents, and incorporated fully herein.]

J. **SEVERABILITY**

If any portion of this Declaration, or the application thereof to any person or circumstance, is found to be invalid, the remainder of the provisions of this instrument, or application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

K. **MITIGATION**

If the work required by a mitigation plan approved by the Corps and PADEP, including maintenance or remedial work, occurs within the Conservation Area, then the Grantee is allowed to construct and undertake the mitigation work in accordance with an authorized mitigation plan.

L. **ASSIGNMENT**

The Grantee [If Holder exists: and/or Holder each] is authorized to assign or transfer its rights and obligations under this Declaration to an organization that is a qualified organization under Section 170(h) of the Internal Revenue Code at the time of transfer.

M. **COAL RIGHTS NOTICE**

The following notice is given to and accepted by Grantor for the purpose and with the intention of compliance with the requirements of the Pennsylvania Conservation and Preservation Easements Act. Nothing herein shall imply the presence or absence of workable coal seams or the severance of coal interests from the Property.

# NOTICE:

**THIS DECLARATION may impair the development of coal interests including workable coal seams or coal interests which have been severed from the Property.**

IN WITNESS WHEREOF, intending to be legally bound, the Parties have executed this Declaration the day and year first above written.

**GRANTOR**:

_____

WITNESS:

_____

**GRANTEE**:

First Pennsylvania Resource, L.L.C.
a Pennsylvania limited liability company

By: Resource Environmental Solutions, LLC, its sole manager

By: _____
Name: _____
Title: _____

WITNESS:

_____

**HOLDER**:

_____

By: _____

WITNESS:

_____

COMMONWEALTH OF PENNSYLVANIA :
: SS
COUNTY OF _____ :

On _____, before me, a Notary Public for the Commonwealth aforesaid, personally appeared _____, known to me or satisfactorily proven to be the person whose name is subscribed to the within instrument, and acknowledged that he executed the same for the purposes therein contained.

IN WITNESS WHEREOF, I have set my hand and official seal.

_____
Notary Public
My commission expires:
_____

[SEAL]

COMMONWEALTH OF PENNSYLVANIA :
: SS
COUNTY OF _____ :

On _____, before me, a Notary Public for the Commonwealth aforesaid, personally appeared _____, who acknowledged himself/herself to be the _____of the _____known to me or satisfactorily proven to be the person whose name is subscribed to the within instrument, and acknowledged that he executed the same for the purposes therein contained.

IN WITNESS WHEREOF, I have set my hand and official seal.

_____
Notary Public
My commission expires:
_____

[SEAL]

COMMONWEALTH OF PENNSYLVANIA :
: SS
COUNTY OF _____ :

On _____, before me, a Notary Public for the Commonwealth aforesaid, personally appeared _____, who acknowledged himself/herself to be the _____ of Resource Environmental Solutions, LLC, as manager of First Pennsylvania Resource, L.L.C., a Pennsylvania limited liability company, and that s/he, in the capacity set forth above, on behalf of the Grantee, being authorized to do so, executed, in my presence, the foregoing Declaration for the purposes herein contained.

IN WITNESS WHEREOF, I have set my hand and official seal.

_____
Notary Public
My commission expires:
_____

[SEAL]

# APPENDIX C
# REPRESENTATIVE SITE PHOTOGRAPHS

LAYOUT 3: ADDITIONAL IMPACTS. SEVERE BANK EROSION (TOP LEFT). INVASIVE CATTAIL (TOP RIGHT). INVASIVE REED CANARY GRASS AND WETLAND DITCHING (BOTTOM LEFT). ARTIFICIAL DRAINAGES (BOTTOM RIGHT).

LAYOUT 1: PHOTO SERIES OF RIP RAP BANK ARMORING OCCURING THROUGHOUT THE SITE.

LAYOUT 4: VISUAL OVERVIEW PERSPECTIVE OF THE RESTORATION SITE.

LAYOUT 2: PHOTO SERIES OF STREAM DITCHING AND STRAIGHTENING OCCURING THROUGHOUT THE SITE.

# STARRUCCA CREEK REPRESENTATIVE SITE BASELINE PHOTOGRAPHS

# APPENDIX D
# BASELINE DATA

# BASELINE PERFORMANCE SUMMARY TABLE

| Baseline and Performance Summary | | | | | | |
|---|---|---|---|---|---|---|
| **Monitoring Station Name** | **Performance Type** | **Evaluation** | **Baseline value** | **Unit** | **Question** | **Functional Goal Met?** |
| **S-1 (Relocation)** | Hydrologic Interaction | 2D Modeling (2 year) | Little interaction under 2-year flow | - | Modeling area stream and floodplain interaction high? | No |
| | Shear Stress/Energy Dissipation | PSF (100 year) | High shear stress in channel throughout the Project | PSF | Shear stress modeling low? | No |
| | Geomorphic Stability | BEHI Score | Moderate | - | BEHI evaluation low? | No |
| | Hydrologic Interaction | Visual Observation | Low Quality Floodplain Wetlands | - | Well-functioning floodplain wetlands? | No |
| | | | Incised channel little hydrologic interaction with floodplain | - | Hydrologic interaction in root zone? | No |
| | Macroinvertebrates | Aquatic Life-Use Attainment Benchmark | Non-Attaining (Impaired) | - | Aquatic Life-Use Benchmark Attained? | No |
| | Fish | Biological Metrics | H'=1.68, EH=0.81, N=8, High % Tolerant | - | Fish diversity high, even, and non-tolerant? | No |
| | Habitat Evaluation | Qualitative Assessment | 2 (Fast-Shallow/Slow-Deep) | - | EPA velocity/depth regimes diverse? | No |
| | Geomorphic Stability | Visual Observation | Incised Channel, Ditched | - | Horizontal and vertical stability is stable? | No |
| | Large Woody Debris | Volume LWD | 0.006 | m^3/ m^2 | LWD assessment within regional reference (0.0183-0.0236)? | No |
| | Vegetation | Invasive Cover (%) | 20-50 | % | Invasive cover less than 5%? | No |
| | Vegetation | Qualitative Assessment | Reverting agricultural field/wetland complex with non-native grasses and shrubs | - | Mature diverse native plant community? | No |
| **S-2 (Relocation)** | Hydrologic Interaction | 2D Modeling (2 year) | Little interaction under 2-year flow | - | Modeling area stream and floodplain interaction high? | No |
| | Shear Stress/Energy Dissipation | PSF (100 year) | High shear stress in channel throughout the Project | PSF | Shear stress modeling low? | No |
| | Geomorphic Stability | BEHI Score | Moderate | - | BEHI evaluation low? | No |
| | Hydrologic Interaction | Visual Observation | Low Quality Floodplain Wetlands | - | Well-functioning floodplain wetlands? | No |
| | | | Incised channel little hydrologic interaction with floodplain | - | Hydrologic interaction in root zone? | No |
| | Macroinvertebrates | Aquatic Life-Use Attainment Benchmark | Non-Attaining (Impaired) | - | Aquatic Life-Use Benchmark Attained? | No |
| | Fish | Biological Metrics | H'=1.42, EH=0.65, N=9, High % Tolerant | - | Fish diversity high, even, and non-tolerant? | No |
| | Habitat Evaluation | Qualitative Assessment | 2 (Slow-Shallow/Slow-Deep) | - | EPA velocity/depth regimes diverse? | No |
| | Geomorphic Stability | Visual Observation | Incised Channel, Ditched | - | Horizontal and vertical stability is stable? | No |
| | Large Woody Debris | Volume LWD | 0 | m^3/ m^2 | LWD assessment within regional reference (0.0183-0.0236)? | No |
| | Vegetation | Invasive Cover (%) | 20-50 | % | Invasive cover less than 5%? | No |
| | Vegetation | Qualitative Assessment | Reverting agricultural field/wetland complex with non-native grasses and shrubs | - | Mature diverse native plant community? | No |
| **S-3 (Relocation)** | Hydrologic Interaction | 2D Modeling (2 year) | Little interaction under 2-year flow | - | Modeling area stream and floodplain interaction high? | No |
| | Shear Stress/Energy Dissipation | PSF (100 year) | High shear stress in channel throughout the Project | PSF | Shear stress modeling low? | No |
| | Geomorphic Stability | BEHI Score | Moderate | - | BEHI evaluation low? | No |
| | Hydrologic Interaction | Visual Observation | Low Quality Floodplain Wetlands | - | Well-functioning floodplain wetlands? | No |
| | | | Incised channel little hydrologic interaction with floodplain | - | Hydrologic interaction in root zone? | No |
| | Macroinvertebrates | Aquatic Life-Use Attainment Benchmark | Non-Attaining (Impaired) | - | Aquatic Life-Use Benchmark Attained? | No |
| | Fish | Biological Metrics | H'=0.19, EH=0.28, N=2, Low % Tolerant | - | Fish diversity high, even, and non-tolerant? | No |
| | Habitat Evaluation | Qualitative Assessment | 2 (Slow-Shallow/Slow-Deep) | - | EPA velocity/depth regimes diverse? | No |
| | Geomorphic Stability | Visual Observation | Incised Channel, Ditched | - | Horizontal and vertical stability is stable? | No |
| | Large Woody Debris | Volume LWD | 0 | m^3/ m^2 | LWD assessment within regional reference (0.0183-0.0236)? | No |
| | Vegetation | Invasive Cover (%) | 20-50 | % | Invasive cover less than 5%? | No |
| | Vegetation | Qualitative Assessment | Reverting agricultural field/wetland complex with non-native grasses and shrubs | - | Mature diverse native plant community? | No |

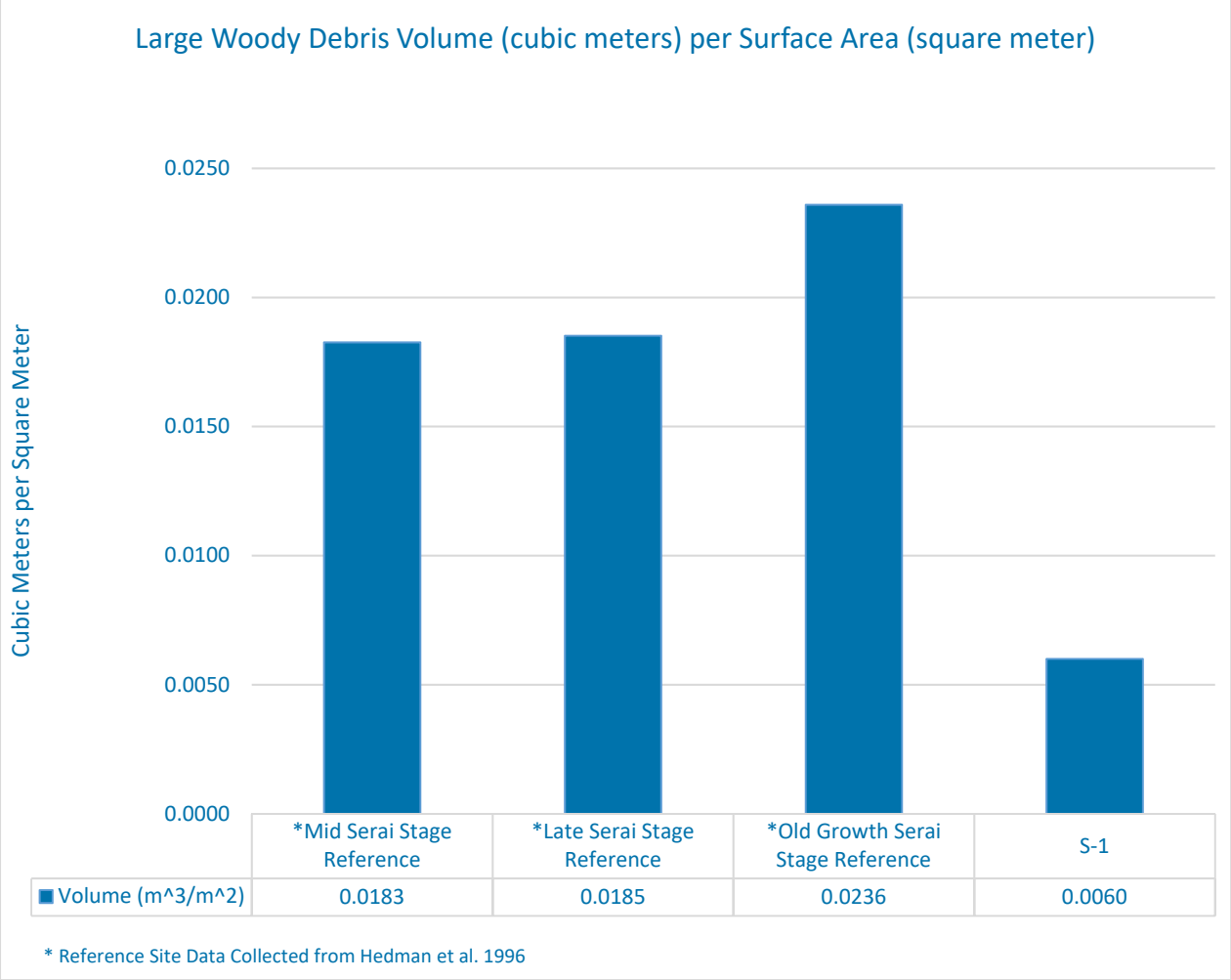
# BANK EROSION HAZARD INDEX (BEHI)

| Measurement | BEHI Summary Table | | |
|---|---|---|---|
| | Starrucca Creek Mitigation Bank | | |
| | Main Stem (S1) | Stream 13 (S2) | Stream 14 (S3) |
| Study Bank Height (ft) = SBH | 4.00 | 3.25 | 4.00 |
| Bankfull Height (ft) = BFH | 3.00 | 1.00 | 1.00 |
| Ratio (SBH/BFH) | 1.33 | 3.25 | 4.00 |
| Index | 4.84 | 10.00 | 10.00 |
| Root Depth (ft) = RD | 2.00 | 3.25 | 4.00 |
| Study Bank Height (ft) = SBH | 4.00 | 3.25 | 4.00 |
| Ratio (RD/SBH) | 0.50 | 1.00 | 1.00 |
| Index | 3.90 | 1.00 | 1.00 |
| Root Density (%) = R% | 80.00 | 90.00 | 90.00 |
| Multiplier R%*(RD/SBH) | 40.00 | 90.00 | 90.00 |
| Index | 5.11 | 1.45 | 1.45 |
| Bank Angle (Degrees) | 95.00 | 80.00 | 80.00 |
| Index | 8.14 | 5.90 | 5.90 |
| Surface Protection (%) | 50.00 | 95.00 | 95.00 |
| Index | 4.32 | 1.23 | 1.23 |
| Bank Material | Silt | Silt | Silt |
| Stratification | None | None | None |
| Location | Straight Reach | Straight Reach | Straight Reach |
| BEHI Value | 26.31 | 19.58 | 19.58 |
| Bank Material Adjustment | 0.00 | 0.00 | 0.00 |
| Stratification Adjustment | 0.00 | 0.00 | 0.00 |
| BEHI Rating | 26.31 | 19.58 | 19.58 |
| Erosion Potential | Moderate | Moderate | Moderate |

# LARGE WOODY DEBRIS (LWD)

# MAIN STEM (S-1) LWD

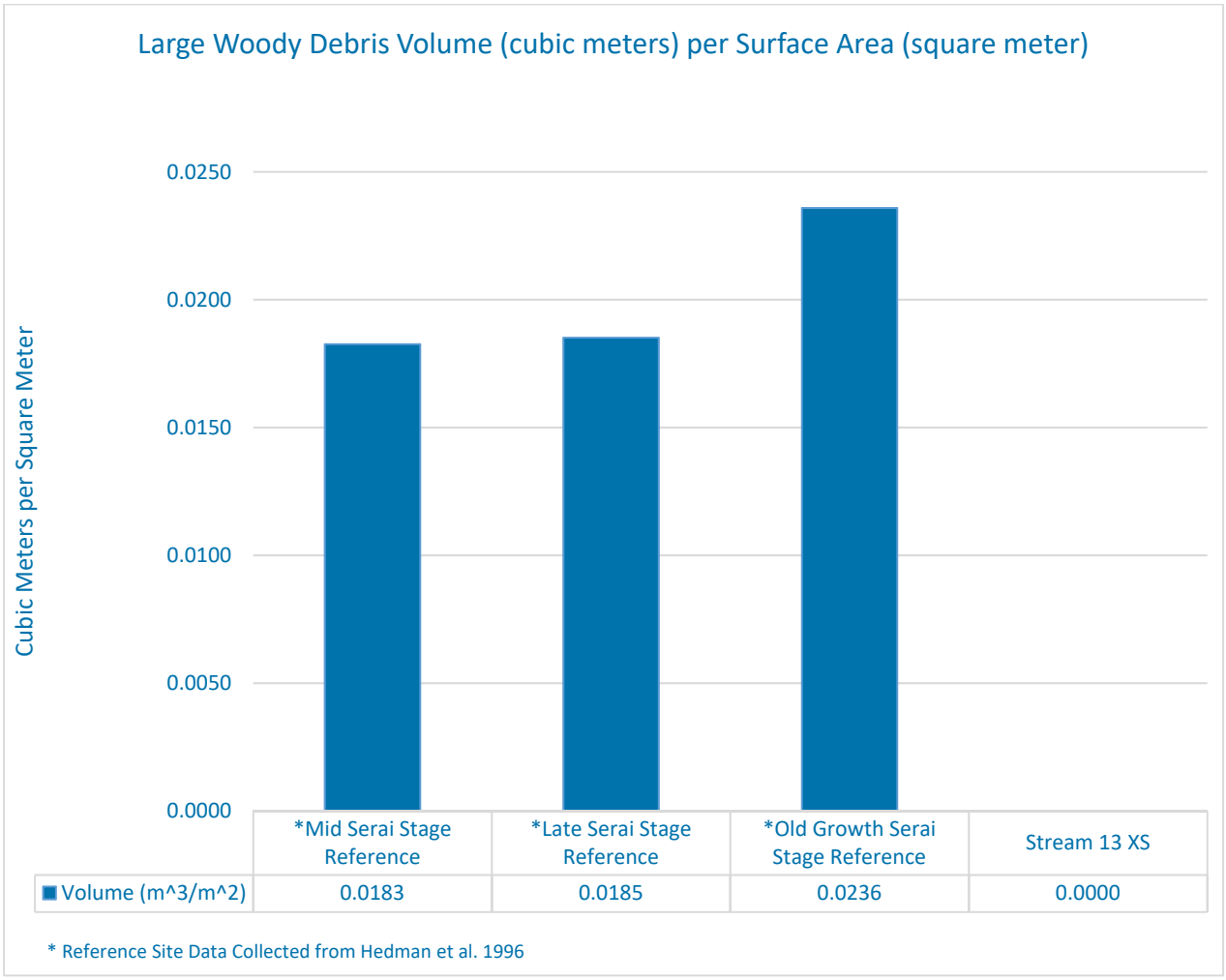
| Large Woody Debris Volume (cubic meter) per Surface Area (square meter) | |
|---|---|
| **Serai Stage** | **Volume (m^3/m^2)** |
| *Mid Serai Stage Reference | 0.0183 |
| *Late Serai Stage Reference | 0.0185 |
| *Old Growth Serai Stage Reference | 0.0236 |
| S-1 | 0.0060 |




* Reference Site Data Collected from Hedman et al. 1996

# STREAM 13 (S-2) LWD

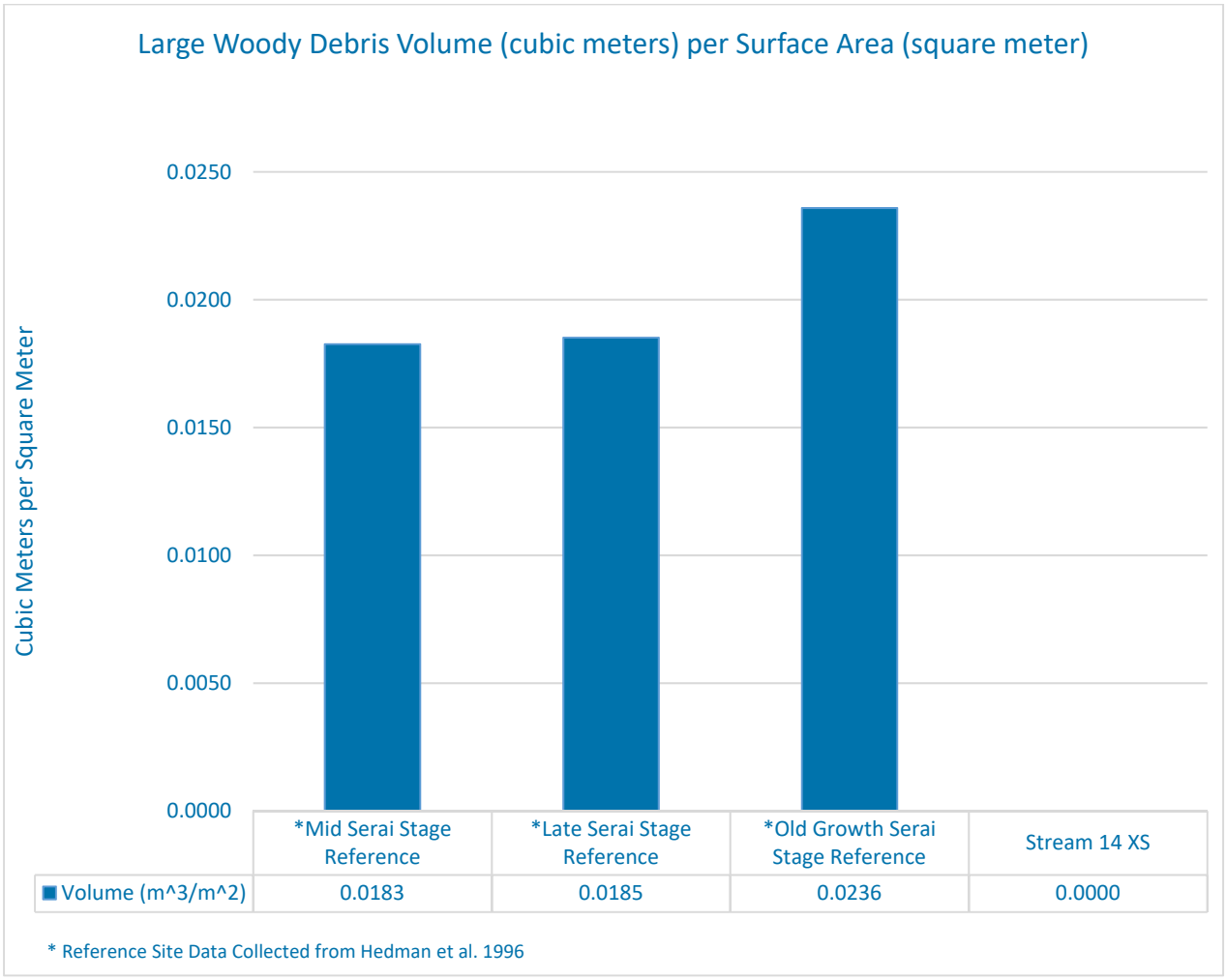
| Large Woody Debris Volume (cubic meter) per Surface Area (square meter) | |
|---|---|
| **Serai Stage** | **Volume (m^3/m^2)** |
| *Mid Serai Stage Reference | 0.0183 |
| *Late Serai Stage Reference | 0.0185 |
| *Old Growth Serai Stage Reference | 0.0236 |
| S-2 | 0.0000 |




* Reference Site Data Collected from Hedman et al. 1996

# STREAM 14 (S-3) LWD

| Large Woody Debris Volume (cubic meter) per Surface Area (square meter) | |
|---|---|
| **Serai Stage** | **Volume (m^3/m^2)** |
| *Mid Serai Stage Reference | 0.0183 |
| *Late Serai Stage Reference | 0.0185 |
| *Old Growth Serai Stage Reference | 0.0236 |
| S-3 | 0.0000 |

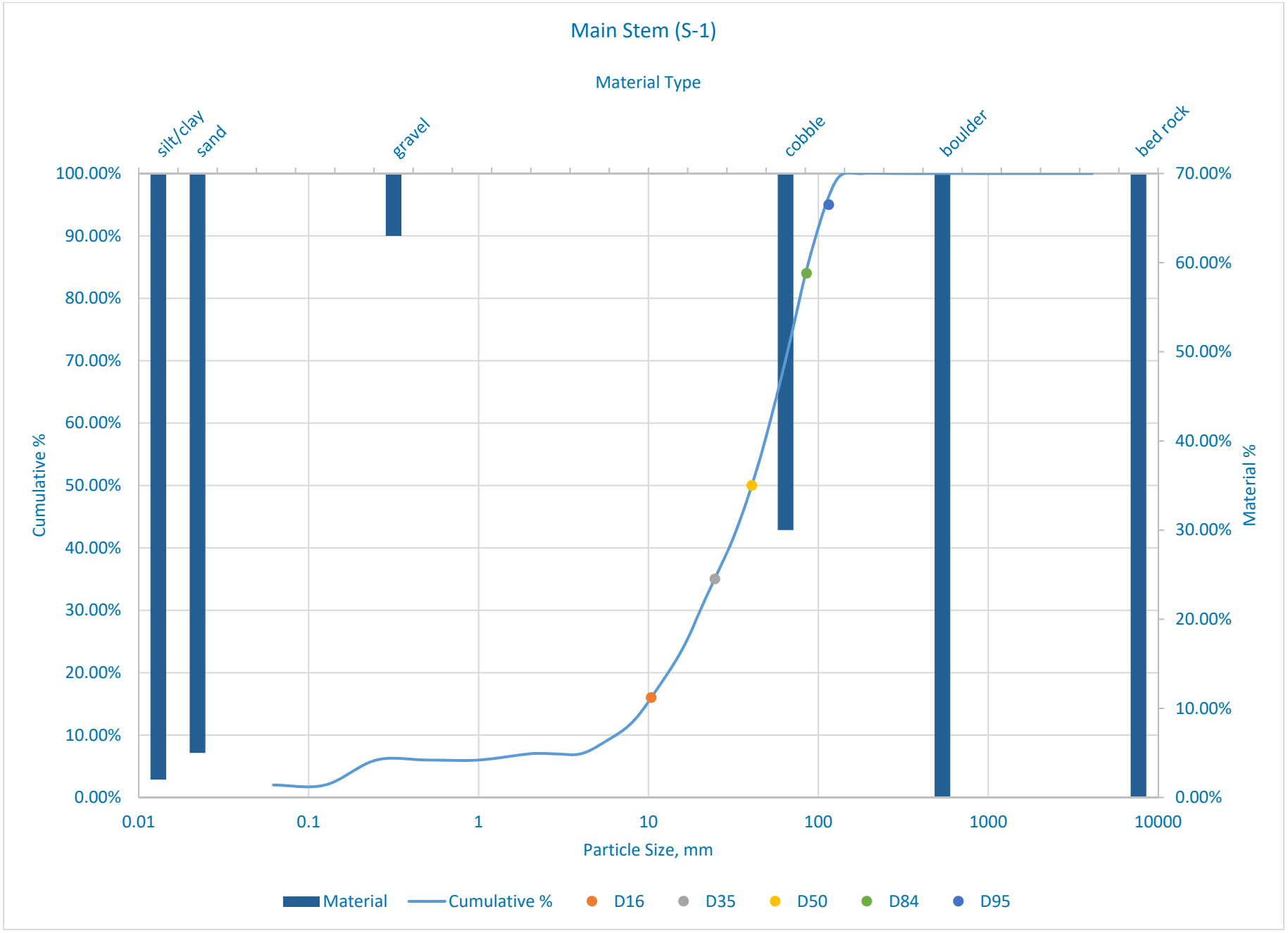



* Reference Site Data Collected from Hedman et al. 1996

# PEBBLE COUNT DATA

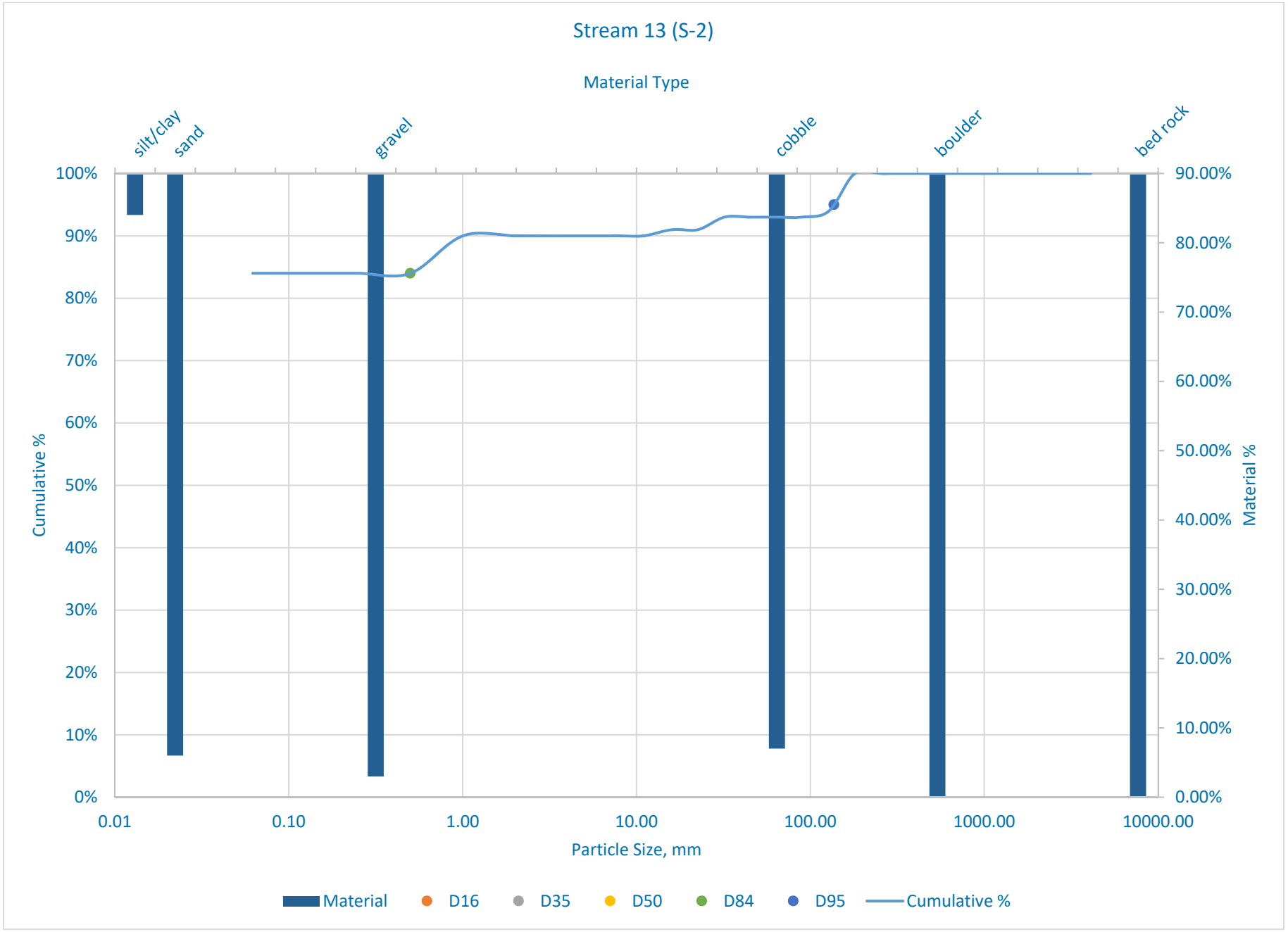
# Main Stem (S-1)

| S-1 Sample 1 n=100 20% Riffle, 20% Pool, 60% Run | | | | | | |
|---|---|---|---|---|---|---|
| **Material** | **Particle** | **Size Range (mm)** | **Count** | **Particle %** | **Cumulative %** | **Size Class %** |
| **silt/clay** | silt/clay | 0.062 | 2.00 | 2.00% | 2.00% | 2.00% |
| **sand** | very fine | 0.125 | 0.00 | 0.00% | 2.00% | 5.00% |
| | fine | 0.25 | 4.00 | 4.00% | 6.00% | |
| | medium | 0.5 | 0.00 | 0.00% | 6.00% | |
| | coarse | 1 | 0.00 | 0.00% | 6.00% | |
| | very coarse | 2 | 1.00 | 1.00% | 7.00% | |
| **gravel** | very fine | 2.8 | 0.00 | 0.00% | 7.00% | 63.00% |
| | | 4 | 0.00 | 0.00% | 7.00% | |
| | fine | 5.6 | 2.00 | 2.00% | 9.00% | |
| | | 8 | 3.00 | 3.00% | 12.00% | |
| | medium | 11 | 5.00 | 5.00% | 17.00% | |
| | | 16 | 7.00 | 7.00% | 24.00% | |
| | coarse | 22.6 | 9.00 | 9.00% | 33.00% | |
| | | 32 | 9.00 | 9.00% | 42.00% | |
| | very coarse | 45 | 12.00 | 12.00% | 54.00% | |
| | | 64 | 16.00 | 16.00% | 70.00% | |
| **cobble** | small | 90 | 17.00 | 17.00% | 87.00% | 30.00% |
| | medium | 128 | 12.00 | 12.00% | 99.00% | |
| | large | 180 | 1.00 | 1.00% | 100.00% | |
| | very large | 256 | 0.00 | 0.00% | 100.00% | |
| **boulder** | small | 362 | 0.00 | 0.00% | 100.00% | 0.00% |
| | | 512 | 0.00 | 0.00% | 100.00% | |
| | medium | 1024 | 0.00 | 0.00% | 100.00% | |
| | large | 2048 | 0.00 | 0.00% | 100.00% | |
| | very large | 4096 | 0.00 | 0.00% | 100.00% | |
| **bed rock** | bed rock | BR | 0.00 | 0.00% | 100.00% | 0.00% |
| **Total** | | | **100** | 100.00% | | |
| **Particle Size Determination** | **Dxx** | **D16** | **D35** | **D50** | **D84** | **D95** |
| | **Size,mm** | 10.40 | 24.69 | 40.67 | 85.41 | 115.33 |


Main Stem (S-1)
Material Type
silt/clay
sand
gravel
cobble
boulder
bed rock
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Cumulative %
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Material %
0.01
0.1
1
10
100
1000
10000
Particle Size, mm
Material
Cumulative %
D16
D35
D50
D84
D95

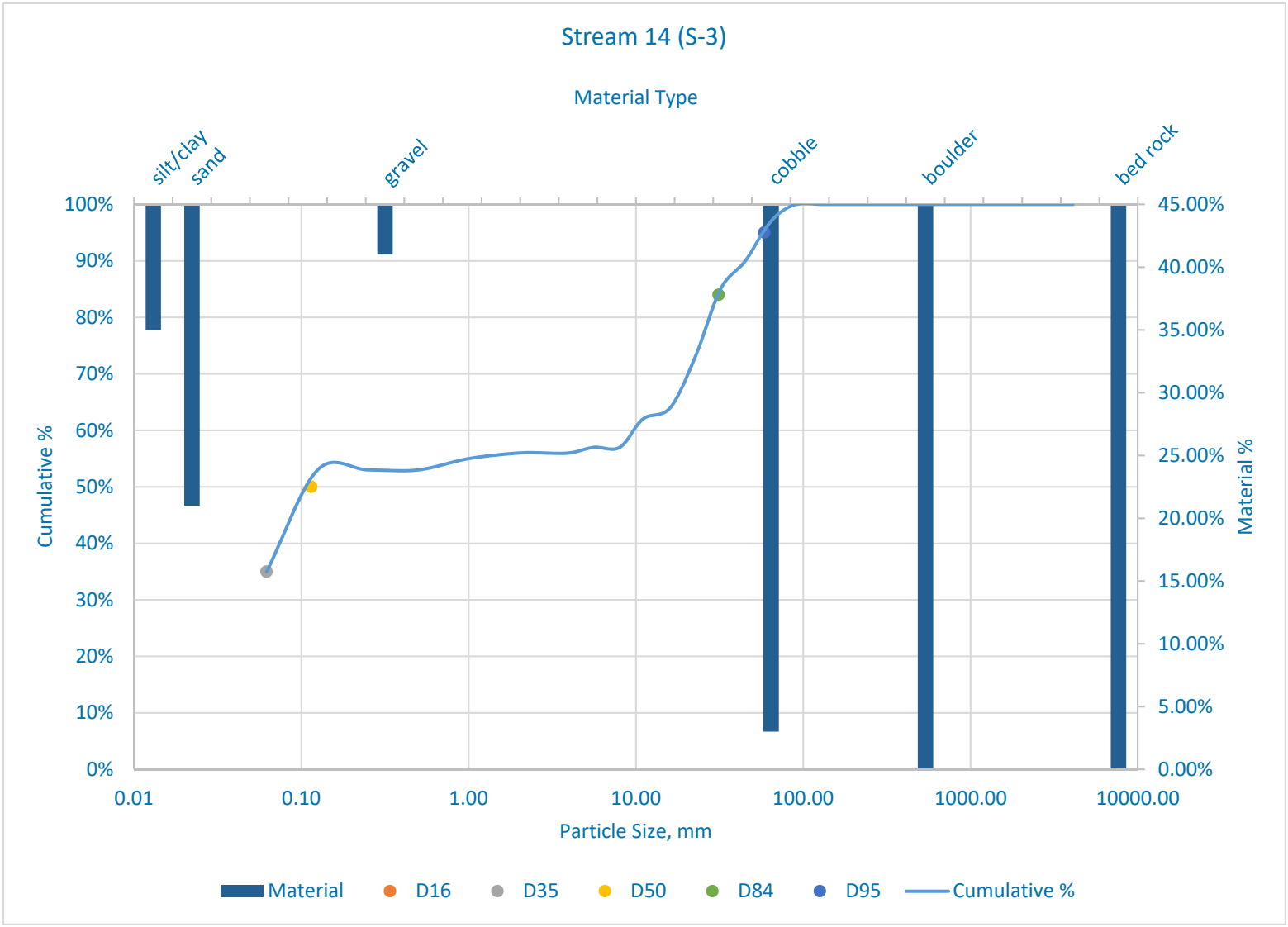
# Stream 13 (S-2)

| S-2 Sample 1 n=100 20% Pool, 80% Run | | | | | | |
|---|---|---|---|---|---|---|
| **Material** | **Particle** | **Size Range (mm)** | **Count** | **Particle %** | **Cumulative %** | **Size Class %** |
| **silt/clay** | silt/clay | 0.062 | 84.00 | 84.00% | 84.00% | 84.00% |
| **sand** | very fine | 0.125 | 0.00 | 0.00% | 84.00% | 6.00% |
| | fine | 0.25 | 0.00 | 0.00% | 84.00% | |
| | medium | 0.5 | 0.00 | 0.00% | 84.00% | |
| | coarse | 1 | 6.00 | 6.00% | 90.00% | |
| | very coarse | 2 | 0.00 | 0.00% | 90.00% | |
| **gravel** | very fine | 2.8 | 0.00 | 0.00% | 90.00% | 3.00% |
| | | 4 | 0.00 | 0.00% | 90.00% | |
| | fine | 5.6 | 0.00 | 0.00% | 90.00% | |
| | | 8 | 0.00 | 0.00% | 90.00% | |
| | medium | 11 | 0.00 | 0.00% | 90.00% | |
| | | 16 | 1.00 | 1.00% | 91.00% | |
| | coarse | 22.6 | 0.00 | 0.00% | 91.00% | |
| | | 32 | 2.00 | 2.00% | 93.00% | |
| | very coarse | 45 | 0.00 | 0.00% | 93.00% | |
| | | 64 | 0.00 | 0.00% | 93.00% | |
| **cobble** | small | 90 | 0.00 | 0.00% | 93.00% | 7.00% |
| | medium | 128 | 1.00 | 1.00% | 94.00% | |
| | large | 180 | 6.00 | 6.00% | 100.00% | |
| | very large | 256 | 0.00 | 0.00% | 100.00% | |
| **boulder** | small | 362 | 0.00 | 0.00% | 100.00% | 0.00% |
| | | 512 | 0.00 | 0.00% | 100.00% | |
| | medium | 1024 | 0.00 | 0.00% | 100.00% | |
| | large | 2048 | 0.00 | 0.00% | 100.00% | |
| | very large | 4096 | 0.00 | 0.00% | 100.00% | |
| **bed rock** | bed rock | BR | 0.00 | 0.00% | 100.00% | 0.00% |
| **Total** | | | **100** | 100.00% | | |
| **Particle Size Determination** | **Dxx** | **D16** | **D35** | **D50** | **D84** | **D95** |
| | **Size,mm** | #N/A | #N/A | #N/A | 0.50 | 136.67 |


Stream 13 (S-2)
Material Type
silt/clay
sand
gravel
cobble
boulder
bed rock
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative %
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Material %
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Particle Size, mm
Material
D16
D35
D50
D84
D95
Cumulative %

# Stream 14 (S-3)

| S-3 Sample 1 n=10% Riffle, 10% Pool, 80% Run | | | | | | |
|---|---|---|---|---|---|---|
| **Material** | **Particle** | **Size Range (mm)** | **Count** | **Particle %** | **Cumulative %** | **Size Class %** |
| **silt/clay** | silt/clay | 0.062 | 35.00 | 35.00% | 35.00% | 35.00% |
| **sand** | very fine | 0.125 | 18.00 | 18.00% | 53.00% | 21.00% |
| | fine | 0.25 | 0.00 | 0.00% | 53.00% | |
| | medium | 0.5 | 0.00 | 0.00% | 53.00% | |
| | coarse | 1 | 2.00 | 2.00% | 55.00% | |
| | very coarse | 2 | 1.00 | 1.00% | 56.00% | |
| **gravel** | very fine | 2.8 | 0.00 | 0.00% | 56.00% | 41.00% |
| | | 4 | 0.00 | 0.00% | 56.00% | |
| | fine | 5.6 | 1.00 | 1.00% | 57.00% | |
| | | 8 | 0.00 | 0.00% | 57.00% | |
| | medium | 11 | 5.00 | 5.00% | 62.00% | |
| | | 16 | 2.00 | 2.00% | 64.00% | |
| | coarse | 22.6 | 9.00 | 9.00% | 73.00% | |
| | | 32 | 12.00 | 12.00% | 85.00% | |
| | very coarse | 45 | 5.00 | 5.00% | 90.00% | |
| | | 64 | 7.00 | 7.00% | 97.00% | |
| **cobble** | small | 90 | 3.00 | 3.00% | 100.00% | 3.00% |
| | medium | 128 | 0.00 | 0.00% | 100.00% | |
| | large | 180 | 0.00 | 0.00% | 100.00% | |
| | very large | 256 | 0.00 | 0.00% | 100.00% | |
| **boulder** | small | 362 | 0.00 | 0.00% | 100.00% | 0.00% |
| | | 512 | 0.00 | 0.00% | 100.00% | |
| | medium | 1024 | 0.00 | 0.00% | 100.00% | |
| | large | 2048 | 0.00 | 0.00% | 100.00% | |
| | very large | 4096 | 0.00 | 0.00% | 100.00% | |
| **bed rock** | bed rock | BR | 0.00 | 0.00% | 100.00% | 0.00% |
| **Total** | | | **100** | 100.00% | | |
| **Particle Size Determination** | **Dxx** | **D16** | **D35** | **D50** | **D84** | **D95** |
| | **Size,mm** | #N/A | 0.06 | 0.11 | 31.22 | 58.57 |


Stream 14 (S-3)
Material Type
silt/clay
sand
gravel
cobble
boulder
bed rock
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cumulative %
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Material %
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Particle Size, mm
Material
D16
D35
D50
D84
D95
Cumulative %

# FISH SURVEY DATA

# Main Stem (S-1) Fish Survey Results

| S-1 Fish Survey Results | | | | |
|---|---|---|---|---|
| ***Scientific Name*** | **Common Name** | **Count** | **Trophic Designation** | **Tolerance** |
| *Cottus bairdi* | Mottled Sculpin | 9 | Insectivore | Intolerant |
| *Etheostoma nigrum* | Johnny Darter | 2 | Insectivore | Intermediate |
| *Exoglossum maxillingua* | Cutlips Minnow | 4 | Insectivore | Intolerant |
| *Luxilus cornutus* | Common Shiner | 3 | Insectivore | Intermediate |
| *Rhinichthys atratulus* | Blacknose Dace | 27 | Generalist | Tolerant |
| *Rhinichthys cataractae* | Longnose Dace | 1 | Insectivore | Intolerant |
| *Salvelinus fontinalis* | Brook Trout | 21 | Piscivore | Intolerant |
| *Semotilus atromaculatus* | Creek Chub | 17 | Generalist | Tolerant |

| S-1 Fish Biologic Indices | | |
|---|---|---|
| **Metric** | **Value** | **Rating** |
| **Species Richness** | 8 | ---------- |
| **Total Individuals** | 84 | ---------- |
| **Percent Piscivore** | 25.00 | ---------- |
| **Percent Herbivore** | 0.00 | ---------- |
| **Percent Omnivore** | 0.00 | ---------- |
| **Percent Insectivore** | 22.62 | ---------- |
| **Percent Generalist** | 52.38 | ---------- |
| **Percent Invertivore** | 0.00 | ---------- |
| **Percent Filter Feeder** | 0.00 | ---------- |
| **Percent Intolerant** | 41.67 | ---------- |
| **Percent Intermediate** | 5.95 | ---------- |
| **Percent Tolerant** | 52.38 | ---------- |
| **Shannon's Diversity Index** | 1.68 | Diverse |
| **Shannon's Evenness Index** | 0.81 | Even |

# Stream 13 (S-2) Fish Survey Results

| S-2 Fish Survey Results | | | | |
|---|---|---|---|---|
| *Ameiurus natalis* | Yellow Bullhead | 1 | Insectivore | Tolerant |
| *Catostomus commersoni* | White Sucker | 8 | Omnivore | Tolerant |
| *Etheostoma nigrum* | Johnny Darter | 6 | Insectivore | Intermediate |
| *Lepomis gibbosus* | Pumpkinseed | 7 | Insectivore | Intermediate |
| *Luxilus cornutus* | Common Shiner | 53 | Insectivore | Intermediate |
| *Notemigonus crysoleucas* | Golden Shiner | 2 | Omnivore | Tolerant |
| *Rhinichthys atratulus* | Blacknose Dace | 11 | Generalist | Tolerant |
| *Salvelinus fontinalis* | Brook Trout | 24 | Piscivore | Intolerant |
| *Semotilus atromaculatus* | Creek Chub | 126 | Generalist | Tolerant |

| S-2 Fish Biologic Indices | | |
|---|---|---|
| **Metric** | **Value** | **Rating** |
| **Species Richness** | 9 | ---------- |
| **Total Individuals** | 238 | ---------- |
| **Percent Piscivore** | 10.08 | ---------- |
| **Percent Herbivore** | 0.00 | ---------- |
| **Percent Omnivore** | 4.20 | ---------- |
| **Percent Insectivore** | 28.15 | ---------- |
| **Percent Generalist** | 57.56 | ---------- |
| **Percent Invertivore** | 0.00 | ---------- |
| **Percent Filter Feeder** | 0.00 | ---------- |
| **Percent Intolerant** | 10.08 | ---------- |
| **Percent Intermediate** | 27.73 | ---------- |
| **Percent Tolerant** | 62.18 | ---------- |
| **Shannon's Diversity Index** | 1.42 | Moderately Diverse |
| **Shannon's Evenness Index** | 0.65 | Moderately Even |

# Stream 14 (S-3) Fish Survey Results

| S-3 Fish Survey Results | | | | |
|---|---|---|---|---|
| ***Scientific Name*** | **Common Name** | **Count** | **Trophic Designation** | **Tolerance** |
| *Cottus bairdi* | Mottled Sculpin | 2 | Insectivore | Intolerant |
| *Salvelinus fontinalis* | Brook Trout | 39 | Piscivore | Intolerant |

| S-3 Fish Biologic Indices | | |
|---|---|---|
| **Metric** | **Value** | **Rating** |
| **Species Richness** | 2 | ---------- |
| **Total Individuals** | 41 | ---------- |
| **Percent Piscivore** | 95.12 | ---------- |
| **Percent Herbivore** | 0.00 | ---------- |
| **Percent Omnivore** | 0.00 | ---------- |
| **Percent Insectivore** | 4.88 | ---------- |
| **Percent Generalist** | 0.00 | ---------- |
| **Percent Invertivore** | 0.00 | ---------- |
| **Percent Filter Feeder** | 0.00 | ---------- |
| **Percent Intolerant** | 100.00 | ---------- |
| **Percent Intermediate** | 0.00 | ---------- |
| **Percent Tolerant** | 0.00 | ---------- |
| **Shannon's Diversity Index** | 0.19 | Poor Diversity |
| **Shannon's Evenness Index** | 0.28 | Uneven |

# MACROINVERTEBRATE SURVEY

# Main Stem (S-1) Macroinvertebrate Survey Results

| S-1 - Sample Length = 100 Meters | | | |
|---|---|---|---|
| ***Scientific Name*** | **Common Name** | **Tolerance Value** | **Count** |
| *Coleoptera Elmidae* | Riffle Beetles | 5 | 20 |
| *Coleoptera Psephenidae* | Water Pennies | 4 | 2 |
| *Diptera Chironomidae* | Non-biting Midges | 6 | 26 |
| *Diptera Tipulidae* | Craneflies | 4 | 17 |
| *Ephemeroptera Baetidae* | Small Minnow Mayflies | 6 | 64 |
| *Ephemeroptera Caenidae* | Small Square-gill Mayflies | 7 | 1 |
| *Ephemeroptera Ephemerellidae* | Spiny Crawler Mayflies | 2 | 8 |
| *Ephemeroptera Heptageniidae* | Flathead Mayflies | 3 | 7 |
| *Ephemeroptera Isonychiidae* | Bush-legged Mayflies | 3 | 5 |
| *Plecoptera Leuctridae* | Rolled-winged Stoneflies | 0 | 10 |
| *Plecoptera Perlidae* | Common Stoneflies | 3 | 8 |
| *Trichoptera Hydropsychidae* | Netspinning Caddisflies | 5 | 30 |
| *Trichoptera Limnephilidae* | Northern Casemaker Caddisflies | 4 | 2 |
| *Trichoptera Philopotamidae* | Fingernet Caddisflies | 3 | 1 |

| S-1 - Sample Length = 100 Meters | | | |
|---|---|---|---|
| **Metric** | **Observed Value** | **Standardized Score** | **Adjusted Score** |
| Total Individuals | 201.00 | - | - |
| Taxa Richness | 14.00 | 42.42 | 42.42 |
| EPT Richness (PTV 0-4) | 7.00 | 36.84 | 36.84 |
| Beck's Index (Version 3) | 4.00 | 10.53 | 10.53 |
| Hilsenhoff Biotic Index | 4.78 | 64.41 | 64.41 |
| Shannon's Diversity Index | 2.11 | 73.80 | 73.80 |
| Percent Sensitive Individuals (PTV 0-3) | 19.40 | 22.96 | 22.96 |
| **IBI Score** | **41.83** | | |
| **BCG 123/BCG 456 Taxa** | **0.71** | | |
| **BCG 123/BCG 456 Individuals** | **0.18** | | |
| **Mayfly Taxa** | **5.00** | | |
| **Mayfly Percent** | **42.29** | | |
| **Aquatic Life Use Attainment Benchmark** | **Impaired** | | |

# Stream 13 (S-2) Macroinvertebrate Survey Results

| S-2 - Sample Length = 100 Meters | | | |
|---|---|---|---|
| ***Scientific Name*** | **Common Name** | **Tolerance Value** | **Count** |
| *Amphipoda Amphipoda* | Scuds | 6 | 32 |
| *Diptera Chironomidae* | Non-biting Midges | 6 | 90 |
| *Ephemeroptera Baetidae* | Small Minnow Mayflies | 6 | 10 |
| *Ephemeroptera Caenidae* | Small Square-gill Mayflies | 7 | 1 |
| *Ephemeroptera Ephemeridae* | Riffle Beetles | 4 | 20 |
| *Ephemeroptera Leptophlebiidae* | Prongilled Mayflies | 4 | 1 |
| *Isopoda Isopoda* | Sow Bugs | 8 | 42 |
| *Odonata Aeshnidae* | Darner Dragonflies | 3 | 1 |
| *Oligochaeta Oligochaeta* | Aquatic Worms | 10 | 2 |
| *Trichoptera Limnephilidae* | Northern Casemaker Caddisflies | 4 | 1 |
| *Trichoptera Phryganeidae* | Giant Casemaker Caddisflies | 4 | 1 |

| S-2 - Sample Length = 100 Meters | | | |
|---|---|---|---|
| **Metric** | **Observed Value** | **Standardized Score** | **Adjusted Score** |
| Total Individuals | 201.00 | - | - |
| Taxa Richness | 11.00 | 33.33 | 33.33 |
| EPT Richness (PTV 0-4) | 4.00 | 21.05 | 21.05 |
| Beck's Index (Version 3) | 0.00 | 0.00 | 0.00 |
| Hilsenhoff Biotic Index | 6.22 | 46.62 | 46.62 |
| Shannon's Diversity Index | 1.54 | 53.71 | 53.71 |
| Percent Sensitive Individuals (PTV 0-3) | 0.50 | 0.59 | 0.59 |
| **IBI Score** | **25.88** | | |
| **BCG 123/BCG 456 Taxa** | **0.14** | | |
| **BCG 123/BCG 456 Individuals** | **0.01** | | |
| **Mayfly Taxa** | **4.00** | | |
| **Mayfly Percent** | **15.92** | | |
| **Aquatic Life Use Attainment Benchmark** | **Impaired** | | |

# Stream 14 (S-3) Macroinvertebrate Survey Results

| S-3 - Sample Length = 100 Meters | | | |
|---|---|---|---|
| ***Scientific Name*** | **Common Name** | **Tolerance Value** | **Count** |
| *Amphipoda Amphipoda* | Scuds | 6 | 35 |
| *Coleoptera Elmidae* | Riffle Beetles | 5 | 1 |
| *Diptera Ceratopogonidae* | Biting Midges | 6 | 1 |
| *Diptera Chironomidae* | Non-biting Midges | 6 | 202 |
| *Ephemeroptera Caenidae* | Small Square-gill Mayflies | 7 | 1 |

| S-3 - Sample Length = 100 Meters | | | |
|---|---|---|---|
| **Metric** | **Observed Value** | **Standardized Score** | **Adjusted Score** |
| Total Individuals | 240.00 | - | - |
| Taxa Richness | 5.00 | 15.15 | 15.15 |
| EPT Richness (PTV 0-4) | 0.00 | 0.00 | 0.00 |
| Beck's Index (Version 3) | 0.00 | 0.00 | 0.00 |
| Hilsenhoff Biotic Index | 6.00 | 49.32 | 49.32 |
| Shannon's Diversity Index | 0.49 | 17.29 | 17.29 |
| Percent Sensitive Individuals (PTV 0-3) | 0.00 | 0.00 | 0.00 |
| **IBI Score** | **13.63** | | |
| **BCG 123/BCG 456 Taxa** | **0.00** | | |
| **BCG 123/BCG 456 Individuals** | **0.00** | | |
| **Mayfly Taxa** | **1.00** | | |
| **Mayfly Percent** | **0.42** | | |
| **Aquatic Life Use Attainment Benchmark** | **Impaired** | | |

# RIVERINE & WETLAND CONDITION ASSESSMENTS

| Riverine and Wetland Condition Index Values | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Resource Type** | **Restoration Type** | **Function** | **Existing Score** | **Existing Condition** | **Post Score** | **Post Condition** | **Existing Condition Index** | **Post Condition Index** | **Condition Index Differential** |
| Streams | Relocation/ Rehabilitation | Channel/Floodplain | 5.00 | Poor | 18.00 | Optimal | 0.25 | 0.90 | 0.65 |
| | | Riparian Vegetation | 9.10 | High Marginal | 18.00 | Optimal | 0.46 | 0.90 | 0.45 |
| | | Riparian ZOI | 10.83 | High Marginal | 15.00 | High Suboptimal | 0.54 | 0.75 | 0.21 |
| | | Habitat | 13.00 | Suboptimal | 18.00 | Optimal | 0.65 | 0.90 | 0.25 |
| | | Channel Alteration | 5.00 | Poor | 18.00 | Optimal | 0.25 | 0.90 | 0.65 |
| | | **Final Condition Index Values** | | | | | **0.43** | **0.87** | **0.44** |
| Wetlands | Reestablishment | WZOI | 0.00 | Low Poor | 18.00 | Optimal | 0.00 | 0.80 | 0.80 |
| | | Roadbed Presence | 0.00 | Low Poor | 16.00 | Low Optimal | 0.00 | 0.60 | 0.60 |
| | | Vegetation Condition | 0.00 | Low Poor | 16.00 | Low Optimal | 0.00 | 0.80 | 0.80 |
| | | Hydrologic Modification | 0.00 | Low Poor | 18.00 | Optimal | 0.00 | 0.90 | 0.90 |
| | | Sediment Stressors | 0.00 | Low Poor | 18.00 | Optimal | 0.00 | 0.90 | 0.90 |
| | | Water Quality Stressors | 0.00 | Low Poor | 18.00 | Optimal | 0.00 | 0.90 | 0.90 |
| | | **Final Condition Index Values** | | | | | **0.00** | **0.82** | **0.82** |
| | Rehabilitation | WZOI | 13.50 | Suboptimal | 18.00 | Optimal | 0.68 | 0.80 | 0.13 |
| | | Roadbed Presence | 12.00 | Low Suboptimal | 16.00 | Low Optimal | 0.60 | 0.60 | 0.00 |
| | | Vegetation Condition | 5.00 | High Poor | 16.00 | Low Optimal | 0.25 | 0.80 | 0.55 |
| | | Hydrologic Modification | 3.00 | Poor | 18.00 | Optimal | 0.15 | 0.90 | 0.75 |
| | | Sediment Stressors | 12.00 | Low Suboptimal | 18.00 | Optimal | 0.60 | 0.90 | 0.30 |
| | | Water Quality Stressors | 8.00 | Marginal | 18.00 | Optimal | 0.40 | 0.90 | 0.50 |
| | | **Final Condition Index Values** | | | | | **0.45** | **0.82** | **0.37** |
| | Enhancement | WZOI | 16.92 | Optimal | 18.00 | Optimal | 0.85 | 0.90 | 0.05 |
| | | Roadbed Presence | 16.00 | Low Optimal | 16.00 | Low Optimal | 0.80 | 0.80 | 0.00 |
| | | Vegetation Condition | 12.00 | Low Suboptimal | 16.00 | Low Optimal | 0.60 | 0.80 | 0.20 |
| | | Hydrologic Modification | 12.00 | Low Suboptimal | 18.00 | Optimal | 0.60 | 0.90 | 0.30 |
| | | Sediment Stressors | 16.00 | Low Optimal | 18.00 | Optimal | 0.80 | 0.90 | 0.10 |
| | | Water Quality Stressors | 15.00 | High Suboptimal | 18.00 | Optimal | 0.75 | 0.90 | 0.15 |
| | | **Final Condition Index Values** | | | | | **0.73** | **0.87** | **0.13** |

# STREAM & WETLAND FUNCTIONAL CREDIT GENERATION

| Riverine and Wetland Functional Credit Generation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Resource Type** | **Resource Classification** | **Resource Value Factor** | **Restoration Type** | **Compensation Value** | **Condition Index Differential** | **Functional Group** | **Area (Acres)** | **Credits Generated** |
| Streams | Recreational Value | 2.00 | Relocation/Rehabilitation | 3.00 | 0.44 | HAB1 | 3.37 | 8.91 |
| | | | | | | BGC1 | 54.89 | 145.14 |
| | | | | | | HYD1 | 48.59 | 128.48 |
| | | | | | | RS1 | 9.67 | 25.57 |
| Wetlands | Exceptional Value | 3.00 | Reestablishment | 3.00 | 0.82 | HAB2 | 22.54 | 165.67 |
| | | | | | | BGC2 | 22.54 | 165.67 |
| | | | | | | HYD2 | 22.54 | 165.67 |
| | | | Rehabilitation | 2.00 | 0.37 | HAB2 | 33.93 | 75.49 |
| | | | | | | BGC2 | 33.93 | 75.49 |
| | | | | | | HYD2 | 33.93 | 75.49 |
| | | | Enhancement | 1.00 | 0.13 | HAB2 | 4.18 | 1.68 |
| | | | | | | BGC2 | 4.18 | 1.68 |
| | | | | | | HYD2 | 4.18 | 1.68 |

| | | | |
|---|---|---|---|
| **Total Functional Credit Generation** | Streams | HAB1 | 8.91 |
| | | BGC1 | 145.14 |
| | | HYD1 | 128.48 |
| | | RS1 | 25.57 |
| | Wetlands | HAB2 | 242.84 |
| | | BGC2 | 242.84 |
| | | HYD2 | 242.84 |

# APPENDIX E
# WETLAND REPORT

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
STATE COLLEGE FIELD OFFICE
1631 SOUTH ATHERTON STREET, SUITE 101
STATE COLLEGE, PA 16801-6260

March 31, 2016

Resource Environmental Solutions, LLC
c/o BluAcres, LLC
Attn: Mr. Chris Clouser
205 McKnight Lane
Williamsburg, PA 16693

Dear Mr. Clouser:

This is in response to your correspondence received November 17, 2015 requesting a jurisdictional determination for a property identified as the Starrucca Creek Mitigation Bank Project, located north of S.R. 4039 (Jackson Street), at latitude 41.879084 N; and longitude -75.4783051 W; located in Starrucca Borough, Wayne County and Thompson Township, Susquehanna County, Pennsylvania (Enclosure 1). The project has been identified as CENAB-OPR-P-2015-01573-P13 (Resource Environmental Solutions, LLC/Starrucca Creek Mitigation Bank).

A field inspection was conducted on November 19, 2015 for the purpose of issuing a preliminary jurisdictional determination. Based on the information you have submitted and the field inspection, it has been determined that the plan(s) prepared by BluAcres, LLC, entitled: "Wetland Delineation – Starrucca Creek Project; Thompson Township, Susquehanna County; Starrucca Borough, Wayne County, Pennsylvania", dated August 7, 2015, last revised December 28, 2015, sheet(s) 1 of 1, depict the extent of waters and/or wetlands within the defined Limit of Delineation/Study Area. These areas may be waters of the United States, including federally regulated wetlands, and may be regulated by this office pursuant to Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899.

This preliminary jurisdictional determination is based on the information included on the enclosed Preliminary Jurisdictional Determination Form (Enclosure 2) and cannot be appealed. Please refer to the Notification of Administrative Appeal Options and Process and Request for Appeal form for your administrative appeal options (Enclosure 3). If you do not agree with the extent of waters and/or wetlands and this preliminary jurisdictional determination, you are hereby advised of your option to request and obtain an approved jurisdictional determination from this office at the address above. An approved jurisdictional determination is an official, written Corps determination stating the presence or absence of jurisdictional waters of the United States and identifies the limits of waters of the Unites States on a project site. An approved jurisdictional determination can be relied upon for a period of 5 years and can be appealed through the Corps' administrative appeal process set out at 33 CFR Part 331.

You are reminded that any grading or filling of waters of the United States, including wetlands, is subject to Department of the Army authorization. State and local authorizations may be required to conduct activities in these locations. Wetlands under the jurisdiction of the Pennsylvania Department of Environmental Protection may be located on the parcel. You may contact the Pennsylvania Department of Environmental Projection for information regarding jurisdiction and permitting requirements at (570) 826-2511. In addition, the Interstate Land Sales Full Disclosure Act may require that prospective buyers be made aware, by the seller, of the federal authority over any waters of the United States, including wetlands, being purchased.

In future correspondence and permit applications regarding this area of review, please include the file number located in the first paragraph of this letter.

A copy of this letter has been sent to the Pennsylvania Department of Environmental Protection Northeast Regional Office, the Wayne County Conservation District Office, the Susquehanna County Conservation District, and Resource Environmental Solutions, LLC, for informational purposes.

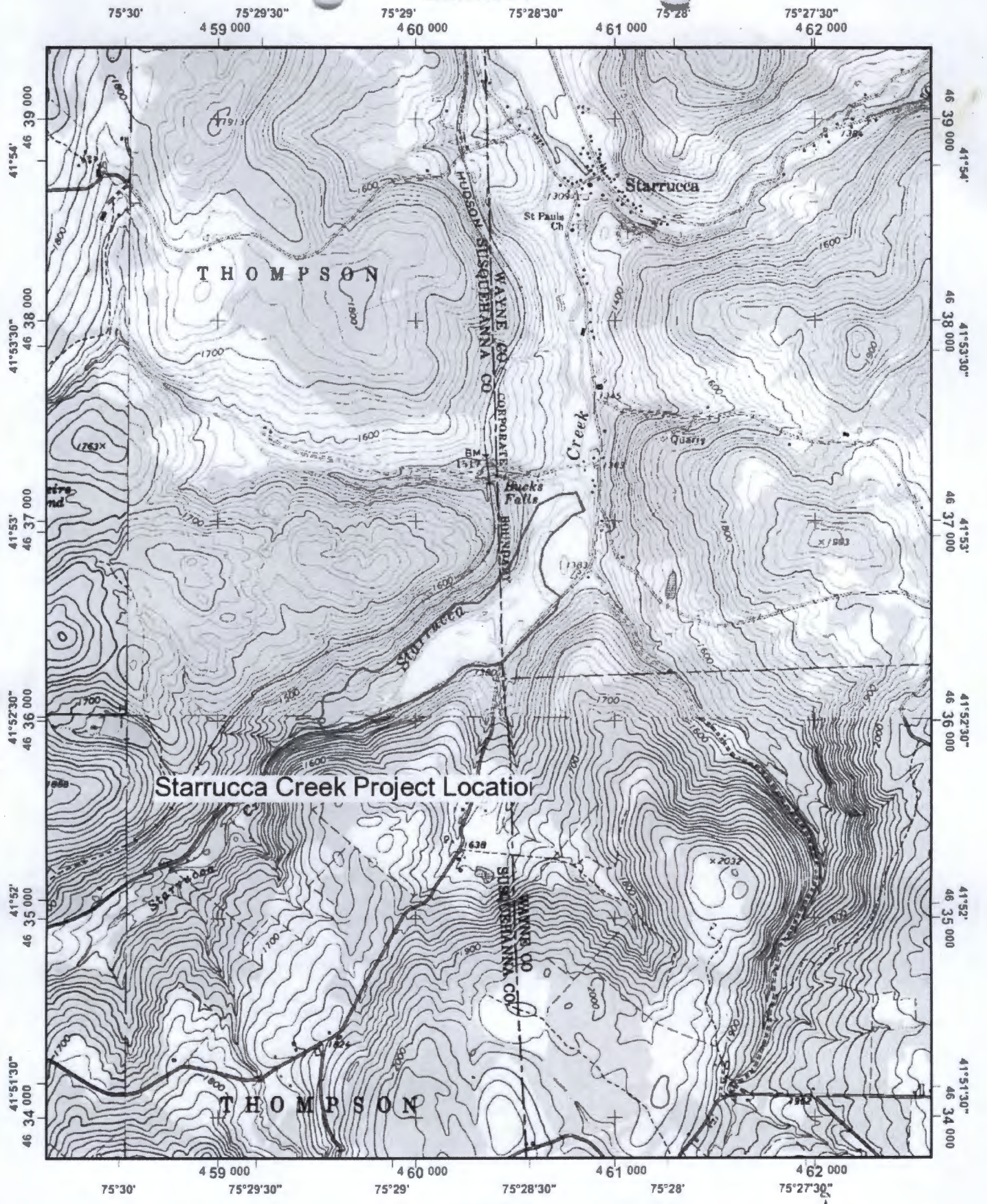
If you have any questions concerning this matter, please call me at (814) 235-0573.

Sincerely,

Amy Elliott
Biologist, Pennsylvania Section
Regulatory Branch

Enclosures

Enclosure 1




1:24000 scale

Universal Transverse Mercator (UTM) Projection Zone 18
North American Datum of 1983
1000 meter UTM / USNG / MGRS
Grid Zone Designation: 18T
100,000-m Squares VM

Magnetic declination of 12W at center of map
on March 17, 2011

**Enclosure 2**

**PRELIMINARY JURISDICTIONAL DETERMINATION FORM**

**BACKGROUND INFORMATION**

**A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD):** March 31, 2016

**B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:**

Resource Environmental Solutions, LLC
c/o BluAcres, LLC
Attn: Mr. Chris Clouser
205 McKnight Lane
Williamsburg, PA 16693

**C. DISTRICT OFFICE, FILE NAME, AND NUMBER:**

Baltimore / NAB-2015-01573-P13 (Resource Environmental Solutions, LLC / Starrucca Creek Mitigation Bank) / Preliminary Jurisdictional Determination.

**D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:**

State: PA
County: Susquehanna & Wayne
Township: Thompson Township & Starrucca Borough
Center coordinates of site: Lat. 41° 52' 43.26" N; Long. -75° 28' 47.91"
Universal Transverse Mercator: N/A
Name of nearest waterbody: Starrucca Creek
Identify (estimate) amount of waters in the review area:
Non-wetland waters: 24,573.5 linear feet (4.65 miles)
Cowardin Class: Riverine
Stream Flow: Perennial, Intermittent, & Ephemeral
Wetlands: 39.04 acres
Cowardin Class: PSS & PEM

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal: N/A
Non-Tidal: N/A

**E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):**

☒ Office (Desk) Determination. Date: March 31, 2016
☒ Field Determination. Date(s): November 19, 2015

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

**SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply** - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: received 11/17/15; 1/19/16; & 3/29/16.

☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

- ☐ Office concurs with data sheets/delineation report.
- ☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☐ U.S. Geological Survey Hydrologic Atlas: .

- ☐ USGS NHD data.
- ☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name:1:24000 Orson, PA & Starrucca, PA.

☒ USDA Natural Resources Conservation Service Soil Survey. Citation:Wayne County Soil Survey & Susquehanna County Soil Survey.

☒ National wetlands inventory map(s). Cite name:Orson, PA & Starrucca, PA .

☐ State/Local wetland inventory map(s): .

☐ FEMA/FIRM maps: .

☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)

☐ Photographs: ☐ Aerial (Name & Date): .

or ☐ Other (Name & Date): .

☐ Previous determination(s). File no. and date of response letter: .

☐ Other information (please specify): .

**IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.**

3/31/16

Signature and date of Regulatory Project Manager (REQUIRED)

Signature and date of person requesting preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

| Site number | Latitude | Longitude | Cowardin Class | Estimated size of wetland, stream, or ditch (AC, LF) | Class of aquatic resource |
|---|---|---|---|---|---|
| Watercourse 1 | 41° 52' 29.25" | 75° 29' 11.89" | Perennial | 153.22 LF | Section 404 – non tidal |
| Watercourse 2 | 41° 52' 28.74" | 75° 29' 12.54" | Intermittent | 62.32 LF | Section 404 – non tidal |
| Watercourse 3 | 41° 52' 30.95" | 75° 29' 07.28" | Perennial | 1238.77 LF | Section 404 – non tidal |
| Watercourse 4 | 41° 52' 35.54" | 75° 29' 00.89" | Perennial | 517.954 LF | Section 404 – non tidal |
| Watercourse 5 | 41° 52' 47.67" | 75° 28' 40.01" | Perennial | 4697.37 LF | Section 404 – non tidal |
| Watercourse 6 | 41° 53' 00.04" | 75° 28' 16.36" | Perennial | 1124.58 LF | Section 404 – non tidal |
| Watercourse 7 | 41° 52' 28.13" | 75° 29' 17.18" | Perennial | 161.58 LF | Section 404 – non tidal |
| Watercourse 8 | 41° 52' 27.75" | 75° 29' 20.39" | Perennial | 1181.93 LF | Section 404 – non tidal |
| Watercourse 9 | 41° 52' 25.43" | 75° 29' 27.04" | Intermittent | 844.28 LF | Section 404 – non tidal |
| Watercourse 10 | 41° 52' 28.83" | 75° 29' 18.73" | Perennial | 103.29 LF | Section 404 – non tidal |
| Watercourse 11 | 41° 52' 28.45" | 75° 29' 18.30" | Perennial | 60.11 LF | Section 404 – non tidal |
| Watercourse 12 | 41° 52' 28.57" | 75° 29' 17.73" | Perennial | 55.23 LF | Section 404 – non tidal |
| Watercourse 13 | 41° 52' 32.85" | 75° 29' 12.58" | Perennial | 449.93 LF | Section 404 – non tidal |
| Watercourse 14 | 41° 52' 34.61" | 75° 29' 13.68" | Intermittent | 94.13 LF | Section 404 – non tidal |
| Watercourse 15 | 41° 52' 34.30" | 75° 29' 13.87" | Intermittent | 64.57 LF | Section 404 – non tidal |
| Watercourse 16 | 41° 52' 34.21" | 75° 29' 14.20" | Perennial | 133.24 LF | Section 404 – non tidal |
| Watercourse 17 | 41° 52' 32.81" | 75° 29' 13.63" | Perennial | 230.44 LF | Section 404 – non tidal |
| Watercourse 18 | 41° 52' 33.58" | 75° 29' 15.33" | Intermittent | 111.17 LF | Section 404 – non tidal |
| Watercourse 19 | 41° 52' 33.24" | 75° 29' 15.30" | Perennial | 77.67 LF | Section 404 – non tidal |
| Watercourse 20 | 41° 52' 32.36" | 75° 29' 11.96" | Intermittent | 54.21 LF | Section 404 – non tidal |
| Watercourse 21 | 41° 52' 32.50" | 75° 29' 10.78" | Intermittent | 45.47 LF | Section 404 – non tidal |

| | | | | | |
|---|---|---|---|---|---|
| Watercourse 22 | 41° 52' 34.32" | 75° 28' 59.62" | Perennial | 1046.49 LF | Section 404 – non tidal |
| Watercourse 23 | 41° 52' 35.00" | 75° 28' 58.69" | Perennial | 49.62 LF | Section 404 – non tidal |
| Watercourse 24 | 41° 52' 33.48" | 75° 29' 03.48" | Perennial | 87.21 LF | Section 404 – non tidal |
| Watercourse 25 | 41° 52' 34.01" | 75° 29' 03.16" | Perennial | 115.61 LF | Section 404 – non tidal |
| Watercourse 26 | 41° 52' 34.07" | 75° 29' 03.58" | Perennial | 64.6 LF | Section 404 – non tidal |
| Watercourse 27 | 41° 52' 34.41" | 75° 29' 01.87" | Perennial | 94.23 LF | Section 404 – non tidal |
| Watercourse 28 | 41° 52' 34.55" | 75° 29' 00.46" | Perennial | 296.6 LF | Section 404 – non tidal |
| Watercourse 29 | 41° 52' 35.62" | 75° 29' 00.06" | Intermittent | 186.66 LF | Section 404 – non tidal |
| Watercourse 30 | 41° 52' 36.08" | 75° 28' 59.73" | Intermittent | 25.25 LF | Section 404 – non tidal |
| Watercourse 31 | 41° 52' 37.80" | 75° 28' 57.21" | Perennial | 191.24 LF | Section 404 – non tidal |
| Watercourse 32 | 41° 52' 45.40" | 75° 28' 48.03" | Perennial | 173.3 LF | Section 404 – non tidal |
| Watercourse 33 | 41° 52' 46.01" | 75° 28' 44.23" | Perennial | 389.42 LF | Section 404 – non tidal |
| Watercourse 34 | 41° 52' 46.88" | 75° 28' 43.81" | Perennial | 76.46 LF | Section 404 – non tidal |
| Watercourse 35 | 41° 52' 46.33" | 75° 28' 44.78" | Perennial | 222.15 LF | Section 404 – non tidal |
| Watercourse 36 | 41° 52' 46.33" | 75° 28' 45.31" | Perennial | 40.81 LF | Section 404 – non tidal |
| Watercourse 37 | 41° 52' 47.45" | 75° 28' 45.07" | Intermittent | 339.33 LF | Section 404 – non tidal |
| Watercourse 38 | 41° 52' 47.30" | 75° 28' 41.83" | Perennial | 96.13 LF | Section 404 – non tidal |
| Watercourse 39 | 41° 52' 48.34" | 75° 28' 38.62" | Perennial | 56.65 LF | Section 404 – non tidal |
| Watercourse 40 | 41° 52' 47.32" | 75° 28' 40.05" | Perennial | 559.76 LF | Section 404 – non tidal |
| Watercourse 41 | 41° 52' 47.19" | 75° 28' 28.27" | Perennial | 1771.13 LF | Section 404 – non tidal |
| Watercourse 42 | 41° 52' 47.43" | 75° 28' 37.80" | Perennial | 1512.6 LF | Section 404 – non tidal |
| Watercourse 43 | 41° 52' 48.51" | 75° 28' 25.48" | Perennial | 18.87 LF | Section 404 – non tidal |
| Watercourse 44 | 41° 52' 48.25" | 75° 28' 27.38" | Perennial | 91.67 LF | Section 404 – non tidal |
| Watercourse 45 | 41° 52' 43.25" | 75° 28' 32.60" | Intermittent | 34.38 LF | Section 404 – |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | non tidal |
| Watercourse 46 | 41° 52' 42.13" | 75° 28' 33.52" | Intermittent | 17.62 LF | Section 404 – non tidal |
| Watercourse 47 | 41° 52' 39.13" | 75° 28' 38.99" | Perennial | 191.04 LF | Section 404 – non tidal |
| Watercourse 48 | 41° 52' 31.91" | 75° 28' 58.73" | Perennial | 59.86 LF | Section 404 – non tidal |
| Watercourse 49 | 41° 52' 28.34" | 75° 29' 09.05" | Ephemeral | 29.63 LF | Section 404 – non tidal |

| | | | | | |
|---|---|---|---|---|---|
| Ditch 1 | 41° 52' 44.85" | 75° 28' 47.80" | Ephemeral ditch | 370.27 LF | Section 404 – non tidal |
| Ditch 2 | 41° 52' 48.68" | 75° 28' 36.81" | Ephemeral ditch | 83.36 LF | Section 404 – non tidal |
| Ditch 3 | 41° 52' 42.02" | 75° 28' 39.46" | Ephemeral ditch | 2013.45 LF | Section 404 – non tidal |
| Ditch 4 | 41° 52' 45.48" | 75° 28' 37.54" | Ephemeral ditch | 1773.17 LF | Section 404 – non tidal |
| Ditch 5 | 41° 52' 42.90" | 75° 28' 46.73" | Ephemeral ditch | 42.57 LF | Section 404 – non tidal |
| Ditch 6 | 41° 52' 39.63" | 75° 28' 41.56" | Ephemeral ditch | 251.95 LF | Section 404 – non tidal |
| Ditch 7 | 41° 52' 35.24" | 75° 28' 50.95" | Ephemeral ditch | 421.7 LF | Section 404 – non tidal |
| Ditch 8 | 41° 52' 31.66" | 75° 28' 59.46" | Ephemeral ditch | 316.82 LF | Section 404 – non tidal |
| Wetland A1 | 41° 52' 43.71" | 75° 28' 34.19" | PEM2ED | 7.15 AC | Section 404 – non tidal |
| Wetland A2 | 41° 52' 44.34" | 75° 28' 37.49" | PEM2ED | 7.4 AC | Section 404 – non tidal |
| Wetland A3 | 41° 52' 45.30" | 75° 28' 42.81" | PEM2ED | 10.66 AC | Section 404 – non tidal |
| Wetland A4 | 41° 52' 54.37" | 75° 28' 30.49" | PEM2ED | 4.56 AC | Section 404 – non tidal |
| Wetland A5 | 41° 52' 46.03" | 75° 28' 44.83" | PEM2ED | 0.22 AC | Section 404 – non tidal |
| Wetland A6 | 41° 52' 46.27" | 75° 28' 45.48" | PEM2ED | 0.02 AC | Section 404 – non tidal |
| Wetland A7 | 41° 52' 46.59" | 75° 28' 44.57" | PEM2ED | 0.11 AC | Section 404 – non tidal |
| Wetland A8 | 41° 52' 46.91" | 75° 28' 43.36" | PEM2ED | 0.01 AC | Section 404 – non tidal |
| Wetland A9 | 41° 52' 47.39" | 75° 28' 41.84" | PEM2ED | 208 SQ FT | Section 404 – non tidal |
| Wetland A10 | 41° 52' 47.38" | 75° 28' 40.26" | PEM2ED | 0.39 AC | Section 404 – non tidal |
| Wetland A11 | 41° 52' 48.42" | 75° 28' 38.62" | PEM2ED | 80 SQ FT | Section 404 – |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | non tidal |
| Wetland A12 | 41° 52' 50.48" | 75° 28' 34.81" | PEM2ED | 1.27 AC | Section 404 – non tidal |
| Wetland B | 41° 52' 31.24" | 75° 29' 05.16" | PSS6E | 4.2 AC | Section 404 – non tidal |
| Wetland C | 41° 52' 29.44" | 75° 29' 23.79" | PEM2Y | 0.09 AC | Section 404 – non tidal |
| Wetland D | 41° 52' 29.86" | 75° 29' 20.77" | PEM2Y | 0.01 AC | Section 404 – non tidal |
| Wetland E | 41° 52' 30.70" | 75° 29' 16.97" | PEM2Y | 0.09 AC | Section 404 – non tidal |
| Wetland F | 41° 52' 31.35" | 75° 29' 13.82" | PEM2Y | 108 SQ FT | Section 404 – non tidal |
| Wetland G | 41° 52' 32.14" | 75° 29' 12.36" | PEM2Y | 0.01 AC | Section 404 – non tidal |
| Wetland H | 41° 52' 30.29" | 75° 29' 12.29" | PEM2Y | 0.08 AC | Section 404 – non tidal |
| Wetland I | 41° 52' 33.28" | 75° 29' 11.33" | PEM2Y | 0.09 AC | Section 404 – non tidal |
| Wetland J | 41° 52' 34.98" | 75° 29' 03.33" | PEM2Y | 0.02 AC | Section 404 – non tidal |
| Wetland K1 | 41° 52' 33.71" | 75° 29' 01.19" | PSS6Eb | 1.2 AC | Section 404 – non tidal |
| Wetland K2 | 41° 52' 33.31" | 75° 29' 03.56" | PSS6Eb | 0.02 AC | Section 404 – non tidal |
| Wetland K3 | 41° 52' 33.97" | 75° 29' 03.48" | PSS6Eb | 0.03 AC | Section 404 – non tidal |
| Wetland K4 | 41° 52' 34.14" | 75° 29' 03.75" | PSS6Eb | 0.01 AC | Section 404 – non tidal |
| Wetland K5 | 41° 52' 32.28" | 75° 29' 06.12" | PSS6Eb | 0.66 AC | Section 404 – non tidal |
| Wetland L | 41° 52' 36.77" | 75° 28' 58.82" | PEM2Y | 0.05 AC | Section 404 – non tidal |
| Wetland M1 | 41° 52' 46.90" | 75° 28' 45.48" | PEM2Cb | 0.38 AC | Section 404 – non tidal |
| Wetland M2 | 41° 52' 47.57" | 75° 28' 44.36" | PEM2Cb | 0.14 AC | Section 404 – non tidal |
| Wetland N | 41° 52' 47.81" | 75° 28' 40.40" | PEM2Cb | 0.06 AC | Section 404 – non tidal |
| Wetland O | 41° 52' 48.84" | 75° 28' 38.34" | PEM2Cb | 0.01 AC | Section 404 – non tidal |
| Wetland P | 41° 52' 50.11" | 75° 28' 36.94" | PEM2Cb | 0.08 AC | Section 404 – non tidal |
| Wetland Q | 41° 52' 52.72" | 75° 28' 33.59" | PEM2Cb | 0.25 AC | Section 404 – non tidal |
| Wetland R | 41° 52' 56.10" | 75° 28' 30.86" | PEM2Cb | 0.03 AC | Section 404 – non tidal |

| Enclosure 3 | | | |
|---|---|---|---|
| Applicant: Resource Environmental Solutions, LLC | | File Number: 2015-01573-P13 | Date: 3/31/16 |
| Attached is: | | | See Section below |
| | INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission) | | A |
| | PROFFERED PERMIT (Standard Permit or Letter of permission) | | B |
| | PERMIT DENIAL | | C |
| | APPROVED JURISDICTIONAL DETERMINATION | | D |
| X | PRELIMINARY JURISDICTIONAL DETERMINATION | | E |

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the Baltimore District Engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations (JD) associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the Baltimore District Engineer. Your objections must be received by the Baltimore District Engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the Baltimore District Engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the Baltimore District Engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the Baltimore District Engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the North Atlantic Division Engineer, ATTN: CENAD-PD-PSD-O, Fort Hamilton Military Community, Building 301, General Lee Avenue, Brooklyn, NY 11252-6700. This form must be received by the North Atlantic Division Engineer within 60 days of the date of this notice with a copy furnished to the Baltimore District Engineer.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the North Atlantic Division Engineer, ATTN: CENAD-PD-PSD-O, Fort Hamilton Military Community, Building 301, General Lee Avenue, Brooklyn, NY 11252-6700. This form must be received by the North Atlantic Division Engineer within 60 days of the date of this notice with a copy furnished to the Baltimore District Engineer.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the North Atlantic Division Engineer, ATTN: CENAD-PD-PSD-O, Fort Hamilton Military Community, Building 301, General Lee Avenue, Brooklyn, NY 11252-6700. This form must be received by the North Atlantic Division Engineer within 60 days of the date of this notice with a copy furnished to the Baltimore District Engineer.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

## SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

## POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

| | |
|---|---|
| If you have questions regarding this decision and/or the appeal process you may contact:<br>Mr. Frank Plewa<br>U.S. Army Corps of Engineers<br>Carlisle Field Office, Regulatory Branch, Baltimore District<br>ATTN: CENAB-OPR-P<br>Carlisle, Pennsylvania 17013-2657<br>Telephone: (717) 249-2522<br>Email: Frank.plewa@usace.army.mil | If you only have questions regarding the appeal process you may also contact:<br>Mr. James W. Haggerty<br>Administrative Appeals Review Officer<br>North Atlantic Division, Corps of Engineers Fort Hamilton<br>General Lee Avenue , Military Community Bldg. 301<br>Brooklyn, NY 11252-6700<br>Telephone: (718) 765-7163<br>Email: James.W.Haggerty@usace.army.mil |

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

| | | |
|---|---|---|
| _____<br>Signature of appellant or agent. | Date: | Telephone number: |

BluAcres·LLC
Wetlands and Wildlife Habitat

**Resource Environmental Solutions, LLC (RES)**

**S t a r r u c c a  C r e e k  P r o j e c t**

# Wetland Delineation Report

*Thompson Township, Susquehanna County, PA.*
*Borough of Starrucca, Wayne County, PA.*

*August 7, 2015*

# TABLE OF CONTENTS



## 1.0 INTRODUCTION

BluAcres, LLC (BluAcres) was hired to determine the presence of wetlands and if found delineate the wetlands and other waters subject to federal jurisdiction under Section 404 of the Clean Water Act on the Starrucca Creek Project in an area relative to a proposed mitigation bank project for Resource Environmental Solutions, LLC (RES). RES an environmental based restoration company and performed the identification, delineation, and mapping of the on-site streams and ditches and provided them to BluAcres, LLC for inclusion in this report.

Starrucca Creek is located in the Northern Appalachian Ridges and Valleys Major Land Resource Area (MLRA-140). The eastern portion of the site is located in the Borough of Starruca, Wayne County, the western portion is located in Thompson Township, Susquehanna County, Pennsylvania.

The project area is located north of Jackson Street/PA State Highway 4039 at Lat: 41.879084W and Long: -75.4783051N (NAD83).

## 2.0 SITE DESCRIPTION

The project site is comprised mostly of an open agricultural field (currently in CREP), with numerous streams and ditches braiding into Starrucca Creek which is flowing from a southwest to a northeast direction. The site is comprised of a total of 49 delineated perennial and intermittent streams and 9 delineated agricultural ditches. (*Appendix C*) The total length of the 49 delineated streams is 19,300.2 linear ft. and the 9 delineated ditches is 5,273.3 linear ft.

## 3.0 METHODS

A wetland determination was conducted according to the methods outlined in the Corps of Engineers 1987 Wetland Delineation Manual and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeastern Region; following the routine determination procedures.

Off-Site Method: Preliminary data gathering was conducted using the following sources; Google Earth Aerial Imagery, PennPilot historic aerial photos, Orthorectified Digital Imagery of Pennsylvania from the PAMAP Program, National Wetland Inventory, and the USDA Web Soil Survey were examined and utilized to determine if known wetlands occurred on the project site.

The NWI did indicate the presence of a Palustrine Scrub Shrub wetland located in the southeast portion of the project. The Web Soil Survey also indicated that Wy (Wyalusing silt loam), 7B (Edgemere) a component of the Shohola-Edgemere complex, Chippewa, a component of VsB (Volusia silt loam), and Holly, component of the Bh (Basher silt loam) were listed as hydric soils and are mapped in the project area. With this information we determined that wetlands were highly likely in the project area and we identified suspect areas to be verified in the field.

Onsite Method: The Routine On-site Method described in Section D of Chapter IV in the 1987 Manual was used to determine if wetlands exist in the project area. Prior to initiating sampling,

suspect wetland and upland areas from off-site investigations were visited for confirmation. The project area was walked to identify general topographic conditions and drainage patterns, major plant communities and potential areas of disturbance. This initial investigation confirmed that several of the suspect wetlands identified in the off-site methods did exhibit plant communities with known wetland vegetation species. Representative Data Points were recorded in the areas. the dominant plant species in each stratum of the community were visually determined and its Federal Indicator Status was defined, hydrology information was visually assessed during the soils investigation, and soil borings were obtained using a sharp shooter hand shovel and checked for hydric soil indicators to determine its wetland status. The Code of Federal Regulations defines a wetland as an area having hydric soils, wetland hydrology and supporting vegetation dominated by hydrophytes. Under normal conditions, all three of these criteria must be present for an area to qualify as a wetland. Each vegetative community with representative data point was evaluated to determine its wetland status.

## 4.0 RESULTS/CONCLUSIONS

Fieldwork for the delineation was conducted on July 22, 23, and 24, 2015. Weather during the field investigation was sunny and approximately 85 degrees Fahrenheit, and occurred during the dry season.

Forty nine stream segments (36 perennial, 12 intermittent, 1 ephemeral), and nine agricultural surface ditches were previously delineated by RES, LLC. Thirty four wetlands, consisting of five wetland types, totaling 1,726,087 SQ. FT. (39.63 AC) were identified and labeled (See *Appendix C*). The wetland boundaries were clipped at the boundaries of the previously identified and delineated streams and ditches. The identified wetland boundaries were delineated using an RTK GPS in the field. Descriptions of the wetland areas are as follows:

**PEM2Ed:** (Palustrine Emergent, Nonpersistent, Seasonally Flooded/Saturated, Partially Drained/Ditched)

This wetland type consists of wetlands (A1-A12) which were broken into 12 polygons due to the transection of this wetland by numerous delineated streams and ditches. Wetland A is 1,402,689 SQ. FT. (32.2 AC.) in size and was previously farmed as evident by the straight line ditches that exist in the field. This area was suspected to exhibit minimal hydrology indicators due to the presence of and influence of the hydrology by the surface drainage ditches, however Data Point 1 (DP-1), within the zone of influence of a drainage ditch and appeared to be relatively dry relative to other depressional areas of the field, exhibited several hydrology indicators including; Stunted or stressed plants (D1), Microtopographic Relief (D4), and FAC-Neutral Test (D5), all secondary hydrology indicators. This wetland community exhibits visible undulations across the area. The hydrologic regime varies from standing water found in the lowest depressions to dryer, unsaturated soils as indicated in DP-1. In addition, saturation is visible on aerial imagery in this area indicating that seasonal flooding/saturation occurs. Wetland A is bordered to the west by the vegetative

community dominated by Purple Milkweed (*Asclepias purpurascens* – FACU), and Late Goldenrod (*Solidago altissima* – FACU) (DP2) and to the east by a similar vegetative community (DP4).

Vegetation in Wetland A is dominated by Reed Canary Grass (*Phalaris arundinacea* – FACW) and Bog Goldenrod (*Solidago uliginosa* – OBL) with areas of dominance changing, including pockets of Green Bullrush (*Scirpus atroviens* – OBL) and Blunt Spikerush (*Eleocharis obtusa* – OBL) based on the hydrologic regime within the wetland. This area was previously planted to trees by the USDA Farm Service Agencies Conservation Reserve Enhancement Program (CREP) Farm Bill Program as a Conservation Practice 22 (CP22) Forest Riparian Buffer. Tree tubes within the wetland are void of trees or are stunted and an estimated (80%) eighty percent tree mortality was observed, this was suspected due to the field's hydrology.

Soils were consistent with the USDA mapped hydric Wyalusing Silt Loam. A Hydric soil indicator A11 (Depleted below Dark Surface) was present (DP-1).

**PSS6E:** (Palustrine Scrub-Shrub, Deciduous, Seasonally Flooded/Saturated)

This wetland type consists of wetland B. Wetland B is located to the southwest of the open field area. National Wetlands Inventory (NWI) Mapper classifies this as a PSS1/EM5E wetland. Wetland B is 189,937 SQ. FT. (4.4 AC.), exhibiting hydrology features such as, oxidized rhizospheres on living roots (C3) and passing the FAC-neutral test (D5) from the secondary indicator listing. The oxidized rhizospheres occurred at 6 inches of depth and remained consistent through a twenty inch soil profile.

Vegetation is dominated by Giant Goldenrod (*Solidago gigantea* – FACW), Reed Canary Grass (*Phalaris arundinacea* – FACW), and Bog Goldenrod (*Solidago uliginosa* – OBL) in the herbaceous stratum, and Gray Birch (*Betula populifolia* – FAC) in the tree stratum.

Soils were consistent with the USDA mapped soil as a Mixed Alluvial Land, and textures consisting of a gravelly, sandy loam with 50 percent (50%) cobbles present below the top six inches. A hydric soil indicator A11 (Depleted Below Dark Surface) was recorded at Data Point 3 (DP-3). Soil within the top six inches was identified to have a matrix of 10YR 3/2, and was determined to be a sandy loam in which many roots were present. The remaining depth of the soil profile (6-20 inches) was identified to have a matrix of 10YR 3/3 (85%), exhibiting pore lining redox concentrations of 2.5YR 3/6 (15%). The soil at this depth remains a sandy loam, but additionally contains fifty percent (50%) cobbles.

**PEM2Y:** (Palustrine Emergent, Nonpersistent, Saturated/Semipermanent/Seasonal)

This wetland type consists of wetlands (C-J, and L), which are all located to the northern side of Starrucca Creek. Several of these wetlands were located at higher elevations with steeper slopes than wetlands to the south of Starrucca Creek. The combined area of this wetland type is 18,425 SQ. FT. (.42 AC.) Two primary hydrology indicators were identified, High Water Table (A2) and Saturation (A3). The ground was saturated to the surface, and the water table was present at five inches (5in.) roughly fifteen minutes after the soil pit was dug. These primary indicators along with the FAC-neutral test (D5) as a secondary indicator prove positive for hydrology features present in the area. These wetlands are associated with hillside seeps and depressions that exists along and adjacent to seep runoff and the braided streams in the forested area. Although these areas are within the forest we classified them as PEM since they exhibit an open canopy and do not appear to be associated with the forest community.

Vegetation is dominated by Sensitive Fern (*Onoclea sensibilis* – FACW) and Jewelweed (*Impatiens capensis* – FACW) in the herbaceous stratum, while River Birch (*Betula nigra* – FACW) and Eastern Hemlock (*Tsuga Canadensis* – FACU) were within the tree stratum but appeared to be more associated with the adjacent upland community.

Soils in this area were identified as hydric with proof positive hydric soil indicator A11 (Depleted Below Dark Surface). This soil profile was broken up into three separate depths due to varying matrices and redox features. The top five inches (0-5 in.) were identified to have a matrix of 2.5YR 7/1 at (70%), exhibiting pore lining redox concentrations of 7.5YR 5/6 at (30%), this particular section was identified to have a silt loam texture and proved positive for mottling. The middle depth, (5-11 in.) was identified to have a matrix of 2.5YR 7/1 at (60%), exhibiting pore lining redox concentrations of 7.5YR 5/6 at (40%), eighty percent (80%) cobbles present at this depth. The bottom portion of the soil profile (11-20 in.) was identified to have a matrix of 2.5YR 5/1 at (60%), exhibiting pore lining redox concentrations of 7.5YR 5/6 at (40%). Soil texture at this depth remained a silt loam, and cobbles were highly present.

**R3US5Jb:** (Riverine, Upper Perennial, Unconsolidated Shore, Vegetated, Intermittently Flooded, Beaver)

This wetland type consists of wetlands (M-R), which are all located to the northern side of Starrucca Creek. The combined area for this wetland type is 41,647 SQ. FT. (.95 AC.). These wetlands are associated with point bar depositions along Starrucca Creek that extend from the toe of the steep upland slope to the open flowing water within Starruca Creek. These were listed as riverine since they were within the bank full elevations of Starrucca Creek. Several Beaver dams along Starrucca Creek were identified in this area which had an effect on the hydrology of the system.

Vegetation is dominated by Reed Canary Grass (*Phalaris arundinacea* – FACW), Late Goldenrod (Solidago gigantean – FACW), and Spotted Joe-Pye (*Eutrochium maculatum-OBL*) (DP-8)

Soils are a dark surface above a depleted matrix (DP8) consistent with A11 and the edgemere component of the 7B USDA soil description. Many cobbles exist below 6".

**PEM1F:** (Palustrine Emergent, Persistent, Semipermanently Flooded)

This wetland type consists of wetlands (K1-K5), which have been identified as an oxbow region along the stream edge, with a fair sized opening in the canopy. The wetlands in this oxbow region have a combined area of 73,389 SQ. FT. (1.68 AC.) Open pools of water ranging from 6-12 inches ranging to saturated soils exist along the historic channels that once flowed through this area. The hydrology of the area was typical with that of an oxbow, exhibiting standing water and truly aquatic fauna species. With the presence of aquatic fauna and standing water, which appeared to be present throughout the year, hydric soils were assumed without conducting a soil profile.

Vegetation was dominated by Cattail (*Typha latifolia-OBL*) and Arrow Arum (*Peltandra virginica-OBL*) (DP-7)

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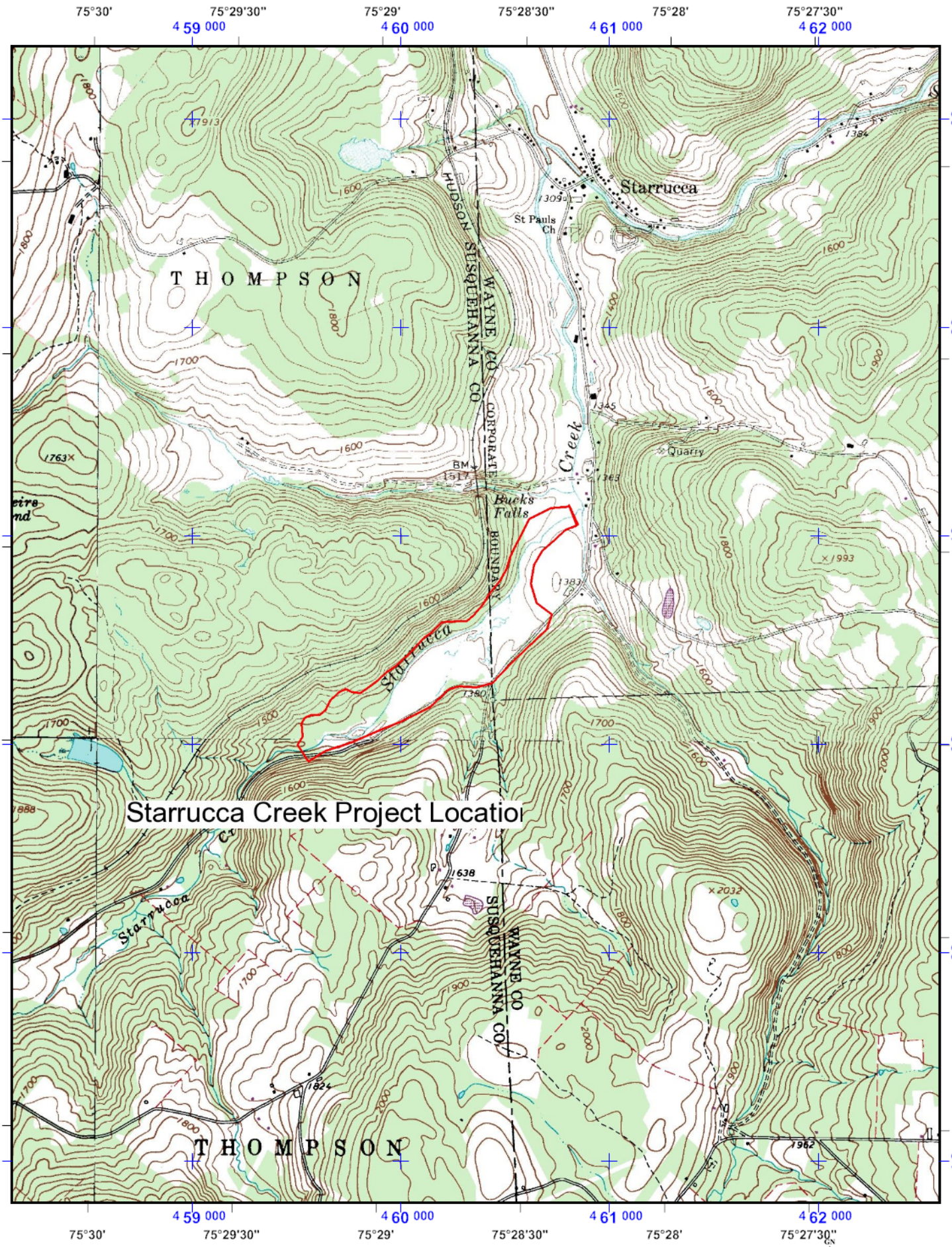
# APPENDIX A

## (Project Location Map)




1:24000 scale

0 0.2 0.4 0.6 0.8 1 Miles

0 0.2 0.4 0.6 0.8 1 Kilometers

Universal Transverse Mercator (UTM) Projection Zone 18
North American Datum of 1983
1000 meter UTM / USNG / MGRS
Grid Zone Designation: 18T
100,000-m Squares:VM

GN
MN 12°
TN 0°

Magnetic declination of 12W at center of map
on March 17, 2011

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# APPENDIX B

## (National Wetland Inventory Map)

# U.S. Fish and Wildlife Service
# National Wetlands Inventory

**Starrucca Creek Project**

**Jul 21, 2015**


## Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

**User Remarks:**

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# APPENDIX C

## (Wetland Delineation Maps)


## LEGEND

- LIMIT OF DELINEATION
- DELINEATED STREAM (BY OTHERS)
- DELINEATED AGRICULTURAL DITCH (BY OTHERS)
- DELINEATED WETLAND
- Wy — USDA MAPPED SOIL TYPE
- ◆DP# — DATA POINT
- △ — HORIZONTAL AND VERTICAL CONTROL POINT

N

USDA – NRCS MAPPED SOILS:

Susquehanna County, Pennsylvania
7B Shohola–Edgemere complex
Bc Basher silt loam
BsF Bath very stony loam
LgF Lackawanna very stony silt loam
MgD Mardin channery silt loam
Mn Mixed alluvial land
OyF Oquaga and Lordstown extremely stony loams
VsB Volusia channery silt loam
Wy Wyalusing silt loam

Wayne County, Pennsylvania
7B Shohola–Edgemere complex
Bh Basher silt loam
WoD Wellsboro extremely stony loam
Wy Wyalusing silt loam

DELINEATED WETLANDS:

| | |
|---|---|
| WETLAND A | 1,402,689 SQ FT. |
| WETLAND B | 189,937 SQ FT. |
| WETLAND C | 3,725 SQ FT |
| WETLAND D | 359 SQ FT |
| WETLAND E | 3,796 SQ FT |
| WETLAND F | 108 SQ FT. |
| WETLAND G | 258 SQ FT |
| WETLAND H | 3,480 SQ FT |
| WETLAND I | 3,932 SQ FT |
| WETLAND J | 762 SQ FT |
| WETLAND K | 73,389 SQ FT |
| WETLAND L | 2,005 SQ FT |
| WETLAND M | 22,654 SQ FT |
| WETLAND N | 2,605 SQ FT |
| WETLAND O | 395 SQ FT |
| WETLAND P | 3,677 SQ FT |
| WETLAND Q | 11,084 SQ FT |
| WETLAND R | 1,232 SQ FT |
| TOTAL | 1,726,087 SQ FT (39.63 ACRES) |

DELINEATED STREAMS:
PERENNIAL
(1,3–8,10–13,16–17,19,22–28,31–36,38–44,47–48)
TOTAL LF = 17,391.20 LF

INTERMITTENT
(2,9,14–15,18,20–21,29–30,37,45–46)
TOTAL LF = 1,879.39 LF

EPHEMERAL (49)
TOTAL LF = 29.63 LF

DELINEATED DITCHES:
TOTAL LF = 5,273.29 LF

NOTES:

1. Basemap generated from site surveys dated July 22, 23, and 24, 2015 and intergrated with LIDAR contours from the PAMAP program. Surrounding site features (e.g., Treelines and roadways) approximated using PAMAP Aerial Imagery. Streames and Ditches shown were were delineated and mapped by Resource Environmental Solutions, LLC.

2. Horizontal and vertical control is based on NAD83, PA North State Plane Coordinates and NAVD88 elevations. RTK GPS methods were used and the state plane coordinates and NAVD88 elevations of the base station "100" were determined by OPUS (On–Line Positioning User Service) holding the CORS Stations WILKES BARRE, ONEONTA, and WAVERLY. All coordinates are true state plane.

3. On–Site Control, Horizontal and Vertical:

| | NORTH | EAST | ELEV | DESCRIP. |
|---|---|---|---|---|
| 100 | 631619.10 | 2587485.35 | 1,368.21 | HUB |
| 101 | 631468.32 | 2587475.21 | 1,376.50 | PK NAIL |
| 102 | 633139.24 | 2588903.90 | 1,383.24 | CEC IP |

GRAPHIC SCALE
200 0 100 200 400
( IN FEET )
1 inch = 200 ft.

BluAcres · LLC
Wetlands and Wildlife Habitat
205 MARKERT LN, MILLINGBURG, PENNSYLVANIA
(814) 312-6870 / www.bluacres.com

**WETLAND DELINEATION**
STARRUCCA CREEK PROJECT
THOMPSON TOWNSHIP, SUSQUEHANNA COUNTY
STARRUCCA BOROUGH, WAYNE COUNTY
PENNSYLVANIA

DATE: 08/07/2015
DESIGNED BY: -
DRAWN BY: CRC/TML
CHECKED BY: CRC/TML
REVISIONS: -
CAD FILE: Starrucca Creek.dwg
PAGE NO: 1
SHEET: 1 of 1

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# APPENDIX D

## (Field Data Forms)

## WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Starrucca Creek Project City/County: Susquehanna County Sampling Date: 1-22-15

Applicant/Owner: Resource Environmental Solutions, LLC State: PA Sampling Point: DP-1

Investigator(s): CR Clouser, TM Lee, Bluacres, LLC. Section, Township, Range: Thompson Township

Landform (hillside, terrace, etc.): Flood plain, open field Local relief (concave, convex, none): None Slope %: 0-1%

Subregion (LRR or MLRA): LRR R, MLRA 140 Lat: 41.879084 Long: -75.4783051 Datum: NAD83

Soil Map Unit Name: Wyalusing, silt loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area** |
| Hydric Soil Present? | Yes X | No ____ | **within a Wetland?** **Yes** X **No** ____ |
| Wetland Hydrology Present? | Yes X | No ____ | If yes, optional Wetland Site ID: ____ |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

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

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes X | No ____ | Depth (inches): 0 |

**Wetland Hydrology Present?** **Yes** X **No** ____

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

Remarks:

The community exhibits visible undulations across the majority of the area surrounding this data point. The hydrologic regime is present in standing water found in ditches, and also local depressions. Leopard frogs were frequently seen inhabiting much of the area within our data point. In addition, saturation is visible on aerial photos of the specified area.

**VEGETATION** – Use scientific names of plants. Sampling Point: DP-1

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Gleditsia triacanthos* | 2 | No | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 2 =Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. *Phalaris arundinacea* | 20 | Yes | FACW |
| 2. *Solidago uliginosa* | 70 | Yes | OBL |
| 3. *Solidago gigantea* | 15 | No | FACW |
| 4. *Galium asprellum* | 15 | No | OBL |
| 5. *Onoclea sensibilis* | 10 | No | FACW |
| 6. *Carex vulpinoidea* | 5 | No | OBL |
| 7. *Juncus effusus* | 5 | No | OBL |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 140 =Total Cover | | |
| **Woody Vine Stratum** (Plot size: 30 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 95 | x 1 = | 95 |
| FACW species | 45 | x 2 = | 90 |
| FAC species | 2 | x 3 = | 6 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 142 (A) | | 191 (B) |

Prevalence Index = B/A = 1.35

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
We chose the driest spot in the suspect wetland mosaic to collect our data point. Point confirmed wetland, vegetative community consists of groupings of listed species based on wetness, hydric soils and hydrology indicators are also present. Reed-Canary grass reaches heights well above 5 feet in the ditch sections. Area was planted by CREP, estimated 80% tree mortality due to wetness.

## SOIL

Sampling Point DP-1

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-10 | 10YR 3/2 | 100 | | | | | Loamy/Clayey | SiL, 30% sand, <20% clay |
| 10-12 | 10YR 3/2 | 90 | 7.5YR 5/8 | 10 | C | PL | Loamy/Clayey | SiL, 25% sand, <20% clay |
| 12-20 | 5Y 4/1 | 80 | 7.5YR 5/8 | 20 | C | PL | Loamy/Clayey | LoS, 80% sand, <10% clay |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ?C Depleted Matrix (F3)
- ?C Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

## WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Starrucca Creek Project City/County: Susquehanna County Sampling Date: 7-22-15

Applicant/Owner: Resource Environmental Solutions, LLC State: PA Sampling Point: DP-2

Investigator(s): CR Clouser, TM Lee, Bluacres, LLC. Section, Township, Range: Thompson Township

Landform (hillside, terrace, etc.): Flood plain, open field Local relief (concave, convex, none): None Slope %: 2%

Subregion (LRR or MLRA): LRR R, MLRA 140 Lat: 41.8772198 Long: -75.4801041 Datum: NAD83

Soil Map Unit Name: Basher silt loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ | No X | **Is the Sampled Area** |
| Hydric Soil Present? | Yes ____ | No X | **within a Wetland?** **Yes** ____ **No** X |
| Wetland Hydrology Present? | Yes ____ | No X | If yes, optional Wetland Site ID: ____ |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

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

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

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

Remarks:

Area on aerials appear to be an upland site. CREP tree survival greather than 80% in this area, there is no microtopography in this area.

**VEGETATION** – Use scientific names of plants. Sampling Point: DP-2

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Acer saccharinum* | 5 | Yes | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 5 | =Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | | =Total Cover | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. *Asclepias purpurascens* | 60 | Yes | FACU |
| 2. *Solidago altissima* | 30 | Yes | FACU |
| 3. *Arctium minus* | 2 | No | FACU |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 92 | =Total Cover | |
| **Woody Vine Stratum** (Plot size: 30 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | =Total Cover | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 5 | x 2 = | 10 |
| FAC species | 0 | x 3 = | 0 |
| FACU species | 92 | x 4 = | 368 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 97 (A) | | 378 (B) |

Prevalence Index = B/A = 3.90

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)
CREP plantings: Acer saccharinum

## SOIL

Sampling Point DP-2

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-14 | 2.5Y 3/3 | 100 | | | | | Loamy/Clayey | No redox features, 25% sand, 10% clay |
| 14-20 | 7.5YR 4/3 | 90 | 10YR 5/8 | 10 | C | PL | Loamy/Clayey | SiL, 25% sand, 10% clay |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

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

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** ____ **No** X

Remarks:

1/2" ribbons were formed, pertaining to approximately 10% clay. The entire column was similar, faint variation from 14-20", with concentrations beginning to appear at 14". 0-20" all found to be of a SiL texture.

## WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Starrucca Creek Project City/County: Susquehanna County Sampling Date: 1-23-15

Applicant/Owner: Resource Environmental Solutions, LLC State: PA Sampling Point: DP-3

Investigator(s): CR Clouser, TM Lee, Bluacres, LLC. Section, Township, Range: Thompson Township

Landform (hillside, terrace, etc.): Flood plain, open field Local relief (concave, convex, none): None Slope %: 2%

Subregion (LRR or MLRA): LRR R, MLRA 140 Lat: 41.8754710 Long: -75.4838955 Datum: NAD83

Soil Map Unit Name: Mixed alluvial land NWI classification: PSS1/EM5E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area** |
| Hydric Soil Present? | Yes X | No ____ | **within a Wetland?** **Yes** X **No** ____ |
| Wetland Hydrology Present? | Yes X | No ____ | If yes, optional Wetland Site ID: ____ |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

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

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No ____ | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** X **No** ____

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

Remarks:
Oxidized rhizospheres at 6". National Wetlands Mapper classifies this as a PSS1/EM5E wetland.

**VEGETATION** – Use scientific names of plants. Sampling Point: DP-3

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Betula populifolia* | 5 | Yes | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 5 | =Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | | =Total Cover | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. *Solidago gigantea* | 30 | Yes | FACW |
| 2. *Phalaris arundinacea* | 20 | Yes | FACW |
| 3. *Solidago uliginosa* | 15 | Yes | OBL |
| 4. *Securigera varia* | 2 | No | UPL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 67 | =Total Cover | |
| **Woody Vine Stratum** (Plot size: 30 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | =Total Cover | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 15 | x 1 = | 15 |
| FACW species | 50 | x 2 = | 100 |
| FAC species | 5 | x 3 = | 15 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 2 | x 5 = | 10 |
| Column Totals: | 72 (A) | | 140 (B) |

Prevalence Index = B/A = 1.94

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point DP-3

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-6 | 10YR 3/2 | 100 | | | | | Loamy/Clayey | Sandy loam, many roots present |
| 6-20 | 10YR 3/3 | 85 | 2.5YR 3/6 | 15 | C | PL | Loamy/Clayey | Sandy loam, 50% cobbles |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

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

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ? Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

0-6 in: silt loam / 6-20 in: sandy loam / 50% cobbles.

## WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Starrucca Creek Project City/County: Wayne County Sampling Date: 7-23-15

Applicant/Owner: Resource Environmental Solutions, LLC State: PA Sampling Point: DP-4

Investigator(s): CR Clouser, TM Lee, Bluacres, LLC. Section, Township, Range: Starrucca Borough

Landform (hillside, terrace, etc.): open field, flood plain Local relief (concave, convex, none): Flat, slightly sloped Slope %: 2%

Subregion (LRR or MLRA): LRR R, MLRA 140 Lat: 41.8821880 Long: -75.4746358 Datum: NAD83

Soil Map Unit Name: Wyalusing silt loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ | No X | **Is the Sampled Area** |
| Hydric Soil Present? | Yes ____ | No X | **within a Wetland?** **Yes** ____ **No** X |
| Wetland Hydrology Present? | Yes ____ | No X | If yes, optional Wetland Site ID: ____ |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

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

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No ____ | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

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

Remarks:

Appears to be upland landform from aerial imaging, no microtopography was found. CREP planting tree survival greater than 80%.

**VEGETATION** – Use scientific names of plants.

Sampling Point: DP-4

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Acer saccharinum* | 5 | Yes | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 5 =Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. *Asclepias purpurascens* | 40 | Yes | FACU |
| 2. *Solidago canadensis* | 20 | No | FACU |
| 3. *Solidago altissima* | 30 | Yes | FACU |
| 4. *Arctium minus* | 2 | No | FACU |
| 5. *Poa nemoralis* | 50 | Yes | FACU |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 142 =Total Cover | | |
| **Woody Vine Stratum** (Plot size: 30 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 5 | x 2 = | 10 |
| FAC species | 0 | x 3 = | 0 |
| FACU species | 142 | x 4 = | 568 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 147 (A) | | 578 (B) |

Prevalence Index = B/A = 3.93

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point DP-4

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-7 | 10YR 3/4 | 100 | | | | | Loamy/Clayey | Silt loam |
| 7-20 | 10Yr 3/4 | 100 | | | | | Loamy/Clayey | Silt loam, 60% cobbles |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

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

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** ____ **No** X

Remarks:

0-7' and 7-20" both silt loams, cobbles appear at 7 inches.

## WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Starrucca Creek Project City/County: Susquehanna County Sampling Date: 7-24-15

Applicant/Owner: Resource Environmental Solutions, LLC State: PA Sampling Point: DP-5

Investigator(s): CR Clouser, TM Lee, Bluacres, LLC. Section, Township, Range: Thompson Township

Landform (hillside, terrace, etc.): Flood plain Local relief (concave, convex, none): relatively flat Slope %: 2%

Subregion (LRR or MLRA): LRR R, MLRA 140 Lat: 41.8742213 Long: -75.4900573 Datum: NAD83

Soil Map Unit Name: Lackawanna very stony silt loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ | No X | **Is the Sampled Area** |
| Hydric Soil Present? | Yes ____ | No X | **within a Wetland?** **Yes** ____ **No** X |
| Wetland Hydrology Present? | Yes ____ | No X | If yes, optional Wetland Site ID: ____ |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

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

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No ____ | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

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

Remarks:
Geomorphic positioning. No standing water or saturation present.

**VEGETATION** – Use scientific names of plants. Sampling Point: DP-5

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Platanus occidentalis* | 2 | No | FACW |
| 2. *Fraxinus pennsylvanica* | 5 | No | FACW |
| 3. *Tsuga canadensis* | 40 | Yes | FACU |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 47 | =Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. *Berberis thunbergii* | 5 | Yes | FACU |
| 2. *Crataegus monogyna* | 5 | Yes | FACU |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 10 | =Total Cover | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. *Solidago canadensis* | 40 | Yes | FACU |
| 2. *Monarda didyma* | 5 | No | FACU |
| 3. | 10 | No | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 55 | =Total Cover | |
| **Woody Vine Stratum** (Plot size: 30 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | =Total Cover | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 7 | x 2 = | 14 |
| FAC species | 0 | x 3 = | 0 |
| FACU species | 95 | x 4 = | 380 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 102 (A) | | 394 (B) |

Prevalence Index = B/A = 3.86

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point DP-5

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-8 | 10YR 3/3 | 100 | | | | | Loamy/Clayey | SiL, 40% sand, <10% clay |
| 8-20 | 10YR 3/3 | 100 | | | | | Loamy/Clayey | SiL, 80% cobbles |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

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

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** ____ **No** X

Remarks:

40% sand, <10% clay in soil profile from 0-20 inches. Cobbles begin to appear at 8 inches, featuring 80% cobbles.

## WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Starrucca Creek Project City/County: Susquehanna County Sampling Date: 7-24-15

Applicant/Owner: Resource Environmental Solutions, LLC State: PA Sampling Point: DP-6

Investigator(s): CR Clouser, TM Lee, Bluacres, LLC. Section, Township, Range: Thompson Township

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): Concave Slope %: 0-8%

Subregion (LRR or MLRA): LRR R, MLRA 140 Lat: 41.8748942 Long: -75.4898598 Datum: NAD83

Soil Map Unit Name: Volusia channery silt loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area** |
| Hydric Soil Present? | Yes X | No ____ | **within a Wetland?** **Yes** X **No** ____ |
| Wetland Hydrology Present? | Yes X | No ____ | If yes, optional Wetland Site ID: ____ |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

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

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Water Table Present? | Yes X | No ____ | Depth (inches): 5 |
| Saturation Present? (includes capillary fringe) | Yes X | No ____ | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** X **No** ____

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

Remarks:
Ground is saturated to the surface, and the water table was present at 5 inches roughly 15 minutes after the soil pit was dug.

**VEGETATION** – Use scientific names of plants. Sampling Point: DP-6

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Betula nigra* | 10 | Yes | FACW |
| 2. *Tsuga canadensis* | 25 | Yes | FACU |
| 3. *Acer rubrum* | 5 | No | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 40 | =Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. *Salix nigra* | 8 | Yes | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 8 | =Total Cover | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. *Onoclea sensibilis* | 30 | Yes | FACW |
| 2. *Impatiens capensis* | 60 | Yes | FACW |
| 3. *Persicaria sagittata* | 10 | No | OBL |
| 4. *Persicaria hydropiper* | 5 | No | OBL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 105 | =Total Cover | |
| **Woody Vine Stratum** (Plot size: 30 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | =Total Cover | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 23 | x 1 = | 23 |
| FACW species | 100 | x 2 = | 200 |
| FAC species | 5 | x 3 = | 15 |
| FACU species | 25 | x 4 = | 100 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 153 (A) | | 338 (B) |

Prevalence Index = B/A = 2.21

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
60% percent Sphagnum moss.

## SOIL

Sampling Point DP-6

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-5 | 2.5YR 7/1 | 70 | 7.5YR 5/6 | 30 | C | PL | Loamy/Clayey | SiL, mottling |
| 5-11 | 2.5YR 7/1 | 60 | 7.5YR 5/6 | 40 | C | PL | Loamy/Clayey | Silt loam, 80% cobbles, 40% sand |
| 11-20 | 2.5YR 5/1 | 60 | 7.5YR 5/6 | 40 | C | PL | Loamy/Clayey | Silt loam, cobbles present |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

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

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ? Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ? Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

0-5": silt loam, mottling. 5-11": silt loam, 80% cobbles present, 40% sand. 11-20": silt loam, cobbles present.

## WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Starrucca Creek Project City/County: Susquehanna County Sampling Date: 7-24-2015

Applicant/Owner: Resource Environmental Solutions, LLC State: PA Sampling Point: DP-7

Investigator(s): CR Clouser, TM Lee, Bluacres, LLC. Section, Township, Range: Thompson Township

Landform (hillside, terrace, etc.): Stream edge, flood plain Local relief (concave, convex, none): Concave Slope %: 0-1

Subregion (LRR or MLRA): LRR R, MLRA 140 Lat: 41.8760087 Long: -75.4846477 Datum: NAD-83

Soil Map Unit Name: 7B Shohola-Edgemere Complex NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area** |
| Hydric Soil Present? | Yes ____ | No X | **within a Wetland?** **Yes** ____ **No** X |
| Wetland Hydrology Present? | Yes X | No ____ | If yes, optional Wetland Site ID: ____ |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

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

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes X | No ____ | Depth (inches): 12 |
| Water Table Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No ____ | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** X **No** ____

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

Remarks:

This portion of the property was an oxbow region, posessing a large pool of water approximately 6-12 inches in depth. The pool inhabited fish species, as well as other aquatic fauna, such as leopard frogs and macro invertebrates. The oxbow in this wetland appears to hold standing water throughout the year.

**VEGETATION** – Use scientific names of plants. Sampling Point: DP-7

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. *Typha latifolia* | 40 | Yes | OBL |
| 2. *Peltandra virginica* | 20 | Yes | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 60 =Total Cover | | |
| **Woody Vine Stratum** (Plot size: 30 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species | x 1 = |
| FACW species | x 2 = |
| FAC species | x 3 = |
| FACU species | x 4 = |
| UPL species | x 5 = |
| Column Totals: (A) | (B) |

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point DP-7

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

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

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

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** ____ **No** X

Remarks:

A soil profile was not conducted for this data point, hydric soils were assumed due to present standing water within an oxbow. In addition, the pools of standing water also contained truly aquatic fauna.

## WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Starrucca Creek Project City/County: Susquehanna County Sampling Date: 7-24-2015

Applicant/Owner: Resource Environmental Solutions, LLC State: PA Sampling Point: DP-8

Investigator(s): CR Clouser, TM Lee, Bluacres, LLC. Section, Township, Range: Thompson Township

Landform (hillside, terrace, etc.): Point bar, toe slope Local relief (concave, convex, none): Concave Slope %: 0-1%

Subregion (LRR or MLRA): LRR R, MLRA 140 Lat: 41.8799648 Long: -75.4778106 Datum: NAD-83

Soil Map Unit Name: 7B Shohola-Edgemere Complex NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

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

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area** |
| Hydric Soil Present? | Yes X | No ____ | **within a Wetland?** **Yes** X **No** ____ |
| Wetland Hydrology Present? | Yes X | No ____ | If yes, optional Wetland Site ID: ____ |

Remarks: (Explain alternative procedures here or in a separate report.)

### HYDROLOGY

**Wetland Hydrology Indicators:**

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

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

Secondary Indicators (minimum of two required)

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

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No ____ | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No ____ | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** X **No** ____

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

Remarks:

The area proved positive for geomorphic positioning, and contained a concave feature from the forested slope to the north. This wetland type resembled a point bar, and toe slope within the flood plain.

**VEGETATION** – Use scientific names of plants. Sampling Point: DP-8

| Tree Stratum (Plot size: 30 ft) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 15 ft) | | | |
| 1. *Salix nigra* | 20 | Yes | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | 20 =Total Cover | | |
| **Herb Stratum** (Plot size: 5 ft) | | | |
| 1. *Phalaris arundinacea* | 60 | Yes | FACW |
| 2. *Solidago gigantea* | 30 | Yes | FACW |
| 3. *Eutrochium maculatum* | 10 | No | OBL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| | 100 =Total Cover | | |
| **Woody Vine Stratum** (Plot size: 30 ft) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | =Total Cover | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species | x 1 = |
| FACW species | x 2 = |
| FAC species | x 3 = |
| FACU species | x 4 = |
| UPL species | x 5 = |
| Column Totals: (A) | (B) |

Prevalence Index = B/A =

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

## SOIL

Sampling Point DP-8

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

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-6 | 2.5Y 3/2 | 100 | | | | | Loamy/Clayey | Silt loam, 40% sand, 10% clay |
| 6-20 | 10YR 6/2 | 80 | 10YR 5/6 | 20 | C | PL | Loamy/Clayey | Sandy loam, 60% sand, 10% clay |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
| | | | | | | | | |

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

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

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ? Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

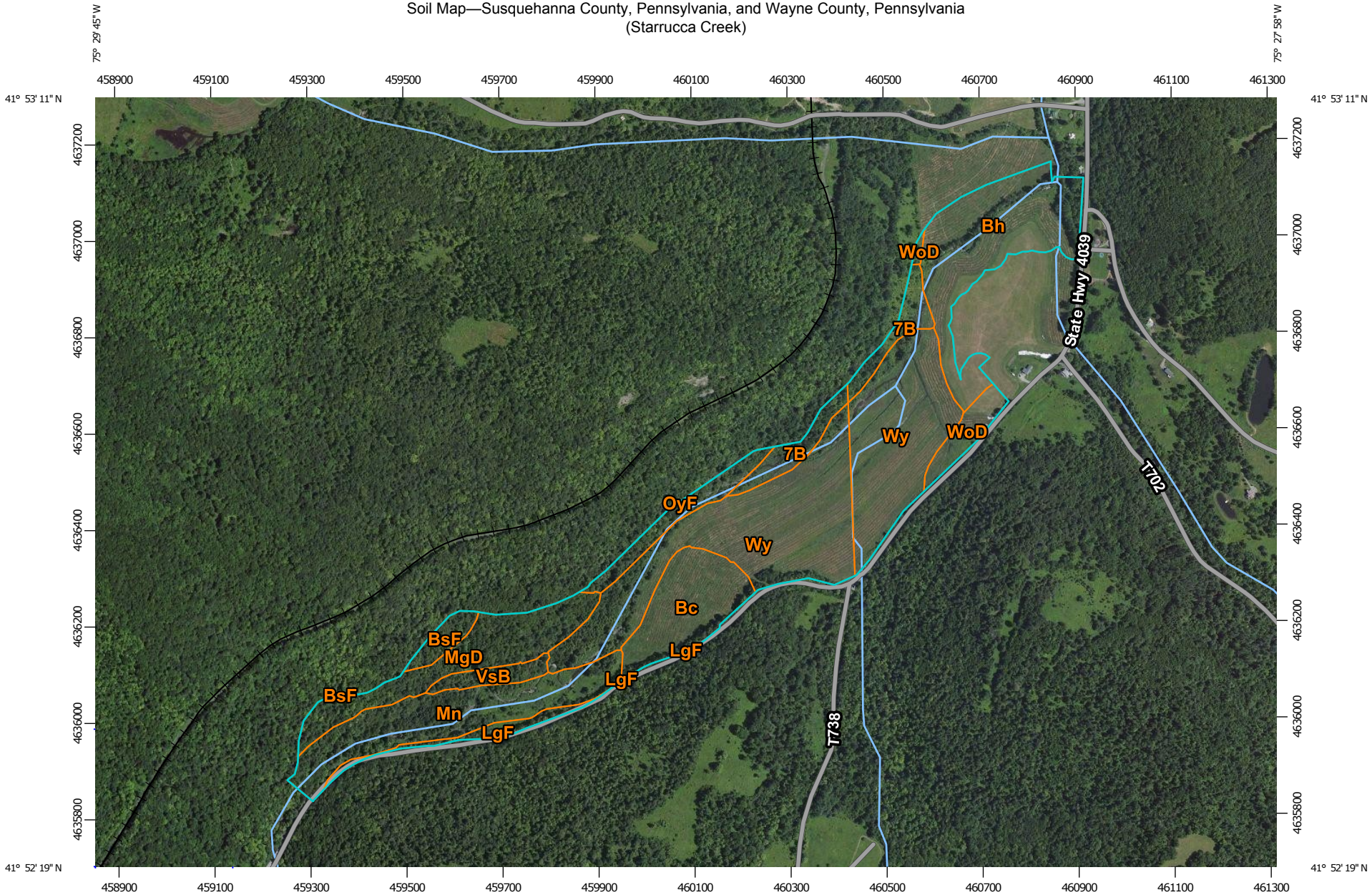
0-6 inches: silt loam, 40% sand, 10% clay. 6-20 inches: Sandy loam, 60% sand, 10% clay, with cobbles at 40%. Redox pore lining concentrations begin to appear after 6 inches, with a color of 10YR 5/6.

BluAcres·LLC
Wetlands and Wildlife Habitat

# APPENDIX E

## (USDA Soil Report)

Soil Map—Susquehanna County, Pennsylvania, and Wayne County, Pennsylvania
(Starrucca Creek)



## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**
- Streams and Canals

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**
- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Susquehanna County, Pennsylvania
Survey Area Data: Version 8, Sep 22, 2014

Soil Survey Area: Wayne County, Pennsylvania
Survey Area Data: Version 8, Sep 22, 2014

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 20, 2011—Jul 5, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Susquehanna County, Pennsylvania (PA115) | | | |
|---|---|---|---|
| **Map Unit Symbol** | **Map Unit Name** | **Acres in AOI** | **Percent of AOI** |
| 7B | Shohola-Edgemere complex, 0 to 8 percent slopes, very rubbly | 2.8 | 2.4% |
| Bc | Basher silt loam | 9.6 | 8.5% |
| BsF | Bath very stony loam, 30 to 60 percent slopes | 1.9 | 1.6% |
| LgF | Lackawanna very stony silt loam, 30 to 50 percent slopes | 2.0 | 1.7% |
| MgD | Mardin channery silt loam, 8 to 25 percent slopes, very stony | 10.9 | 9.7% |
| Mn | Mixed alluvial land | 14.8 | 13.1% |
| OyF | Oquaga and Lordstown extremely stony loams, 25 to 70 percent slopes | 3.8 | 3.4% |
| VsB | Volusia channery silt loam, 0 to 8 percent slopes, extremely stony | 2.1 | 1.9% |
| Wy | Wyalusing silt loam | 25.0 | 22.1% |
| **Subtotals for Soil Survey Area** | | **73.0** | **64.5%** |
| **Totals for Area of Interest** | | **113.1** | **100.0%** |

| Wayne County, Pennsylvania (PA127) | | | |
|---|---|---|---|
| **Map Unit Symbol** | **Map Unit Name** | **Acres in AOI** | **Percent of AOI** |
| 7B | Shohola-Edgemere complex, 0 to 8 percent slopes, very rubbly | 2.7 | 2.4% |
| Bh | Basher silt loam | 17.4 | 15.3% |
| WoD | Wellsboro extremely stony loam, 8 to 25 percent slopes | 3.1 | 2.7% |
| Wy | Wyalusing silt loam | 17.0 | 15.0% |
| **Subtotals for Soil Survey Area** | | **40.1** | **35.5%** |
| **Totals for Area of Interest** | | **113.1** | **100.0%** |

# Hydric Soil List - All Components

This table lists the map unit components and their hydric status in the survey area. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; Hurt and others, 2002).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2). Definitions for the codes are as follows:

1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;
3. Soils that are frequently ponded for long or very long duration during the growing season.
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;
4. Map unit components that are frequently flooded for long duration or very long duration during the growing season that:
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;

Hydric Condition: Food Security Act information regarding the ability to grow a commodity crop without removing woody vegetation or manipulating hydrology.

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

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Vasilas, L.M., G.W. Hurt, and C.V. Noble, editors. Version 7.0, 2010. Field indicators of hydric soils in the United States.

# Report—Hydric Soil List - All Components

| Hydric Soil List - All Components–PA115-Susquehanna County, Pennsylvania | | | | | |
|---|---|---|---|---|---|
| **Map symbol and map unit name** | **Component/Local Phase** | **Comp. pct.** | **Landform** | **Hydric status** | **Hydric criteria met (code)** |
| 7B: Shohola-Edgemere complex, 0 to 8 percent slopes, very rubbly | Shohola | 62 | Drainageways | No | — |
| | Edgemere | 29 | Depressions | Yes | 2,3 |
| | Mardin | 9 | — | No | — |
| Bc: Basher silt loam | Basher | 90 | Flood plains | No | — |
| | Wyalusing | 5 | Depressions | Yes | 2,3 |
| BsF: Bath very stony loam, 30 to 60 percent slopes | Bath | 100 | Mountains | No | — |
| LgF: Lackawanna very stony silt loam, 30 to 50 percent slopes | Lackawanna | 100 | Hillslopes,ridges | No | — |
| MgD: Mardin channery silt loam, 8 to 25 percent slopes, very stony | Mardin-Very stony | 85 | Till plains | No | — |
| | Lordstown-Very stony | 5 | Ridges | No | — |
| | Volusia-Very stony | 5 | Hills | No | — |
| | Bath-Very stony | 5 | Till plains,drumlinoid ridges,hills | No | — |
| Mn: Mixed alluvial land | Fluvents-Mixed alluvium | 80 | Flood-plain steps | No | — |
| | Wyalusing | 20 | Depressions | Yes | 2,3 |
| OyF: Oquaga and Lordstown extremely stony loams, 25 to 70 percent slopes | Oquaga | 48 | Hillslopes | No | — |
| | Lordstown | 22 | Hills | No | — |
| | Arnot | 10 | — | No | — |
| | Lackawanna | 10 | — | No | — |
| | Bath | 10 | — | No | — |
| VsB: Volusia channery silt loam, 0 to 8 percent slopes, extremely stony | Volusia-Extremely stony | 90 | Hills | No | — |
| | Chippewa-Extremely stony | 5 | Depressions | Yes | 2 |
| | Mardin-Extremely stony | 5 | Till plains | No | — |
| Wy: Wyalusing silt loam | Wyalusing | 100 | Flood plains | Yes | 2,4 |

| Hydric Soil List - All Components–PA127-Wayne County, Pennsylvania | | | | | |
|---|---|---|---|---|---|
| **Map symbol and map unit name** | **Component/Local Phase** | **Comp. pct.** | **Landform** | **Hydric status** | **Hydric criteria met (code)** |
| 7B: Shohola-Edgemere complex, 0 to 8 percent slopes, very rubbly | Shohola | 62 | Drainageways | No | — |
| | Edgemere | 29 | Depressions | Yes | 2,3 |
| | Mardin | 9 | — | No | — |
| Bh: Basher silt loam | Basher | 87 | Flood plains | No | — |
| | BASHER, FREQUENTLY FLOODED | 8 | — | No | — |
| | Holly | 5 | Backswamps,depressions on flood plains | Yes | 2 |
| MdD: Mardin extremely stony loam, 8 to 25 percent slopes | Mardin | 85 | Hills | No | — |
| | Volusia | 0-20 | Hills | No | — |
| | Chippewa | 2 | Depressions | Yes | 2,3 |
| WoD: Wellsboro extremely stony loam, 8 to 25 percent slopes | Wellsboro | 85 | Valley sides | No | — |
| | Lackawanna | 10 | — | No | — |
| | Norwich | 3 | Depressions | Yes | 2 |
| | Morris | 2 | — | No | — |
| Wy: Wyalusing silt loam | Wyalusing | 100 | Flood plains | Yes | 2,4 |

## Data Source Information

Soil Survey Area: Susquehanna County, Pennsylvania
Survey Area Data: Version 8, Sep 22, 2014

Soil Survey Area: Wayne County, Pennsylvania
Survey Area Data: Version 8, Sep 22, 2014

# APPENDIX F
# WATERCOURSE IDENTIFICATION REPORT

# Watercourse Identification Report

First Pennsylvania Resource, LLC
Starrucca Creek Mitigation Bank
Thompson Township, Susquehanna County, and
Starrucca Borough, Wayne County, Pennsylvania

**January 2019**

**Prepared by:**
First Pennsylvania Resource, LLC a wholly owned subsidiary of
Resource Environmental Solutions, LLC
33 Terminal Way, Suite W445A
Pittsburgh, PA 15219

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# LIST OF APPENDICES



# LIST OF TABLES

# 1.0 Introduction

First Pennsylvania Resource, LLC (FPR), a wholly-owned subsidiary of RES, LLC (RES) proposes to establish the Starrucca Creek Mitigation Bank (Project) within the approved Pennsylvania Statewide Umbrella Mitigation Banking Instrument (PSUMBI) for the purpose of providing compensatory mitigation for unavoidable impacts to waters of the United States (U.S.) occurring as a result of activities authorized under Section 401 and 404 of the Clean Water Act; Section 10 of the Rivers and Harbors Act; Pennsylvania Department of Environmental Protection (PADEP) Chapters 102, 105, and 106 regulatory programs; and Department of the Army Permits, provided such activities have met all applicable requirements and are authorized by the appropriate agencies. The location of the Project is shown in Figure 1: Project Location Map (Appendix A). A Wetland Delineation Report was completed and submitted as a separate report by BluAcres, LLC (August 2015).

Watercourse field identifications were conducted at the proposed Starrucca Creek Mitigation Bank (Project) in July 2015 by FPR biologists. The purpose of the environmental survey was to quantify, characterize, and delineate all existing watercourses within the Project. The Project, as shown in Figure 1: Project Location Map (Appendix A: Figures) is located in Thompson Township, Susquehanna County, and Starrucca Borough, Wayne County, Pennsylvania (PA) and is approximately 2.3 miles north-northwest of Thompson, 1.6 miles south of Starrucca, and 7 miles southeast of Susquehanna, PA. The approximate 105-acre Project Study Area can be characterized by agricultural land with some early to mid-successional forest and includes numerous streams and ditches draining to Starrucca Creek (Main Stem). The Project resides in the Catskill Formation geologic unit of the Devonian age, containing lithologic constituents of sandstone, siltstone, shale, conglomerate, and mudstone (PADCNR, 2001).

# 2.0 Methods

Streams were identified and delineated as Waters of the Commonwealth and/or the United States based on evaluation of typical stream characteristics such as defined streambed and streambanks, exclusion of terrestrial vegetation, hydrologically-sorted substrate material, the presence of an ordinary high-water mark, or observed connection to groundwater. Stream designations and reaches (perennial, intermittent, and ephemeral) were determined based on observed flow regime, observed connection to groundwater, and inhabitant biological communities. Wetlands and streams were given unique map designations and boundaries were surveyed using a Trimble Geo7 Series global positioning system mapping grade unit with the capability of sub-meter accuracy.

Wetland delineations were performed by BluAcres, LLC. (BlueAcres) and were conducted in accordance with the 1987 *United States Army Corps of Engineers (USACE) Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountain and Piedmont Region (Version 2.0)* (USACE, 2012). Wetlands identified during BluAcres survey are described under separate cover as the Starrucca Creek Project Bank Wetland Delineation Report (Wetland Report) dated August 2015.

# 3.0 Findings

The proposed Bank Site is located within the Upper Starrucca Creek watershed (12-digit HUC #020501011302), which is a subwatershed of the Upper Susquehanna River Subbasin (8-digit HUC #02050101). The Upper Starrucca Creek watershed covers approximately 21-square miles, with more than 20 miles of perennial streams, including Starrucca Creek.

Multiple major tributaries are identified within the Project limits – Starrucca Creek, Tributary 32274 to Starrucca Creek, Tributary 32282 to Starrucca Creek, Tributary 32283 to Starrucca Creek and Tributary 32285 to Starrucca Creek. Multiple unnamed tributaries (UNTS), wetlands and riparian floodplains surround these mainstem tributaries of the Project. Within the Project's limits, Starrucca Creek and its tributaries have a designated protected aquatic life use of Cold Water Fishes, Migratory Fishes (CWF, MF) per PA Code, Title 25, Chapter 93 (Commonwealth of PA, 2017). Downstream and outside of the Project's limits, the Pennsylvania Department of Environmental Protection (PADEP) lists Starrucca Creek and Tributary 32274 as having an Existing Use Classification of Exceptional Value (EV) (PADEP, 2017). Streams onsite are listed by the Pennsylvania Fish and Boat Commission (PFBC) as Naturally Reproducing Wild Trout Streams (PFBC 2018a). No PFBC Wild Trout Waters are located within or receive waters from the Project area (PFBC 2018b).

None of the Project waterbodies are defined as a submerged land of the Commonwealth of PA or are listed as navigable waters under Section 10 of the Rivers and Harbors Act of 1899. Project waterbodies are not located within a PA coastal zone and are not designated or nominated for designation as a national or state wild or scenic river. No reservoirs, federal or state parks, forests, or recreation areas were identified within the Project area.

Multiple streams were identified as part of the environmental survey for the Project. A brief discussion of the findings is presented herein. Figures depicting the Project and the locations of the identified resources are provided as Appendix A: Figure 2 Resource Location Map. Stream data forms and photographs are provided as Appendix B: Stream Data Forms and C: Stream Photographs, respectively.

Field efforts verified the existence of multiple UNTs to Starrucca Creek. Streams included perennial, intermittent, and ephemeral watercourse types. A summary of findings is provided in Table 1: Delineated Stream Resources. All identified streams are shown on Figure 2: Resource Location Map provided in Appendix A: Figures.

**Table 1: Summary of Identified Stream Resources**

| Resource Type | Classification | Value |
|---|---|---|
| Streams (Linear Feet) | Perennial | 17,665.42 |
| | Intermittent | 1,605.16 |
| | Ephemeral | 29.63 |
| | **Total** | **19,300.21** |
| Ditches (Linear Feet) | **Total** | **5,273.29** |

Streams onsite exhibit varying degrees of degradation. Areas of vertical and horizontal instability are present due to historic and ongoing agricultural practices. The origin of perennial and intermittent streams is driven by headwater seeps and groundwater upwelling zones, while ephemeral streams are driven by seasonal runoff. Streams within the Project area are predominately gravel and cobble dominated, however geomorphic instability has contributed to both siltation throughout stream reaches. Individual data sheets are provided in Appendix B: Stream Data Forms and photographs are provided in Appendix C: Stream Photographs.

# 4.0 Conclusions

The review/verification of field investigation efforts and associated collected data revealed the existence of multiple perennial, intermittent, and ephemeral watercourses. Table 2: Delineated Stream Summary, provides a detailed summary of delineation findings. Detailed mapping of findings is provided in Appendix A: Figures.

| Table 2: Delineated Stream Resources | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **FPR Stream ID** | **Stream Name** | **Designated Use** | **Existing Use** | **Migratory Fishery** | **FEMA Floodway** | **Stream Type** | **Average Active Width (FT)** | **Delineated Length (LF)** |
| Mainstem | Starrucca Creek | CWF, MF | - | Yes | Yes | PER | 1-21 (Braided) | 12,004.39 |
| Stream 1 | UNT To Starrucca Creek | CWF, MF | EV | Yes | Yes | PER | 10 | 1,124.58 |
| Stream 2 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | INT | 5-10 | 844.28 |
| Stream 3 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | PER | 2-6 | 449.93 |
| Stream 4 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | INT | 1 | 94.13 |
| Stream 5 | UNT To Starrucca Creek | CWF, MF | - | Yes | No | INT | 1 | 64.57 |
| Stream 6 | UNT To Starrucca Creek | CWF, MF | - | Yes | No | PER | 1-4 | 133.24 |
| Stream 7 | UNT To Starrucca Creek | CWF, MF | - | Yes | No | PER | 1 | 77.67 |
| Stream 8 | UNT To Starrucca Creek | CWF, MF | - | Yes | No | INT | 1 | 111.17 |
| Stream 9 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | PER | 2-4 | 230.44 |
| Stream 10 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | INT | 1-3 | 54.21 |
| Stream 11 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | INT | 1 | 45.47 |
| Stream 12 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | INT | 1 | 339.33 |
| Stream 13 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | PER | 1-10 | 1,771.13 |
| Stream 14 | Jurisdictional Ditch | CWF, MF | - | Yes | Yes | PER | 1-6 | 1,512.60 |
| Stream 15 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | PER | 1-2 | 110.54 |
| Stream 16 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | INT | 1 | 34.38 |
| Stream 17 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | INT | 1 | 17.62 |
| Stream 18 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | PER | 2 | 191.04 |
| Stream 19 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | PER | 2 | 59.86 |
| Stream 20 | UNT To Starrucca Creek | CWF, MF | - | Yes | Yes | EPH | 2 | 29.63 |
| *5,273.29 feet of ditches were also identified within the Project | | | | | | | | |

All statements in this document pertaining to the jurisdictional status of streams and wetlands with regard to USACE and state regulations represent the opinion of FPR and are based on present USACE guidance. The jurisdictional status of these features may be confirmed by a USACE Jurisdictional Determination and/or by state agencies.

Respectfully submitted,

**Shawyn Yeamans**
Project Manager
**RES** | res.us
Mobile: 724.421.7621

# 5.0 References


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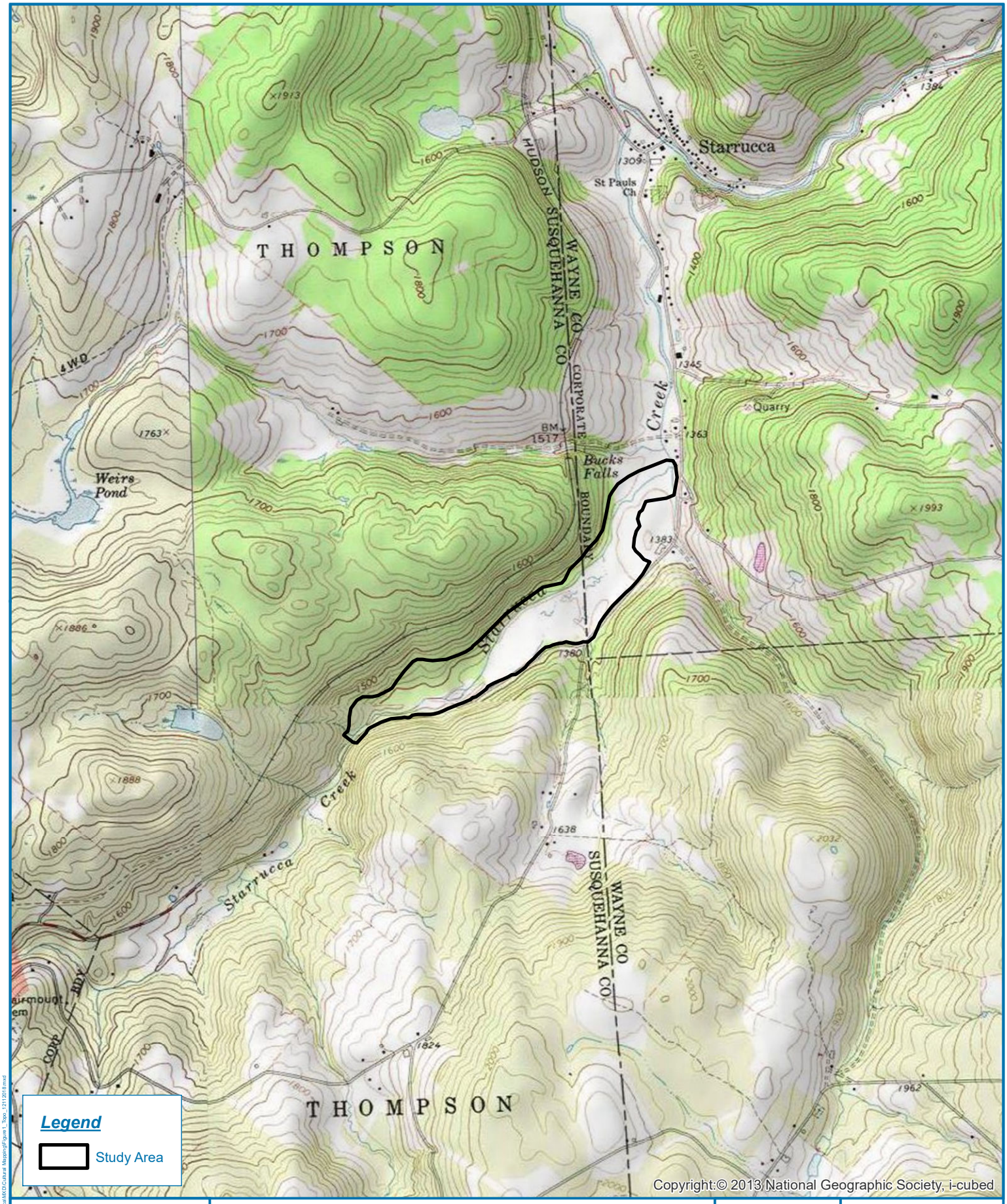
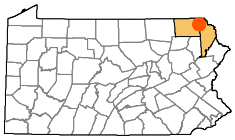
United States Army Corps of Engineers. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountain and Piedmont Region, Version 2.0.* ERDC/EL TR-12.1. United States Army Engineer Research and Development Center, Vicksburg, Mississippi.

# APPENDIX A
# FIGURES




**PROJECT LOCATION**



SUSQUEHANNA AND WAYNE COUNTIES, PA

**PROJECT LOCATION MAP**
**STARRUCCA CREEK MITIGATION BANK**

Feet
0 1,000 2,000

**FIGURE 1**

Date: 1/17/2019
Drawn by: NDR
Checked by: SY

res

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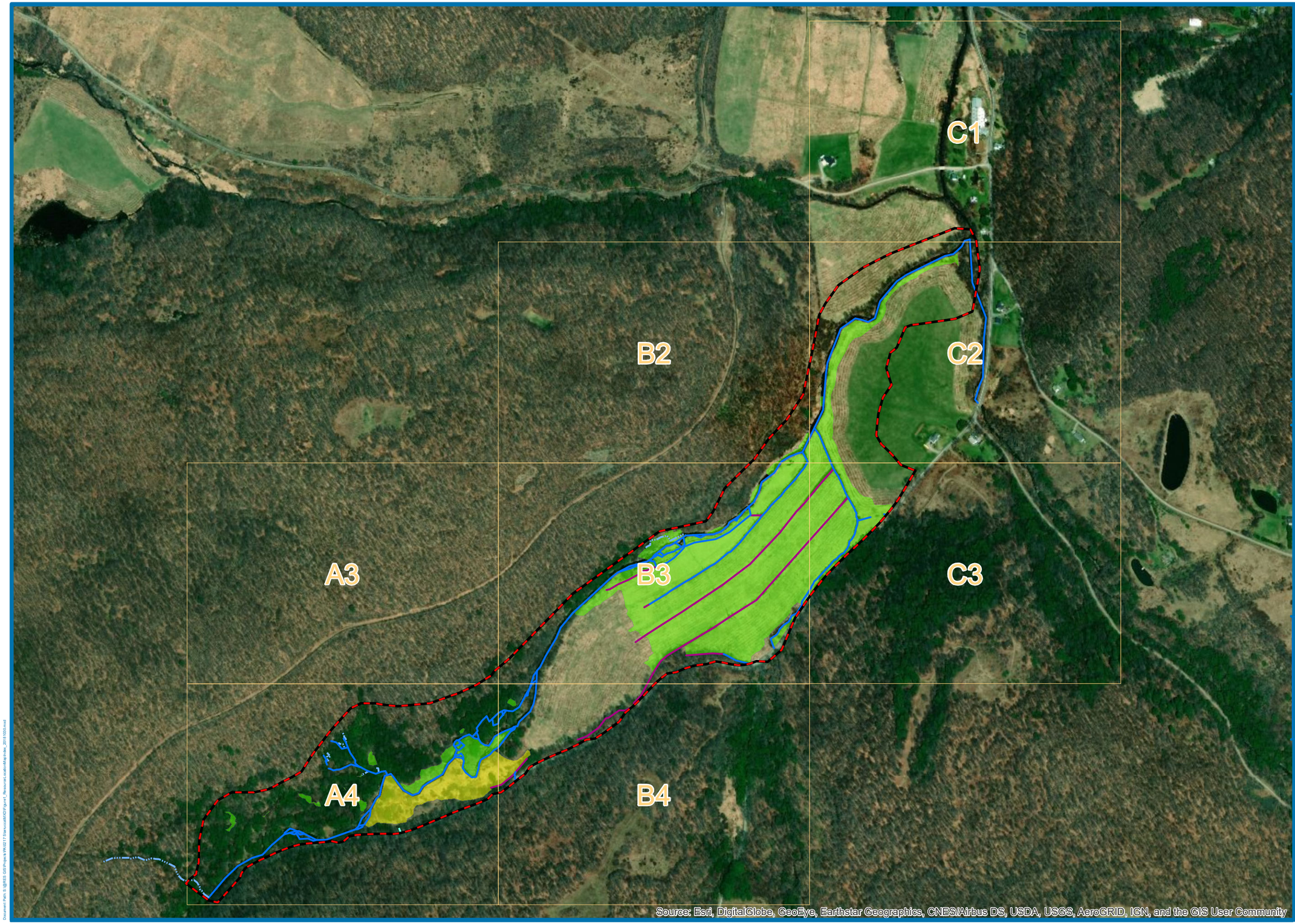



res

N
W E
S

0 500 1,000
Feet

**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

## LEGEND

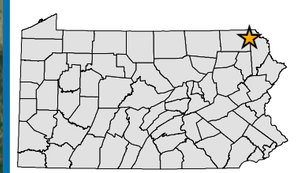
- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
- Perennial (17,665.42 LF)
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS



## REFERENCE

1.) Horizontal Datum is NAD 1983 StatePlane Pennsylvania North FIPS 3701 (US Feet)

2.) The parcel data information/property boundaries depicted on this map is for prospect assessment purposes only. It is not to be used as final boundaries.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: S:\gRES GIS\Projects\PA\0217 Starrucca\MXD\Figure1_ResourceLocationMap.mxd, 2018/10/30.mxd


res

N
W E
S

0 125 250
Feet

**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

**LEGEND**

- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
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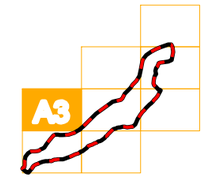
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS

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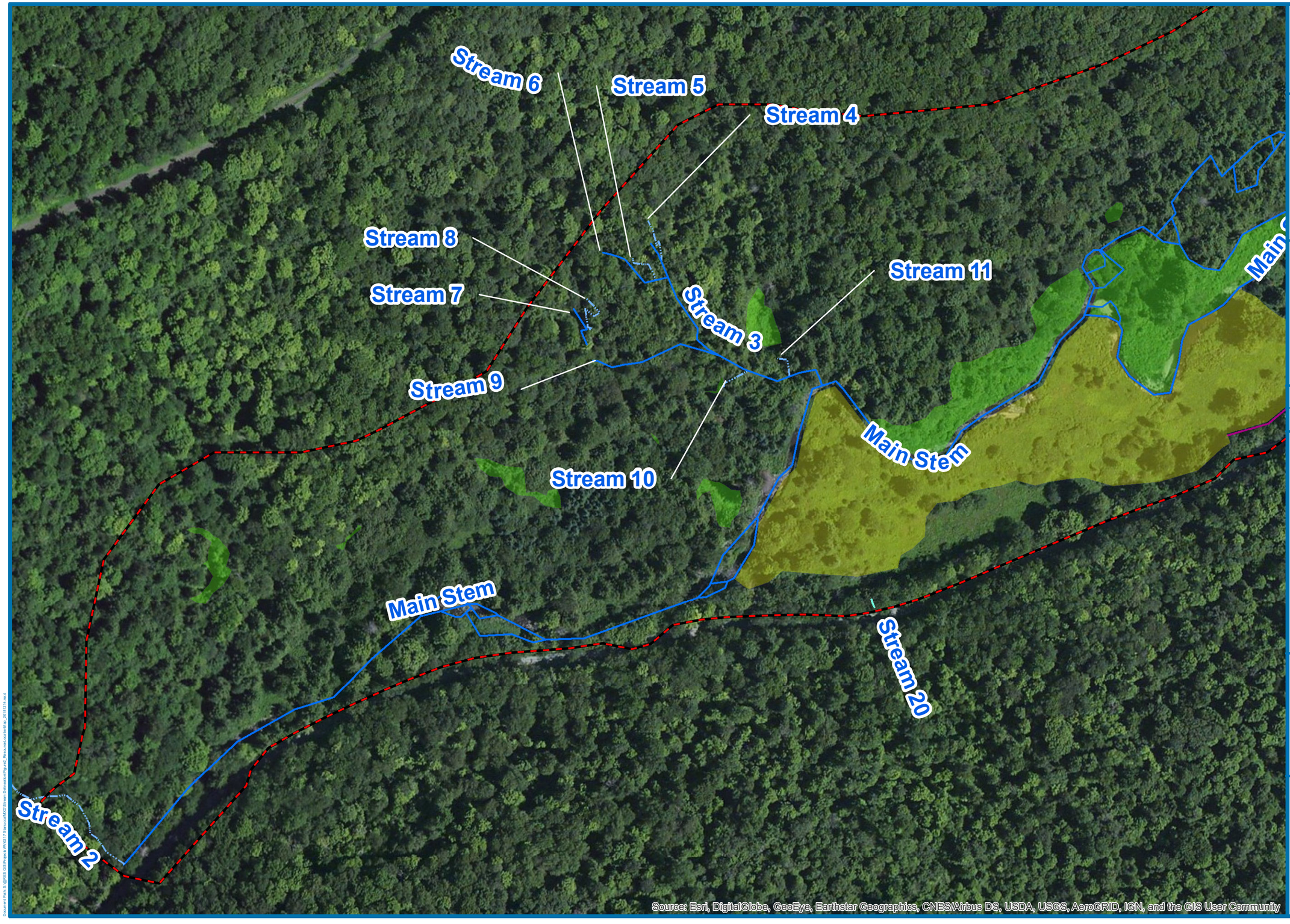


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**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

**LEGEND**

- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
- Perennial (17,665.42 LF)
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS

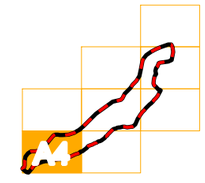

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**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

**LEGEND**

- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
- Perennial (17,665.42 LF)
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS

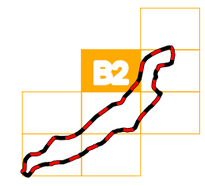


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**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

**LEGEND**

- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
- Perennial (17,665.42 LF)
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS

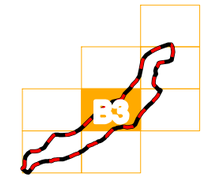


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**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

**LEGEND**

- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
- Perennial (17,665.42 LF)
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS

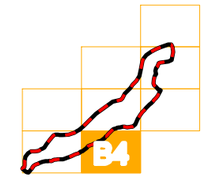


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**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

**LEGEND**

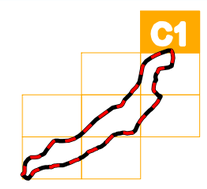
- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
- Perennial (17,665.42 LF)
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS

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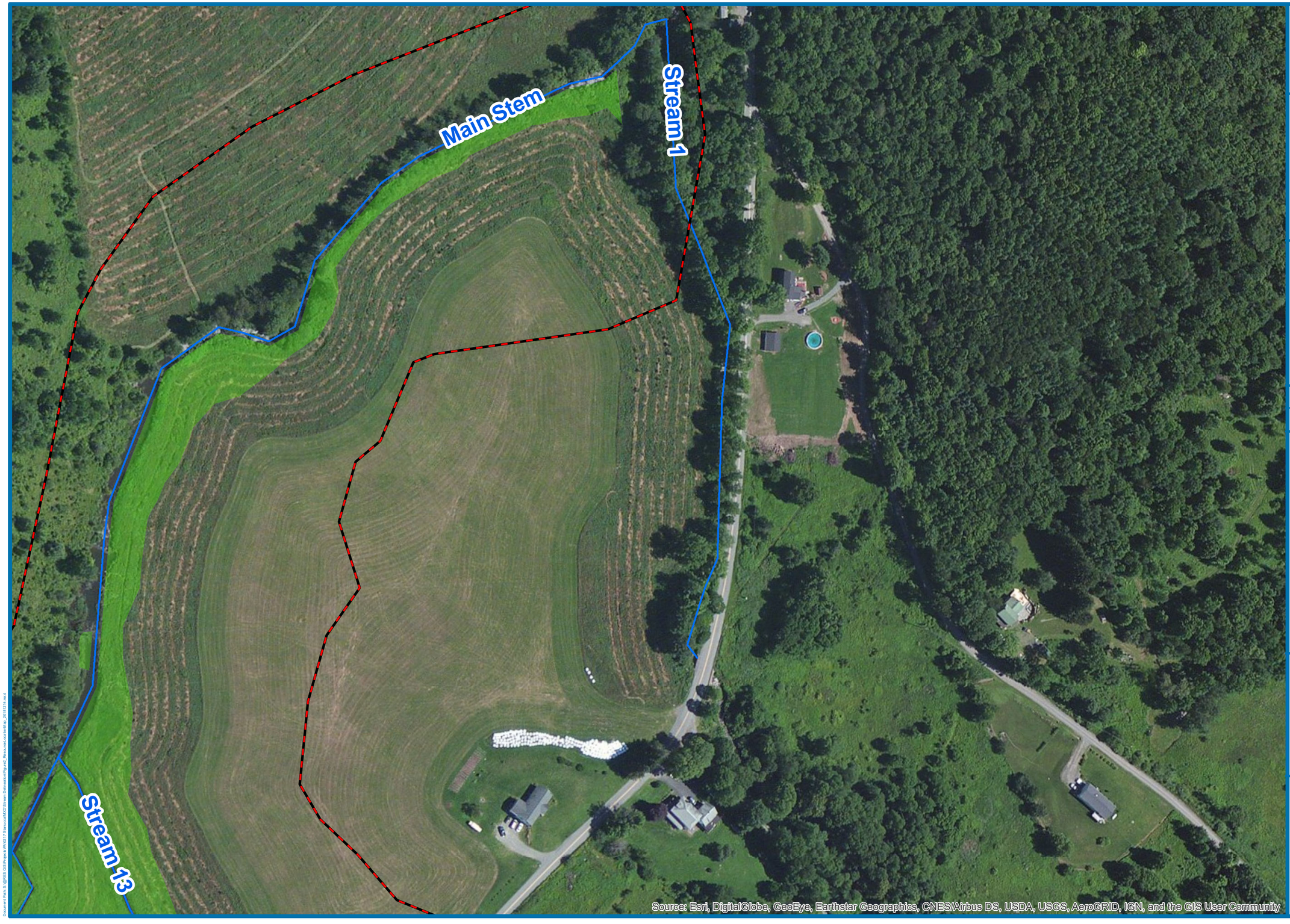


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**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

**LEGEND**

- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
- Perennial (17,665.42 LF)
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS

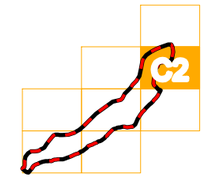


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**FIGURE 2**

**STARUCCA CREEK MITIGATION BANK**

**RESOURCE LOCATION MAP**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

| | |
|---|---|
| Date: 1/17/2019 | Drawn by: NGD/MRH |
| Checked by: SY | |

**LEGEND**

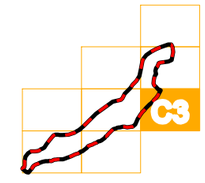
- Study Area

**Streams (19,300.21 LF)**

- Ephemeral (29.63 LF)
- Intermittent (1,605.16 LF)
- Perennial (17,665.42 LF)
- Ditches (5,273.29 LF)

**Delineated Wetlands**

- PEM
- PSS

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# APPENDIX B
# STREAM DATA FORMS

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | Main Stem |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 269,300 |
| Wetted Width (ft) | 1-21 (Braided) |
| Water Depth (ft) | 2.5 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| X | Seep |
| X | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| X | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| X | Forest |
| X | Pasture |
| X | Old Field |
| X | Open Field |
| X | Wetland |
| X | Mixed Used |
| | Industrial |
| | Mining |
| X | Residential |

| **Macroinvertebrate Observations** |
|---|
| Capniidae |
| Psephenidae |
| Crayfish |
| Leptophelbiidae |
| Nemouridae |
| Euonoidae |
| Leuctridae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| X | Halfway (50 %) |
| | Little/None (0-33%) |

| **Other Observations** |
|---|
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| **Channel Conditions** | |
|---|---|
| 1-21 (Braided) | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| X | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 1 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 89,770 |
| Wetted Width (ft) | 10 |
| Water Depth (ft) | 0.5 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| X | Seep |
| X | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| | Gravel |
| | Sand |
| | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| X | Forest |
| | Pasture |
| X | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Euonoidae |
| Ephemerotera |
| Psephenidae |
| Hydropsychidae |
| Limnephilidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
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| **Channel Conditions** | |
|---|---|
| 10 | Active Width (ft) |
| | Bed/Banks |
| | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 2 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 5/26/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 20 |
| Wetted Width (ft) | 3-8 |
| Water Depth (ft) | 0.2 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| X | Seep |
| X | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| X | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| X | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Leptophilibidae |
| Hydropsychidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| Clear Water |
| Aggradation at lower end |

| **Channel Conditions** | |
|---|---|
| 5-10 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 3 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 6-10 |
| Wetted Width (ft) | 2-6 |
| Water Depth (ft) | 0.2 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Leptophisibidane |
| Heptigenidae |
| Lecutricidae |
| Nemouridae |
| Caddis Shells |
| |
| |
| |
| |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| Fish Fry |
| Clear Water |
| Mosses |
| |
| |
| |
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| |
| |

| **Channel Conditions** | |
|---|---|
| 2-6 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| X | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 4 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | |
| Wetted Width (ft) | |
| Water Depth (ft) | 1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Peltoperlidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| X | Mostly (75 %) |
| | Halfway (50 %) |
| | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |

| **Channel Conditions** | |
|---|---|
| 1 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| X | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 5 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 2 |
| Wetted Width (ft) | 1 |
| Water Depth (ft) | 0.12 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Leptophilitidae |
| Nemouridae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| X | Mostly (75 %) |
| | Halfway (50 %) |
| | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |

| **Channel Conditions** | |
|---|---|
| 1 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| X | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 6 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 4-5 |
| Wetted Width (ft) | 1-4 |
| Water Depth (ft) | 0.2 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Leptophilitidae |
| Peltoperlidae |
| Limephelidae |
| Nemouridae |
| Heptigenidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| X | Mostly (75 %) |
| | Halfway (50 %) |
| | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |

| **Channel Conditions** | |
|---|---|
| 1-4 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| X | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 7 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 1 |
| Wetted Width (ft) | 1 |
| Water Depth (ft) | 0.2 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Scuds |
| Caddis Shells |
| Leptophilibidae |
| Leucridae |
| Dixidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| X | Mostly (75 %) |
| | Halfway (50 %) |
| | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |

| **Channel Conditions** | |
|---|---|
| 1 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| X | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 8 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 1 |
| Wetted Width (ft) | 1 |
| Water Depth (ft) | 0.2 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Scuds |
| Caddis Shells |
| Leptophilibidae |
| Leucridae |
| Dixidae |
| Heptigenidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| X | Mostly (75 %) |
| | Halfway (50 %) |
| | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |

| **Channel Conditions** | |
|---|---|
| 1 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| X | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 9 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 4-5 |
| Wetted Width (ft) | 2-4 |
| Water Depth (ft) | 0.2 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Scuds |
| Euonoidae |
| Leaf Caddis Fly |
| Heptigenidae |
| Dixidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| X | Mostly (75 %) |
| | Halfway (50 %) |
| | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |

| **Channel Conditions** | |
|---|---|
| 2-4 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| X | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 10 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | >1 |
| Wetted Width (ft) | 1-3 |
| Water Depth (ft) | 0.1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
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| | | |

| **Hydrology Source(s)** | |
|---|---|
| | Spring |
| X | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Scuds |
| Euonoidae |
| Lepidostomatidae |
| Heptigenidae |
| Dixidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| X | Mostly (75 %) |
| | Halfway (50 %) |
| | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |

| **Channel Conditions** | |
|---|---|
| 1-3 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 11 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 1 |
| Wetted Width (ft) | 1 |
| Water Depth (ft) | 0.1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
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| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| | Cobble |
| X | Gravel |
| | Sand |
| | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| x | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
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| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |
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| **Channel Conditions** | |
|---|---|
| 1 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 12 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | >1 |
| Wetted Width (ft) | 1 |
| Water Depth (ft) | 0.1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| | Spring |
| X | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| | Cobble |
| | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| X | Forest |
| | Pasture |
| X | Old Field |
| | Open Field |
| X | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
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| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| Mosses |
| |
| |
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| |

| **Channel Conditions** | |
|---|---|
| 1 | Active Width (ft) |
| X | Bed/Banks |
| | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

# Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 13 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 50 |
| Wetted Width (ft) | 1-10 |
| Water Depth (ft) | 0.2-5 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| X | Seep |
| X | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| X | Forest |
| X | Pasture |
| X | Old Field |
| X | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Heptigenidae |
| Peltoperlidae |
| Capnidae |
| Baetidae |
| Ephemerellidae |
| Hydropsychidae |
| Philopotamidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| Fish - Including Brook Trout |

| **Channel Conditions** | |
|---|---|
| 1-10 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

# Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 14 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 20 |
| Wetted Width (ft) | 1-6 |
| Water Depth (ft) | 1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| X | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| | Forest |
| X | Pasture |
| X | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Euonoidae |
| Ephemerellidae |
| Hydropsychidae |
| Scuds |
| Physid Snail |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| Fish - Including Brook Trout |

| **Channel Conditions** | |
|---|---|
| 1-6 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

# Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 15 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 5 |
| Wetted Width (ft) | 1-2 |
| Water Depth (ft) | 1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| | Forest |
| X | Pasture |
| X | Old Field |
| | Open Field |
| X | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Scuds |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| |

| **Channel Conditions** | |
|---|---|
| 1-2 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 16 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 3 |
| Wetted Width (ft) | 1 |
| Water Depth (ft) | 0.1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| | Cobble |
| | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| | Forest |
| X | Pasture |
| X | Old Field |
| | Open Field |
| X | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
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| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
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| |

| **Channel Conditions** | |
|---|---|
| 1 | Active Width (ft) |
| X | Bed/Banks |
| | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 17 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 3 |
| Wetted Width (ft) | 1 |
| Water Depth (ft) | 0.1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| | Cobble |
| | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| | Forest |
| X | Pasture |
| X | Old Field |
| | Open Field |
| X | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
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| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
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| **Channel Conditions** | |
|---|---|
| 1 | Active Width (ft) |
| X | Bed/Banks |
| | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| X | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 18 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 1-3 |
| Wetted Width (ft) | 2 |
| Water Depth (ft) | 0.1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| X | Forest |
| X | Pasture |
| X | Old Field |
| | Open Field |
| X | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Scuds |
| Isopoda |
| Tipulidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| |

| **Channel Conditions** | |
|---|---|
| 2 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 19 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | ZS SY |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | 5 |
| Wetted Width (ft) | 2 |
| Water Depth (ft) | 0.1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
| | | |
| | | |
| | | |

| **Hydrology Source(s)** | |
|---|---|
| X | Spring |
| | Seep |
| | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| X | Gravel |
| | Sand |
| X | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| X | Forest |
| X | Pasture |
| X | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
|---|
| Peltoperlidae |
| Nemouridae |
| Euonoidae |

| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
|---|
| |

| **Channel Conditions** | |
|---|---|
| 2 | Active Width (ft) |
| X | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| X | RPW |
| | Non-RPW |

| Stream Type: | |
|---|---|
| X | Perennial |
| | Intermittent |
| | Ephemeral |

## Stream Classification Data Form

| | |
|---|---|
| **Stream Name/Code:** | UNT 20 |
| **Sampling Location:** | Starrucca |
| **Date/Time:** | 7/2/2015 |
| **Investigators:** | SY ZS |

| **Stream Hydrology** | |
|---|---|
| Estimated Flow (gpm) | .1 |
| Wetted Width (ft) | 1 |
| Water Depth (ft) | 0.1 |

| **Photos** | | **GPS Point** |
|---|---|---|
| **DS** | **US** | |
| | | |
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| **Hydrology Source(s)** | |
|---|---|
| | Spring |
| | Seep |
| X | Run-off |
| | Pond |

| **Weather Conditions:** | | **5-Day Precipitation?** | | |
|---|---|---|---|---|
| | Sunny | | Yes | Esimated Amount: (in) |
| | Partly Cloudy | | No | |
| | Couldy | | | |
| X | Rain | | | |

| **Substrate Type(s)** | |
|---|---|
| | Bedrock |
| | Boulder |
| X | Cobble |
| | Gravel |
| | Sand |
| | Silt |
| | Clay |
| | Artificial |

| **Watershed Characteristics** | |
|---|---|
| X | Forest |
| | Pasture |
| | Old Field |
| | Open Field |
| | Wetland |
| | Mixed Used |
| | Industrial |
| | Mining |
| | Residential |

| **Macroinvertebrate Observations** |
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| **Channel Embeddedness** | |
|---|---|
| | Completely (100 %) |
| | Mostly (75 %) |
| | Halfway (50 %) |
| X | Little/None (0-33%) |

| **Other Observations** |
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| **Channel Conditions** | |
|---|---|
| 2 | Active Width (ft) |
| | Bed/Banks |
| X | Alluvial Channel |
| | Eroded Channel |
| | Debris -filled |
| | Terrestrial Vegetation |

| **Recommended USACE JD Status** | |
|---|---|
| | TNW |
| | RPW |
| X | Non-RPW |

| Stream Type: | |
|---|---|
| | Perennial |
| | Intermittent |
| X | Ephemeral |

# APPENDIX C
# STREAM PHOTOGRAPHS

**Photo 1:** Mainstem Stream facing small beaver dam upstream.

**Photo 2:** Mainstem facing downstream.

**Photo 3:** Stream 1 facing bridge across Starrucca Creek Road.

**Photo 4:** Mainstream braided channel.

**Photo 5:** Stream 3 upstream.

**Photo 6:** Stream 6 upstream.

**Photo 7:** Stream 9 upstream.

**Photo 8:** Project overview from Starrucca Creek Road facing Northeast.

**Photo 9:** Mainstem Stream across facing North.

**Photo 10:** Stream 14 Jurisdictional Ditch.

.

**Photo 11:** Stream 13 Upstream.

**Photo 12:** Center of mainstem stream facing West.

**Photo 13:** Rip-Rap on mainstem.

**Photo 14:** Exposed roots at the eastern portion of the Mainstem.

# APPENDIX G
# JURISDICTIONAL AGENCY COORDINATION

# PNDI & RTE

# 1. PROJECT INFORMATION

Project Name: **Starrucca**
Date of Review: **1/14/2019 12:50:33 PM**
Project Category: **Habitat Conservation and Restoration, Wetland Restoration, Wetland Creation, or Wetland Enhancement**
Project Area: **104.99 acres**
County(s): **Susquehanna; Wayne**
Township/Municipality(s): **STARRUCCA; THOMPSON**
ZIP Code: **18462; 18465**
Quadrangle Name(s): **ORSON; STARRUCCA**
Watersheds HUC 8: **Upper Susquehanna**
Watersheds HUC 12: **Upper Starrucca Creek**
Decimal Degrees: **41.878413, -75.480439**
Degrees Minutes Seconds: **41° 52' 42.2876" N, 75° 28' 49.5816" W**

# 2. SEARCH RESULTS

| Agency | Results | Response |
|---|---|---|
| PA Game Commission | No Known Impact | No Further Review Required |
| PA Department of Conservation and Natural Resources | No Known Impact | No Further Review Required |
| PA Fish and Boat Commission | No Known Impact | No Further Review Required |
| U.S. Fish and Wildlife Service | No Known Impact | No Further Review Required |

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate no known impacts to threatened and endangered species and/or special concern species and resources within the project area. Therefore, based on the information you provided, no further coordination is required with the jurisdictional agencies. This response does not reflect potential agency concerns regarding impacts to other ecological resources, such as wetlands.

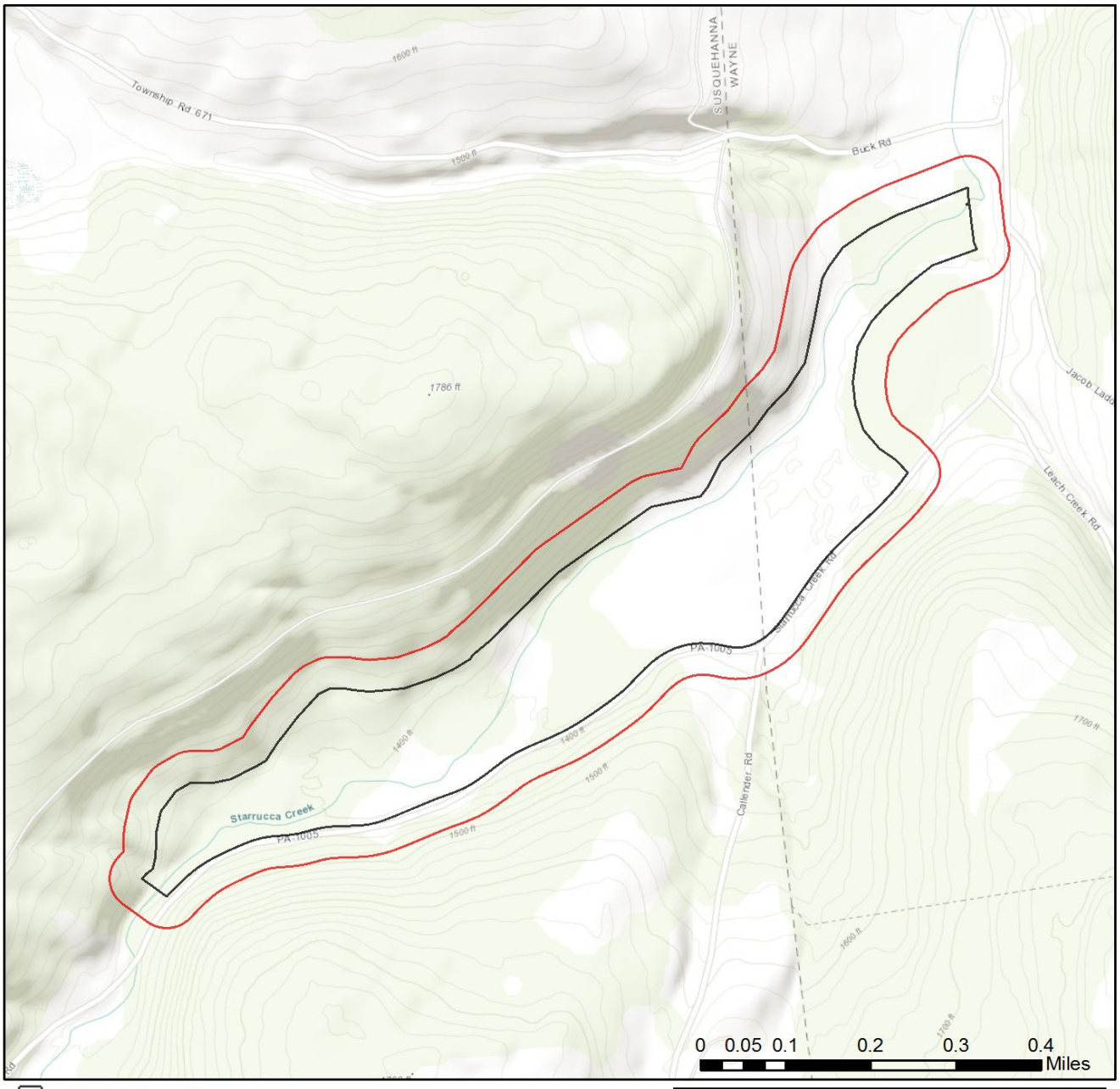
# Starrucca


Project Boundary

Buffered Project Boundary


Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

# Starrucca




Project Boundary

Buffered Project Boundary


Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

# 3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

## PA Game Commission

**RESPONSE:**

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

## PA Department of Conservation and Natural Resources

**RESPONSE:**

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

## PA Fish and Boat Commission

**RESPONSE:**

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

## U.S. Fish and Wildlife Service

**RESPONSE:**

No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq. is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

# 4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. Two review options are available to permit applicants for handling PNDI coordination in conjunction with DEP's permit review process involving either T&E Species or species of special concern. Under sequential review, the permit applicant performs a PNDI screening and completes all coordination with the appropriate jurisdictional agencies prior to submitting the permit application. The applicant will include with its application, both a PNDI receipt and/or a clearance letter from the jurisdictional agency if the PNDI Receipt shows a Potential Impact to a species or the applicant chooses to obtain letters directly from the jurisdictional agencies. Under concurrent review, DEP, where feasible, will allow technical review of the permit to occur concurrently with the T&E species consultation with the jurisdictional agency. The applicant must still supply a copy of the PNDI Receipt with its permit application. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. The applicant and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at https://conservationexplorer.dcnr.pa.gov/content/resources.

## 5. ADDITIONAL INFORMATION

The PNDI environmental review website is a preliminary screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

## 6. AGENCY CONTACT INFORMATION

**PA Department of Conservation and Natural Resources**
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552
Email: RA-HeritageReview@pa.gov

**U.S. Fish and Wildlife Service**
Pennsylvania Field Office
Endangered Species Section
110 Radnor Rd; Suite 101
State College, PA 16801
NO Faxes Please

**PA Fish and Boat Commission**
Division of Environmental Services
595 E. Rolling Ridge Dr., Bellefonte, PA 16823
Email: RA-FBPACENOTIFY@pa.gov

**PA Game Commission**
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA 17110-9797
Email: RA-PGC_PNDI@pa.gov
NO Faxes Please

## 7. PROJECT CONTACT INFORMATION

Name: Nathan Renaudin
Company/Business Name: RES
Address: 33 Terminal Way Suite 431A
City, State, Zip: Pittsburgh, PA 15219
Phone: ( 412 ) 249-2459 Fax: ( )
Email: nrenaudin@res.us

## 8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

Nathan Renaudin
applicant/project proponent signature

1/14/2019
date

PHMC

Pennsylvania State Historic Preservation Office
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION

April 3, 2019

Circa~Cultural Resource Management
Attn: Carol D. Tyrer
453 McLaws Circle, Suite 3
Williamsburg, VA 23185

RE: ER 2019-0513-042-B – COE: Phase I Cultural Resources Survey, Starrucca Creek Mitigation Bank, Starrucca Borough, Wayne County and Thompson Township, Susquehanna County

Dear Ms. Tyrer:

Thank you for submitting this report for the above referenced project. The Pennsylvania State Historic Preservation Office (PA SHPO) reviews projects in accordance with state and federal laws. Section 106 of the National Historic Preservation Act of 1966, and the implementing regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation, is the primary federal legislation. The Environmental Rights amendment, Article 1, Section 27 of the Pennsylvania Constitution and the Pennsylvania History Code, 37 Pa. Cons. Stat. Section 500 et seq. (1988) is the primary state legislation. These laws include consideration of the project's potential effects on both historic and archaeological resources.

Based on the negative results of this investigation, we agree with the recommendation that no further archaeological work is necessary. In our opinion, the proposed project will have no effect on significant cultural resources.

If you have any questions or comments concerning our review, please contact Mark Shaffer at mshaffer@pa.gov or (717) 783-9900.
Sincerely,

Douglas C. McLearen, Chief
Division of Environmental Review

c: Hannah Kalk

33 Terminal Way, Suite 431
Pittsburgh, PA 15219

**Corporate Headquarters**
5020 Montrose Blvd. Suite 650
Houston, TX 77006
Main: 713.520.5400

**Date:** December 11, 2018

**RE:** Request to Initiate Consultation
Starrucca Creek Mitigation Bank
Starrucca Borough, Wayne County, Pennsylvania
Thompson Township, Susquehanna County, Pennsylvania

To Whom It May Concern:

First Pennsylvania Resource, LLC (FPR), a wholly owned subsidiary of Resource Environmental Solutions, LLC (RES) is requesting to initiate consultation with the Pennsylvania Historical and Museum Commission (PHMC) for the proposed wetland and stream restoration activities associated with the Starrucca Creek Mitigation Bank (Project) in Starrucca Borough, Wayne County and Thompson Township, Susquehanna County, Pennsylvania (PA). The location of the Project study area is shown in Figure 1: Project Location Map (Attachment 1: Figures). The purpose of the Project is to provide compensatory mitigation for unavoidable impacts to waters and wetlands of the United States (U.S.) as a result of activities authorized under Section 401 and 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, Pennsylvania Department of Environmental Protection (PADEP) Chapter 102, 105, and 106 regulatory programs and Department of the Army Permits provided such activities have met all applicable requirements and are authorized by the appropriate agencies.

The purpose of this coordination request is to ensure that the proposed project does not impact cultural resources. As indicated in the attached Project Review Form (Attachment 2: Project Review Form), the proposed project will require state and federal permits including PA Department of Environmental Protection (DEP) Chapter 105, 102 and Section 401/404 permit authorizations. A Phase I cultural resources survey of the Project was conducted during September 2015 by Circa~Cultural Resource Management, LLC (Circa~) to identify and record all historic resources within the Project Site. This survey resulted in the identification of no isolated finds, new archaeological sites, or architectural resources. Circa~ recommended no further work for the Bank site based upon their 2015 survey (Attachment 3: Phase 1 Survey Report).

## Bank Site Description

The Bank Site includes a portion of the main stem of Starrucca Creek, multiple unnamed tributaries (UNTs) to Starrucca Creek, man-made ditches, and degraded Palustrine Emergent (PEM) and Palustrine Scrub-Shrub (PSS) wetlands. The Bank Site exhibits a mixture of mixed, evergreen, and deciduous forest in addition to open agricultural land used for hay/cropland in and around the wetlands and streams.

The topography of the stream channels consists of a wide active stream valley surrounded by steep slopes to the north and south. The stream's headwaters are located to the west and the floodplain drops in elevation as the main stem traverses its way east through the steep upland ridges. Multiple tributaries and drainages exist both from the north and from south, emptying the uplands into the floodplain.

The majority of streams and wetlands identified on-site have been degraded to varying degrees through anthropogenic alterations, including historic and current agricultural activities and the introduction of non-native pasture grasses. The extent of degradation is directly related to time elapsed since land use change (i.e. abandonment of farm use) and/or since incidental impacts (i.e. those areas near roadways or cultivated lands that have continued exposure to erosive conditions and invasive species seed stock). Historic and ongoing land use practices have created an environment ideal for the spread of invasive species colonization and monoculture establishment across the Project area. Dominant invasive species observed include Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), Japanese knotweed (*Fallopia japonica*), Autumn Olive (*Eleagnus umbellata*) and reed canarygrass (*Phalaris arundinacea*). Representative photographs of the site are included in the Phase 1 Survey Report (Attachment 3) and the existing site conditions are shown on Figure 2: Existing Conditions Map (Attachment 1: Figures)

## Project Description

Streams identified within the Bank Site will be restored utilizing rehabilitation and relocation approaches. Stream restoration activities within the rehabilitation reaches are anticipated to include installation of geomorphic in-stream structures, while relocation reaches will involve grading within the floodplains and relocation of the streams pattern and profile, a necessary approach used to stabilize a stream and re-establish its connectivity with the floodplain.

All existing wetlands within the Bank Site will be rehabilitated or enhanced. Rehabilitation and enhancement activities will entail diligent invasive species removal and supplemental native species replanting efforts. Wetland re-establishment activities will be supported by the stream relocation activities, as wetland re-establishment is anticipated as a result of the restoration of the connectivity between the streams and their floodplains. Figure 3: Resource Development Map (Attachment 1: Figures), which shows the locations of the proposed wetland and stream activities by restoration type, is provided in Attachment 1: Figures, to aid in the review process. Riparian corridors surrounding existing streams within the Project area will be enhanced and/or re-established through the removal of invasive plant species and will be coupled with supplemental native species plantings. The restoration activities will enhance the overall ecological long-term, self-sustaining viability of the Bank Site.

As shown in Figure 4: Proposed Disturbance Map, the area with the greatest potential of effect (APE) is approximately 45.01 acres and follows the floodplain corridor along streams designated for relocation. Excavation of the floodplain soils along the relocation stream reaches will be returned to the upland fields (identified as Preliminary Spoil Area on Attachment 1: Figures, Figure 4: Proposed Disturbance Map) from which they originated. Excavated soils will be graded to respect existing contours. No adverse impacts are anticipated in those areas as grading in this area will be minimal. Soils will be graded to existing contours and stabilized appropriately. Total potential earthmoving, to include both the proposed grading area and the proposed temporary impacts associated with access, staging and spoil storage, amounts to approximately 58.83 acres. Although a portion of the upland areas proposed for soil stockpiling were not included within the original Phase 1 survey, they have been used for agricultural purposes, primarily hay production, for more than a century and as such, FPR does not anticipate any adverse impacts to potential cultural resources that may be present in these areas. All other portions of the project were addressed within the Phase 1 survey (Attachment 3. Phase 1 Report).

No significant earthwork is anticipated along streams designated for rehabilitation therefore, no adverse impacts to potential cultural resources are anticipated in these areas.

No buildings are located within the footprint of the proposed Project. No adverse impacts to archaeological or architectural resources are anticipated as a result of the wetland and stream restoration activities associated with the Project. **FPR is requesting your review of the proposed Bank Site.**

FPR appreciates your review of this request. Should you have any questions or concerns, please contact me by email or phone at hkalk@res.us or 412-249-2435, respectively.
Sincerely,

Hannah Kalk

Hannah Kalk
Regulatory Specialist
Resource Environmental Solutions

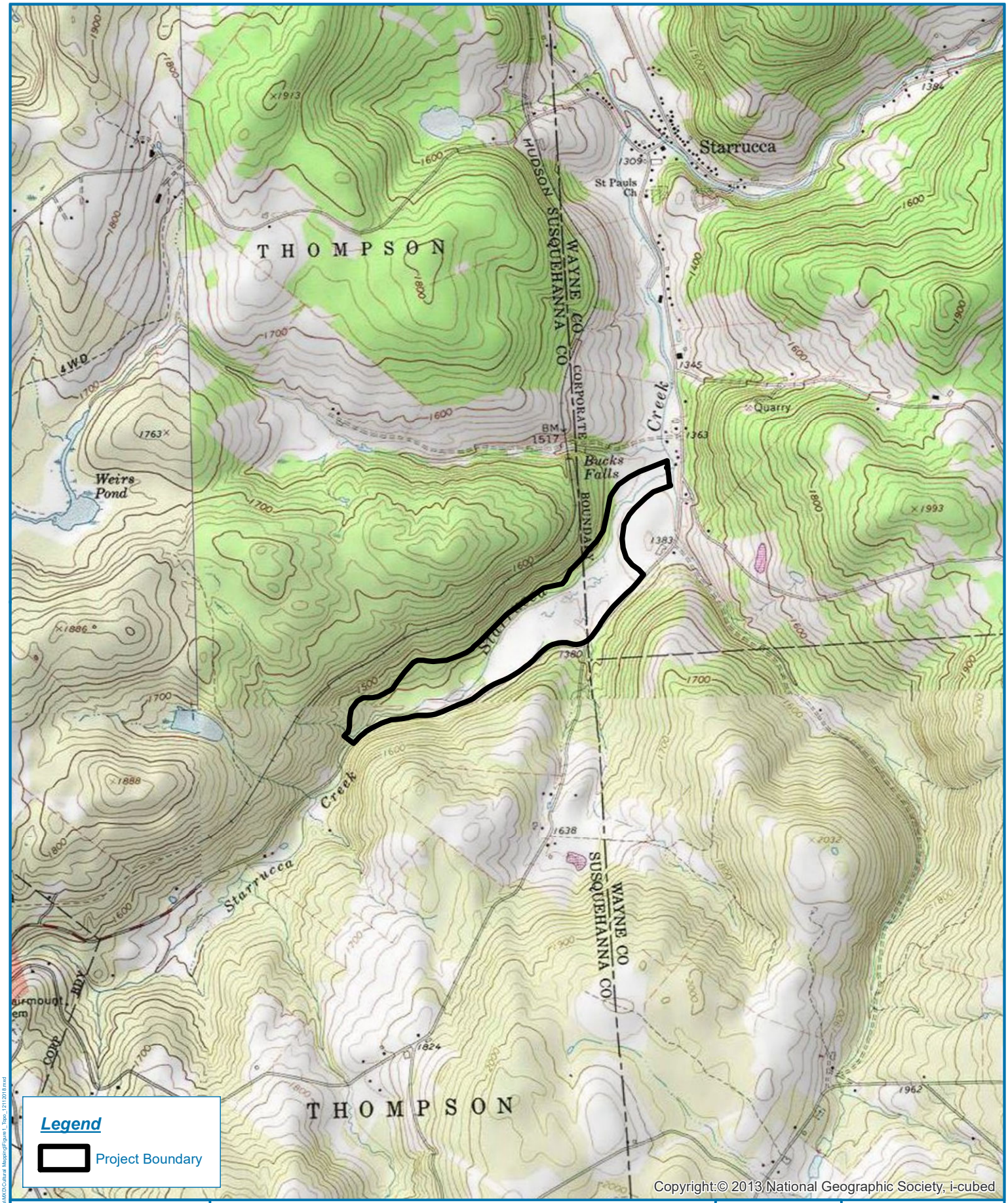
Attachments

33 Terminal Way, Suite 431
Pittsburgh, PA 15219

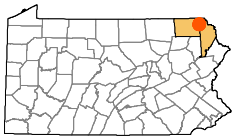
**Corporate Headquarters**
5020 Montrose Blvd. Suite 650
Houston, TX 77006
Main: 713.520.5400

# ATTACHMENT 1

# FIGURES




**PROJECT LOCATION**



SUSQUEHANNA AND WAYNE COUNTIES, PA

**PROJECT LOCATION MAP**
**STARRUCCA CREEK MITIGATION BANK**

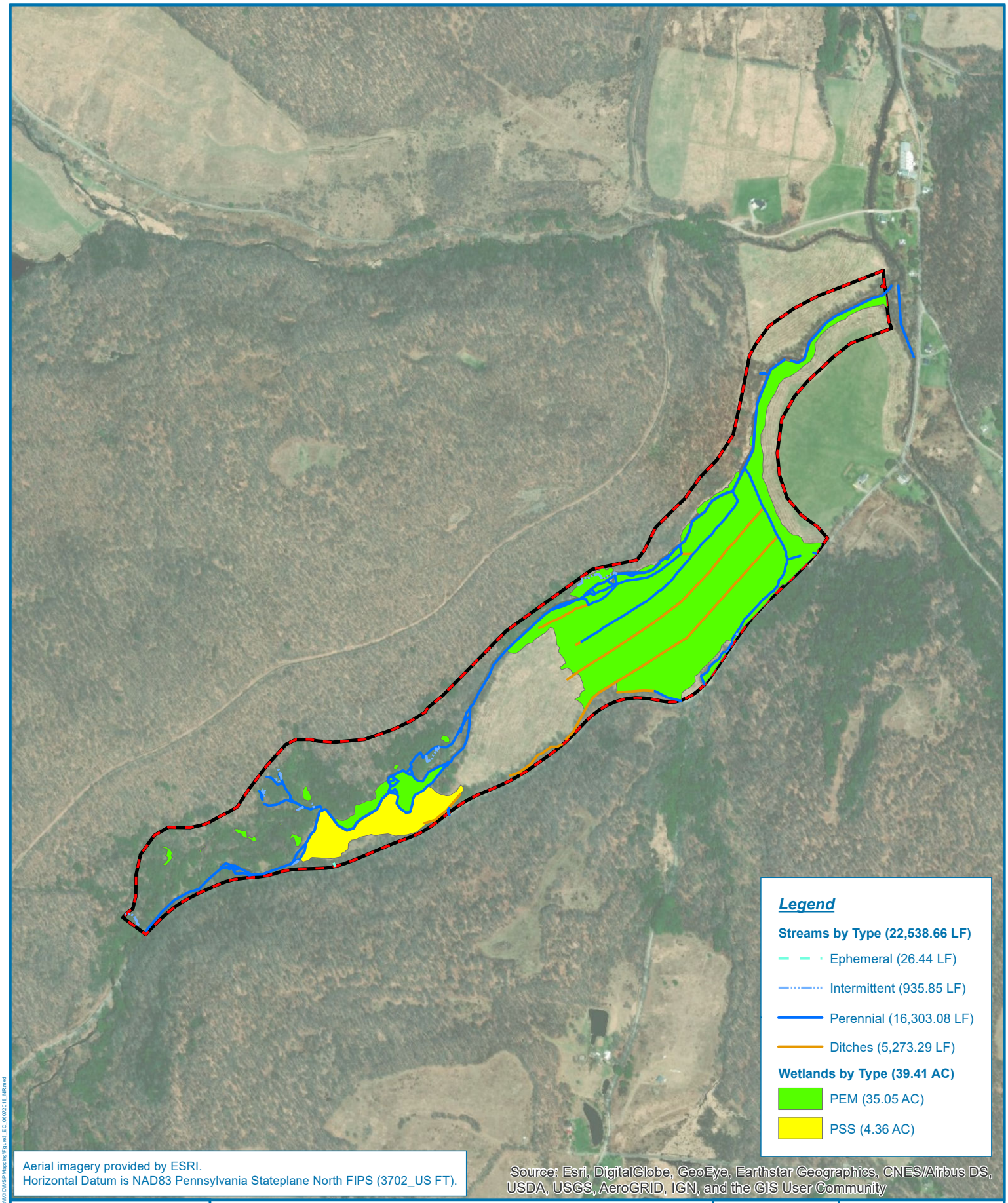
Feet
0 1,000 2,000

**FIGURE 1**

Date: 12/11/2018
Drawn by: NDR
Checked by: SY

res

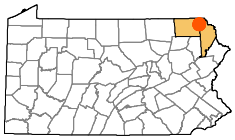
Document Path: S:\GIS\ES GIS\Projects\PA\0217 Starrucca\MXD\Cultural Mapping\Figure1_Topo_12112018.mxd




Aerial imagery provided by ESRI.
Horizontal Datum is NAD83 Pennsylvania Stateplane North FIPS (3702_US FT).

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**PROJECT LOCATION**



SUSQUEHANNA AND WAYNE COUNTIES, PA

# EXISTING CONDITIONS MAP
# STARRUCCA CREEK MITIGATION BANK

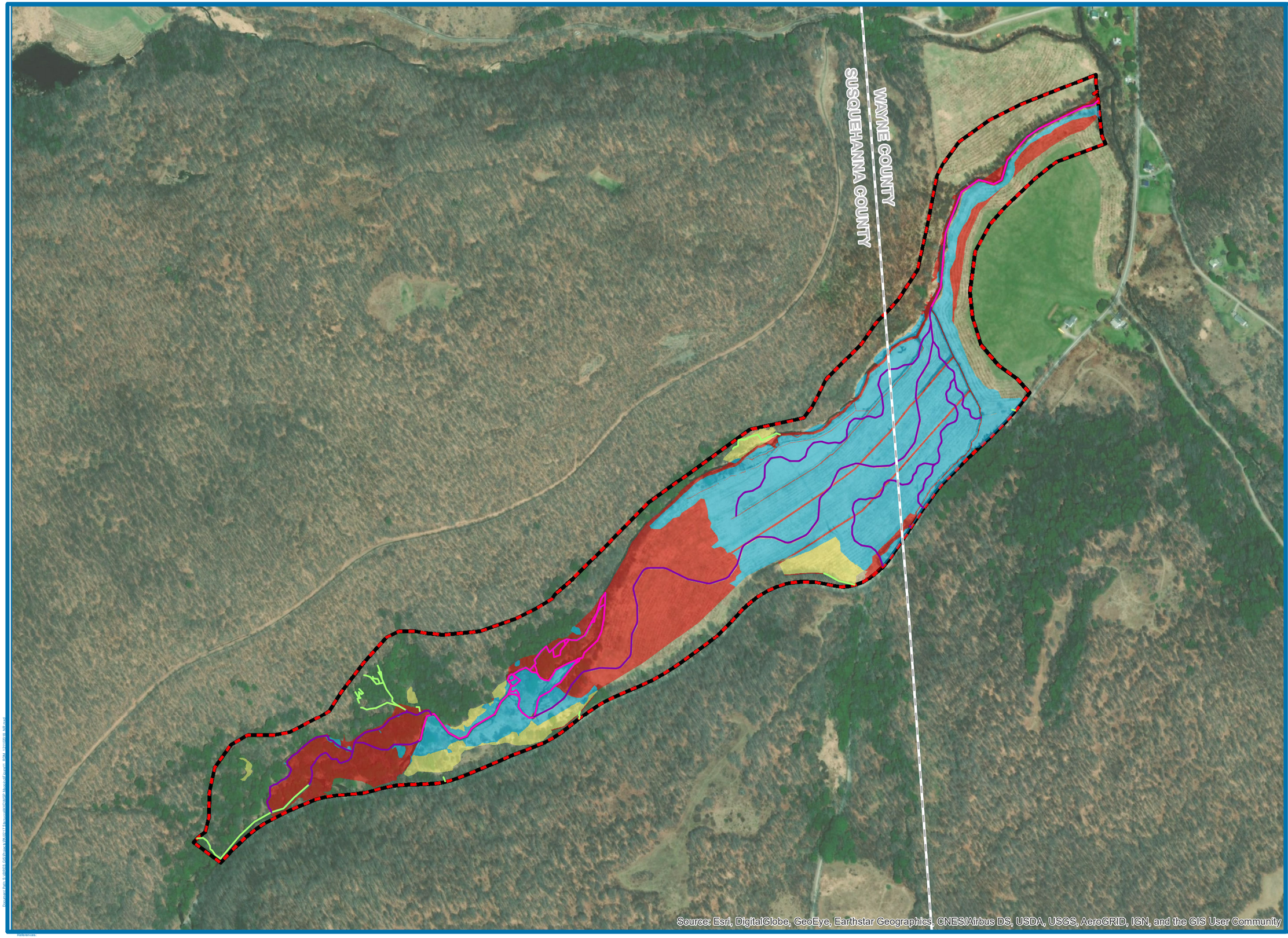
Feet
0 500 1,000

**FIGURE 2**

Date: 12/11/2018
Drawn by: NDR
Checked by: SY

res

Document Path: S:\@RES GIS\Projects\PA\0217 Starrucca\MXD\MBP Mapping\Figure3_EC_06072018_NR.mxd

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N
W E
S

0 250 500
Feet

# FIGURE 3

Resource Development Map
Starrucca Creek Mitigation Bank

| | |
|---|---|
| Date: 12/11/2018 | Drawn by: NDR |
| Checked by: SY | Project No.: 0217 |

## LEGEND

- Project Boundary (104.98 AC)

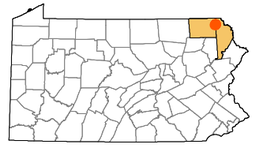
**Wetlands by Restoration Approach (60.65 AC)**

- Enhancement (4.18 AC)
- Rehabilitation (33.93 AC)
- Reestablishment (22.54 AC)

**Streams by Restoration Approach (18,837.51 LF)**

- Preservation (2,518.31 LF)
- Rehabilitation (5,626.15 LF)
- Relocation (10,693.05 LF)

## PROJECT LOCATION



SUSQUEHANNA AND
WAYNE COUNTIES, PA

References:

*Legend*

- Stream Relocation
- Stream Rehabilitation
- Stream Preservation
- Proposed Grading Area (45.01 Acres +/-)
- Proposed Access and Staging (0.96 Acres +/-)
- Proposed Spoil Area (12.56 Acres +/-)
- Project Boundary



0 410 820

Feet

Aerial imagery from ESRI.
Horizontal Datum is NAD 83 PA North.
Study limits are approximate.

**FIGURE 4**

**STARRUCCA CREEK MITIGATION BANK**

**PROPOSED DISTURBANCE MAP**

**WAYNE AND SUSQUEHANNA COUNTY, PENNSYLVANIA**

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# ATTACHMENT 2

# PROJECT REVIEW FORM

Pennsylvania Historical & Museum Commission

# PROJECT REVIEW FORM

**Request to Initiate SHPO Consultation on State and Federal Undertakings**

| SHPO USE ONLY | Reviewers: ____/____ |
|---|---|
| DATE RECEIVED: | DATE DUE: |
| ER NUMBER: | HRSF: _____ |

REV: 06/2018

## SECTION A: PROJECT NAME & LOCATION

**Is this a new submittal?** (●) YES ( ) NO **OR** ( ) **This is additional information for ER Number:**

Project Name: Starrucca Creek Mitigation Bank | County: Wayne | Municipality: Starrucca Bor/Thompson

Project Address: 73 Starrucca Creek Road | City/State/ Zip: Susquehanna | PA | 18847

## SECTION B: CONTACT INFORMATION & MAILING ADDRESS

Name: Hannah Kalk | Phone: (412) 249-2345

Company: First Pennsylvania Resource, LLC | Fax:

Street/PO Box: 33 Terminal Way, #431 | Email: hkalk@res.us

City/State/Zip: Pittsburgh | PA | 15219

## SECTION C: PROJECT DESCRIPTION

**This project is located on: (check all that apply)** ☐ Federal property ☐ State property ☐ Municipal property ☑ Private property

**List all federal and state agencies and programs providing funds, permits, licenses.**

| Agency Type | Agency/Program/Permit Name | Project/Permit/Tracking Number (if applicable) |
|---|---|---|
| State & Federal | 404/401, Chapter 102, 105 | |
| | | |
| | | |

**Proposed Work – Attach project description, scope of work, site plans, and/or drawings**

Project includes (check all that apply): ☑ Construction ☐ Demolition ☐ Rehabilitation ☐ Disposition

Total acres of project area: 117.51 | Total acres of earth disturbance: 58.53

Are there any buildings or structures within the project area? ( ) Yes (●) No | Approximate age of buildings:

| Does this project involve properties listed in or eligible for the National Register of Historic Places, or designated as historic by a local government? | Yes | No | Unsure | Name of historic property or historic districts |
|---|---|---|---|---|
| | ( ) | ( ) | (●) | |

**Please print and mail completed form and all attachments to:**

**PHMC**
**State Historic Preservation Office**
**400 North St.**
**Commonwealth Keystone Building, 2nd Floor**
**Harrisburg, PA 17120-0093**

**Attachments – Please include the following information with this form**

- ☑ **Map –** 7.5' USGS quad showing project boundary and Area of Potential Effect
- ☑ **Description/Scope –** Describe the project, including any ground disturbance and previous land use
- ☑ **Site Plans/Drawings –** Indicate past and present land use, location and dates of buildings, and proposed improvements
- ☑ **Photographs –** Attach prints or digital photographs showing the project site, including images of all buildings and structures keyed to a site plan

## SHPO DETERMINATION (SHPO USE ONLY)

- ☐ There are **NO HISTORIC PROPERTIES** in the Area of Potential Effect
- ☐ The project will have **NO EFFECT** on historic properties
- ☐ The project will have **NO ADVERSE EFFECTS** on historic properties:
- ☐ The project will have **NO ADVERSE EFFECTS WITH CONDITIONS** (see attached)
- ☐ **SHPO REQUESTS ADDITIONAL INFORMATION** (see attached)

**SHPO REVIEWER:** _____ **DATE:** _____

# ATTACHMENT 3

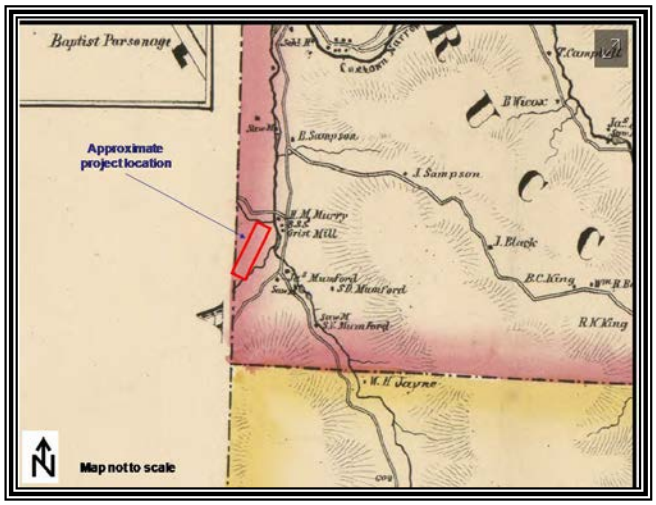
# PHASE 1 CULTURAL RESOURCES SURVEY REPORT

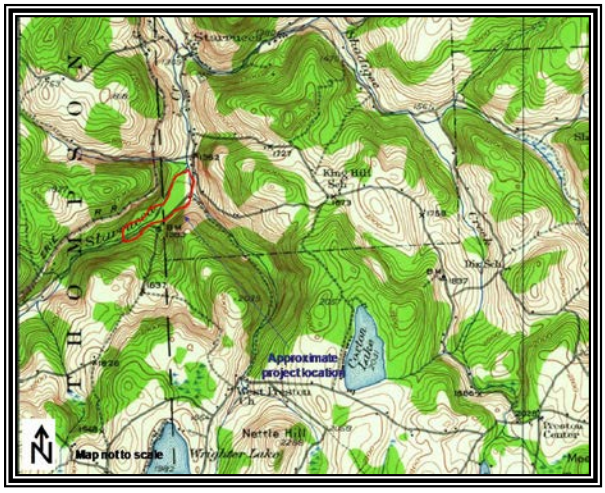
# PHASE I CULTURAL RESOURCES SURVEY

# OF STARRUCA CREEK MITIGATION SITE PROJECT

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

**BHP ENVIRONNENTAL REVIEW #**




## Circa~ Cultural Resource Management

**February 2016**

# PHASE I CULTURAL RESOURCES SURVEY OF STARRUCA CREEK MITIGATION SITE PROJECT SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA BHP ENVIRONNENTAL REVIEW #

**Prepared For:**
**Resource Environmental Solutions, LLC**
**380 Southpointe Boulevard, Suite 405**
**Canonsburg, Pennsylvania 15317**
**(412) 249-2455**

**Prepared By:**
**Carol D. Tyrer, Principal Investigator, and Dawn M. Muir-Frost**

**Circa~ Cultural Resource Management, LLC**
**453 McLaws Circle, Suite 3**
**Williamsburg, Virginia 23185**
**(757) 220-5023**

**February 2016**

## ABSTRACT

*In September of 2015, Resources Environmental Solutions (RES) contracted Circa~ Cultural Resource Management, LLC (Circa~) to conduct a Phase I cultural resources survey of the Starrucca Creek Mitigation Site Project in Susquehanna and Wayne Counties, Pennsylvania. The Area of Potential Effect (APE) for archaeological and architectural resources is the construction impact area.*

*The purpose of this Phase I cultural resources survey was to identify and record all historic resources within the Project Site prior to development of the site. This survey resulted in the identification of no isolated finds, no new archaeological sites, and no architectural resources.*

*The topography of the stream channels consists of a wide active stream valley surrounded by steep slopes to the north and south. Elevations adjacent to the Project Site range from 14,305 feet above mean sea level (AMSL) at the top of the side slopes along the northern side of the Project Site and drops to 10,200 feet AMSL along the stream channel. The elevation of the adjacent slope top to the south is at 14,685 feet AMSL and falls to 11,183 feet AMSL along the Project Site near the road. The stream's headwaters are located to the west and the floodplain drops in elevation as the channel makes its way east through the steep upland ridges. In some sections, the stream appears to have moved over time in the floodplain changing its path during storm episodes. In addition, there are two small drainages to the north and one large drainage to the south that empties the uplands into the floodplain. Vegetation was thick within the stream valley, with tall grasses, thick brambles, and small saplings. In addition, the Project Site is within an existing restoration site planted with native trees that has failed.*

*The Phase I shovel testing did not locate any archaeological resources or surface deposits of artifacts within the Project Site. No architectural resources were identified within the Project Site. In sum, the Project Site consists of a narrow to wide stream valley with low potential areas for site locations along the upland stream channel. In addition, the low areas along the stream channel and further into the floodplain contain poorly-drained soils that are currently either wetlands or marsh. Some slightly elevated areas were noted within the floodplain. Shovel test within these areas show that the landforms were created from flooding episodes. Circa~ recommends no further work for the stream and wetland mitigation areas. There should also be no effect to any viewsheds as the project is limited to restoration.*

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## INTRODUCTION

In September 2015, Circa~ Cultural Resource Management, LLC (Circa~) conducted a Phase I cultural resources survey of the Starruca Creek Mitigation Site Project in Susquehanna and Wayne Counties, Pennsylvania (Figure 1). The purpose of this Phase I cultural resources survey was to identify and record all historic resources within the Project Site prior to development of the site. The Project Site, which encompasses approximately 113 acres, is bordered by Starrucca Creek Road to the south, steep slopes to the north, a narrow stream valley to the west, and the floodplain to the east. Roughly 40 acres within the Project Site consists of existing wetlands and the existing streams and ditches total 23,095.28 linear feet. The Area of Potential Effect (APE) for archaeological and architectural resources is the approximately 60 acres planned for wetlands and stream restoration.

Resources Environmental Solutions (RES) contracted Circa~ to conduct this Phase I survey. Fieldwork was conducted the week of September 14, 2015. The investigation was carried out in compliance with Section 106 of the National Historic Preservation Act of 1966 (as amended) and conducted in accordance with the Secretary of the Interior's *Standards and Guidelines for Archaeological Documentation* and the *Guidelines for Archaeological Investigations in Pennsylvania* of the Bureau for Historic Preservation (BHP) Pennsylvania Historical and Museum Commission (PHMC). The report describes fieldwork results and makes recommendations for further work. No constraints on the project were noted.

First Pennsylvania Resource, LLC (FPR), a wholly-owned subsidiary of RES, is proposing stream and wetland restoration activities as part of the Starrucca Creek Wetland and Stream Mitigation Bank (Project Site) located along the eastern border of Thompson Township, Susquehanna County and the western border of Starrucca Borough, Wayne County, Pennsylvania. The 113-acre Project Site is located approximately one mile northeast of the town of Thompson, and about 8.40 miles south of the New York-Pennsylvania state line and 8.80 miles west of the Pennsylvania-New Jersey state line. The approximate center coordinates for the Project Site are 41°52'43.26" North and 75°28'47.91" West.

A wetland delineation was performed by BlueAcres, LLC (BlueAcres) on July 22, 23, and 24, 2015. RES field staff delineated all streams within the proposed Project Site. Preliminary results of the wetland and stream surveys indicated the presence of 49 stream segments (36 perennial, 12 intermittent, and one ephemeral) and nine agricultural surface ditches as well as 34 wetlands, consisting of five wetland types and totaling 39.63 acres. Of the 23,095.28 linear feet of existing stream within the Project Site, approximately 16,650.46 linear feet is categorized as perennial, 1,141.90 linear feet as intermittent, and 29.63 linear feet as ephemeral. Approximately 5,273.29 linear feet of ditched waterways were also delineated within the Project Site. Of the 39.49 acres of existing wetlands, 33.02, 4.36, and 2.11 acres of Palustrine Emergent (PEM), Palustrine Scrub Shrub (PSS), and Riverine Wetland (R3US5), respectively, were identified within the Project Site.

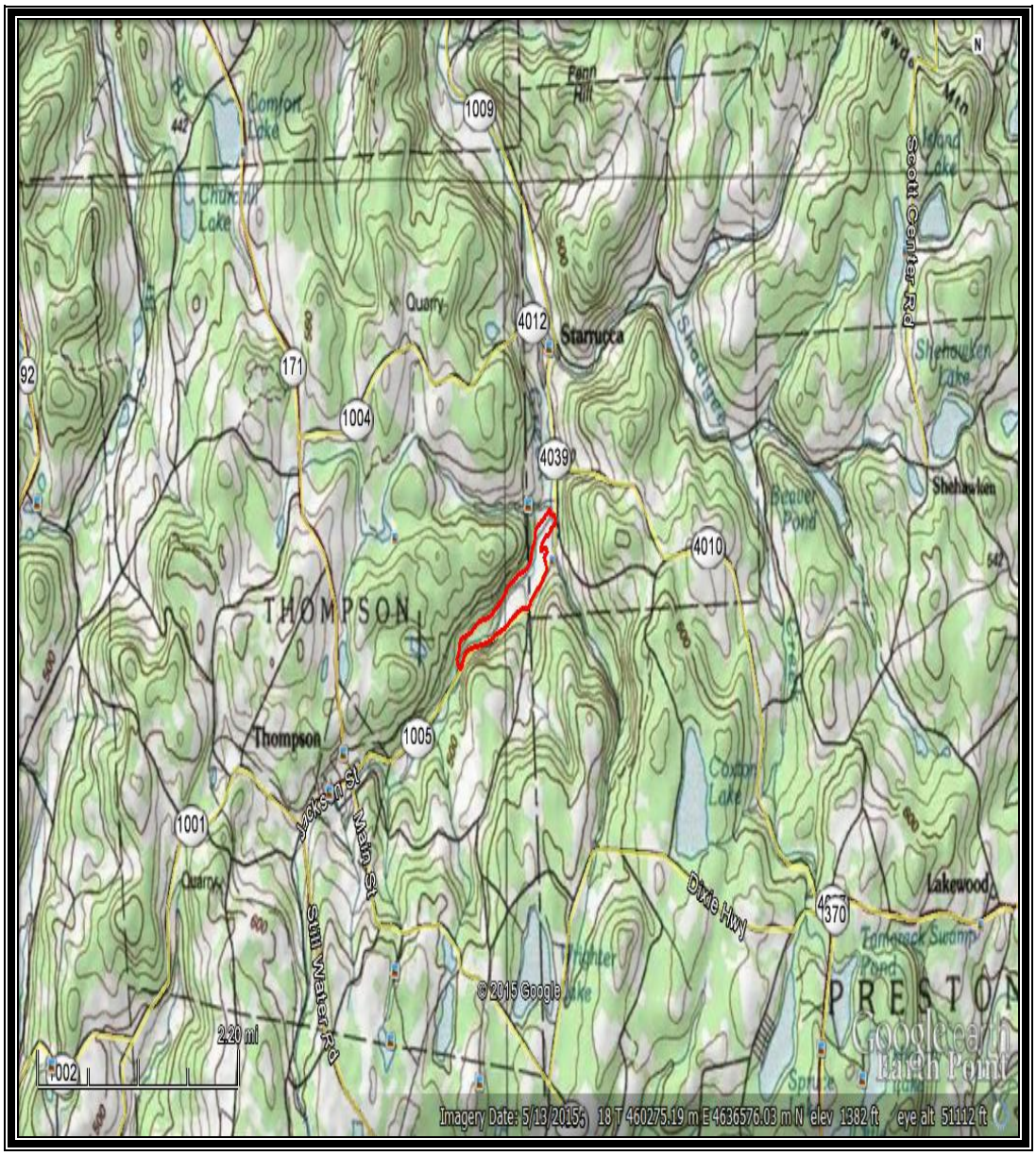

Figure 1. Approximate location of Project Site, on Honesdale quadrangle.

The Project Site, historically disturbed due to agricultural land uses, proposes to enhance, restore, and protect all stream and wetland resources within the Project Site. Most of the Project Site was utilized for cropland within the last century. Sections of the stream banks along the main stem of Starrucca Creek were armored with large rock, a method used to stabilize and channelize the stream, which has kept the stream from meandering and braiding naturally as it had historically, resulting in a stream that is now channelized against the valley wall. Channelization and natural beaver activity has restricted the streams interconnectivity with its floodplain.

In 2009, landowners of the Project Site entered into a 15-year commitment with the Conservation Reserve Enhancement Program (CREP) to keep the environmentally-sensitive land out of agricultural production and convert the land to native grasses, shrubs, trees, and wetland practices. As part of this agreement, the United States Department of Agriculture (USDA) Farm Service Agencies CREP Farm Bill Program assisted in the implementation of a Conservation Practice 22 (CP22) Forest Riparian Buffer by planting native trees and shrubs across the Project Site. While the plantings within the upland portions of the Project Site have proven to retain a higher survival rate, plantings within the wetland areas have failed and therefore, the oversite is considered as failed.

FPR has proposed the restoration of all resources identified on-site utilizing preservation, enhancement, relocation, and rehabilitation approaches. Approximately 1,290.46 linear feet of stream and 0.01 acre of wetland will be preserved, as these resources are ecologically intact. These resources are located at the southwestern end of the Project Site, along the north slope of Starrucca Creek. Impacts in these areas will be minimal to non-existent due the nature of preservation activities, which include supplemental native plantings and invasive species management.

Wetland and stream restoration activities within the enhancement areas are anticipated to include invasive species management including the removal of non-native vegetation and supplemental plantings of native vegetation, in addition to some in-stream habitat improvement along the stream reaches.

Stream restoration activities within the relocation reaches are anticipated to include geomorphic in-stream structures, as well as grading within the floodplain. Most of the main stream of Starrucca Creek is proposed for relocation of the streams pattern and profile, which is necessary to stabilize the stream and re-establish its connectivity with the floodplain.

The rehabilitation of 39.39 acres of wetland will involve plugging of the ditched waterways, which will enhance the hydrology within the Project Site. Stunted and stressed trees planted as part of the CREP CR22 Riparian Buffer plantings within the rehabilitation areas will be transplanted to appropriate locations within the Project Site. The wetland rehabilitation will also include the removal of non-native and invasive vegetation, the planting of woody stems and native herbaceous vegetation to restore a forested plant community, and the grading of the floodplain areas.

Additionally, in conjunction with the Project Site stream relocation and wetland rehabilitation activities, FPR anticipates wetland re-establishment acreage as a result of increased floodplain connectivity and potholes. No adverse impacts are anticipated as part of restoration activities proposed at the Project Site. Permanent legal protection of the Project Site will maximize long-term potential for successful and sustainable mitigation.

This report contains a description of the Project Site's physical and environmental setting, an outline of meaningful historical contexts for the property, a general research design that summarizes field methods, previous research in the area, and expected results, and finally, the survey results are described, the findings reviewed, and recommendations explained. Field notes, artifacts, and other project records are presently being curated in Circa~'s office in Williamsburg, Virginia. It is anticipated that all of these materials will eventually be transferred to the client following the conclusion of the project.

At Circa~, Carol D. Tyrer served as Project Manager and Principal Investigator for the project and was assisted in the field by Charlie Rutledge, Eric Mai, and Matt Carr, Field Archaeologists. Dawn M. Muir-Frost, Registered Professional Archaeologist (RPA), served as the Historian and Architectural Historian for the project and completed the historic context and architectural survey. McKenzie Kyger, Archaeological Lab Technician, assisted in the processing of artifacts. Dawn M. Muir-Frost and Carol D. Tyrer prepared the report. The successful completion of the Phase I survey for the proposed development was made possible by the contribution of many individuals. In particular, Amber Snavley with RES ensured that project information and maps were always available for the study.

## PROJECT LOCATION AND GENERAL DESCRIPTION

### Present Land Use Patterns

Aerial photos from the 1990s to the present show little change within the Project Site during the last 23 years (Figures 2 - 7). The topography of the stream channel consists of a wide active stream valley surrounded by steep slopes to the north and south. Elevations adjacent to the Project Site range from 14,305 feet above mean sea level (AMSL) at the top of the side slopes along the northern side of the Project Site and drops to 10,200 feet AMSL along the stream channel. The elevation of the adjacent slope top to the south is at 14,685 feet AMSL and falls to 11,183 feet AMSL along the Project Site near the road. The stream's headwaters are located to the west and the floodplain drops in elevation as the channel makes its way east through the steep upland ridges. In some sections, the stream appears to have moved over time in the floodplain changing its path during storm episodes. In addition, there are two small drainages to the north and one large drainage to the south that empties the uplands into the floodplain. Vegetation was thick within the stream valley, with tall grasses, thick brambles, and planted trees.

In 2009, landowners of the Project Site entered into a 15-year commitment with the implementation of a Conservation Practice 22 (CP22) Forest Riparian Buffer by planting native trees and shrubs across the Project Site. Plastic piping around the tree trunks

currently protects the plantings. Some of the trees have died and the plastic pipes are strewn on the ground.

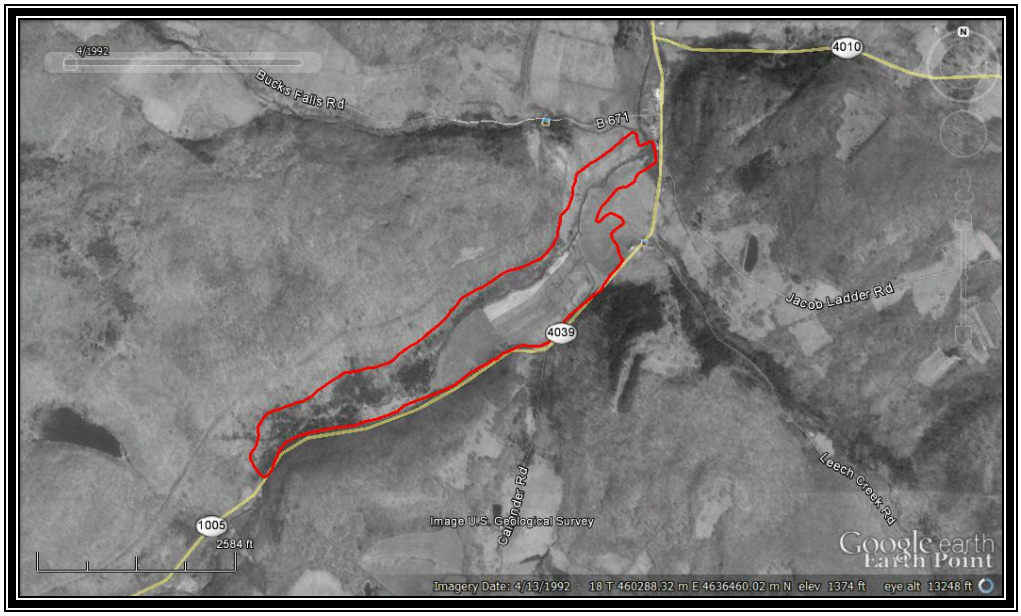


Figure 2. 1992 aerial view of Project Site, from Google Earth.

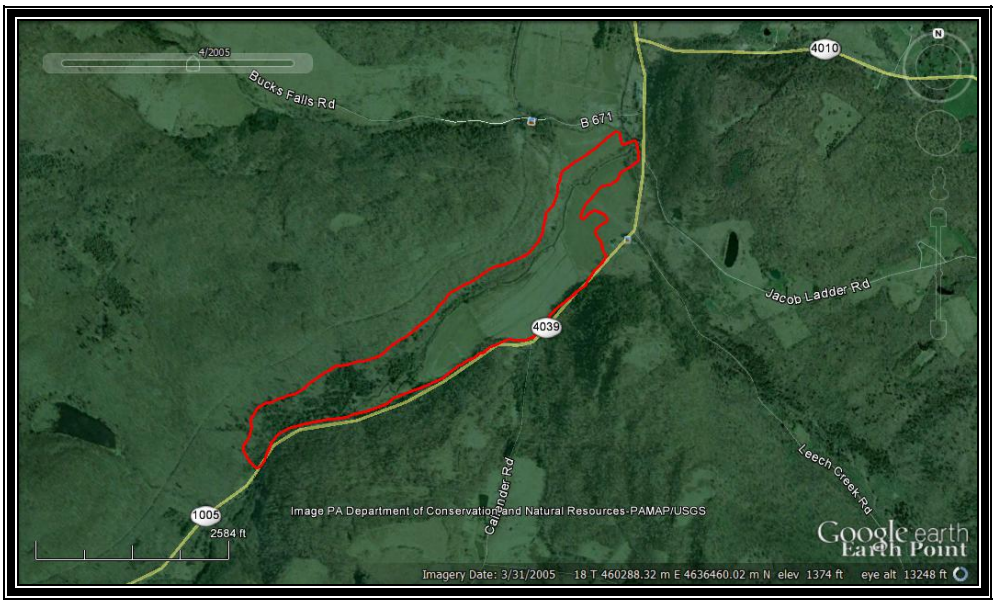


Figure 3. 2005 aerial view of Project Site, from Google Earth.

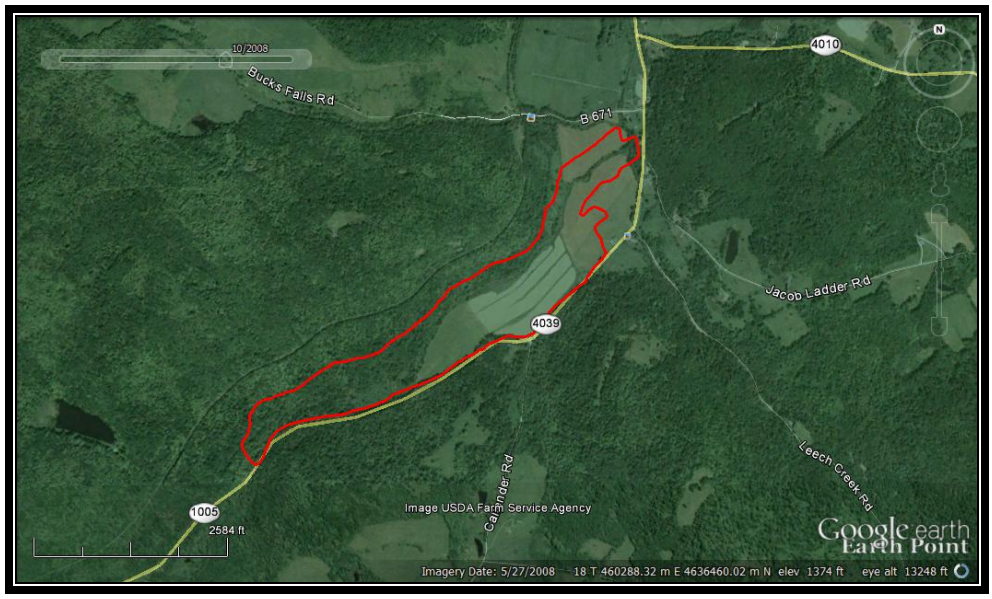


Figure 4. 2008 aerial view of Project Site, from Google Earth.


Figure 5. 2010 aerial view of Project Site, from Google Earth.

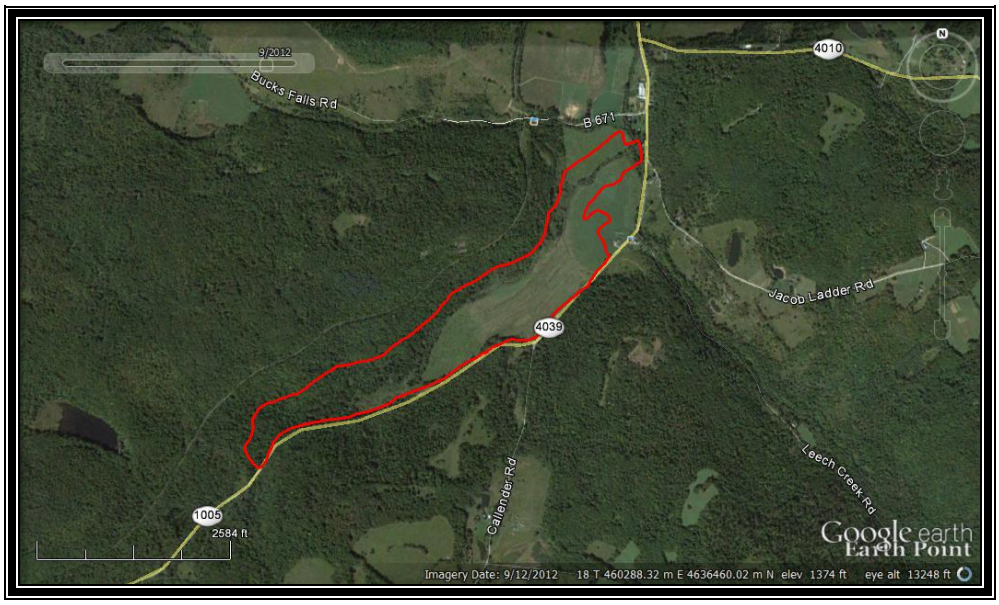


Figure 6. 2012 aerial view of Project Site, from Google Earth.

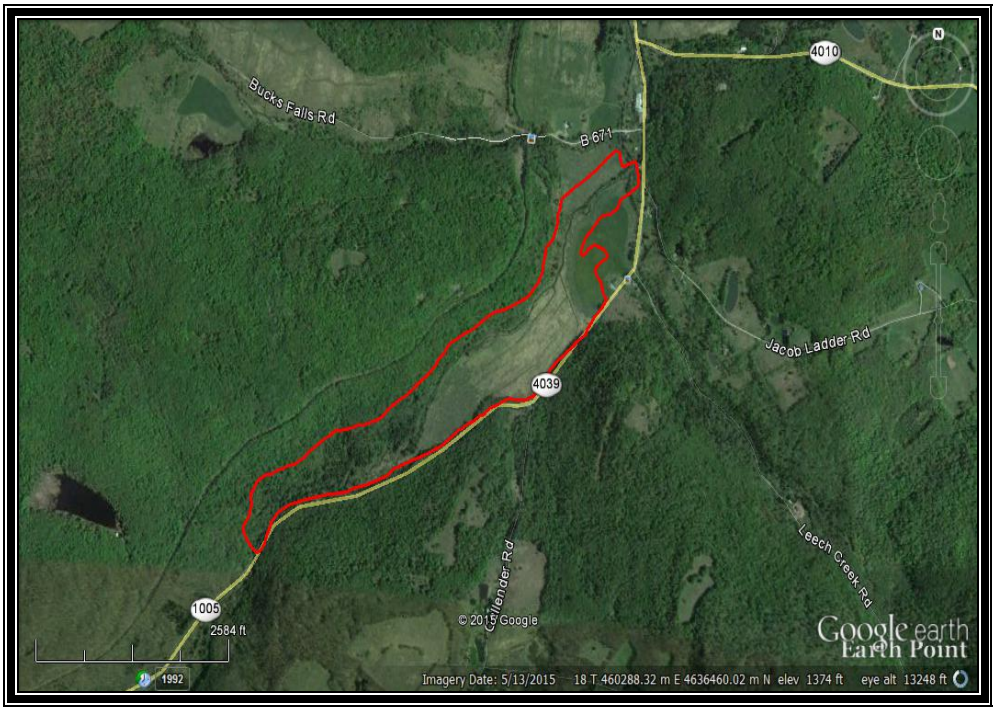


Figure 7. Current aerial view of Project Site, from Google Earth.

**Soils**

Soils maps and associated data provide an analysis of soil types within a geographic area. Despite comprehensive and detailed coverage of most areas by soils surveyors, researchers often miss microenvironments due to their small footprints. Unfortunately, resource rich microenvironments were often common sites of cultural activity. As such, this analysis of archaeological potential is a "best-guess" using the best available data.

Well-drained, agriculturally- and horticulturally-productive soils proximal to transportation corridors were the best choices for historic period occupation. Secondary areas, such as those containing wet soils and acid soils, after improvement such as drainage and liming also may have also been suitable choices for historic occupation.

Areas of wet soils may have been attractive to Native American cultures. In these areas, edible herbaceous plant species may have been gathered and faunal species browsing these areas may have been hunted with success. Well-drained soils proximal to these resource-rich areas may have made adequate hunting and gathering campsites where the hunted and gathered resources were processed. These sites would have left an observable archaeological footprint. Little archaeological evidence would be located within the wet areas, the immediate locale of resource procurement.

Areas containing gravelly soils may have been especially attractive to stone tool-manufacturing Native American cultures but the level of attraction may have depended on the type and quality of the gravels available in these locations. Well-drained soils proximal to quarry-able, gravel-rich areas would have made adequate lithic material procurement campsites but in this case, archaeological materials may be located at both the campsites and the quarry sites.

***Soils Identified Within the Project Site***

At least 10 different soil types and soil type variants exist within the Project Site. These soil types and variants include Wyalusing silt loam; Basher silt loam; mixed alluvial land; Mardin channery silt loam, 8% to 25% slopes, very stony; Shohola-Edgemere complex, 0% to 8% slopes, very rubbly; Wellsboro extremely stony loam, 8% to 25% slopes; Oquaga and Lordstown extremely stony loam, 25% to 70% slopes; Volusia channery silt loam, 0% to 8% slopes, extremely stony; Lackawanna very stony silt loam, 30% to 50% slopes; and bath very stony loam, 30% to 60% slopes. Each of these types and variants are described below including references to drainage, hunting and gathering potential, and horticultural and agricultural productivity potential. Further, conclusions regarding the suitability of each for historic and Native American occupation and archaeological site probability are also explained.

Wyalusing silt loam (Wy) is the primary soil identified within the Project Site covering approximately 40% of the central portion of the Project Site (Figure 8 and Table 1). Basher silt loam (Bc and Bh) is identified within the northern, eastern, and central portions of the Project Site covering approximately 24% of the Project Site. Mixed alluvial land (Mn) is identified within the southwestern portion of the Project Site covering approximately 12% of the Project Site. Mardin channery silt loam, 8% to 25%

slopes, very stony (MgD) is identified within the southern portion of the Project Site covering approximately 10% of the Project Site. Shohola-Edgemere complex, 0% to 8% slopes, very rubbly (7B) is identified within the northwestern and western portions of the Project Site covering approximately 4% of the Project Site. Wellsboro extremely stony loam, 8% to 25% slopes (WoD) is identified within the northern and eastern portions of the Project Site covering approximately 4% of the Project Site. Oquaga and Lordstown extremely stony loam, 25% to 70% slopes (OyF) is identified within the western portion of the Project Site covering approximately 2% of the Project Site. Volusia channery silt loam, 0% to 8% slopes, extremely stony (VsB) is identified within the western portion of the Project Site covering approximately 2% of the Project Site. Lackawanna very stony silt loam, 30% to 50% slopes (LgF) is identified within the southern and southwestern portions of the Project Site covering approximately 1% of the Project Site. Bath very stony loam (BsF) is identified within the western and southwestern portions of the Project Site covering approximately 1% of the Project Site.

*Wyalusing Silt Loam (Wy)*

Wyalusing soil is a very-deep, poorly-drained soil formed in alluvial material found on floodplains along streams (NRCS 2015). Solum thickness ranges from 24 inches to 36 inches in this slightly acid to strongly acid soil. Thin unconforming layers of finer or coarser textured material are found in some pedons and rock fragments, primarily gravel or cobbles, range from 0% to 20% throughout the solum. This soil features a low to very high surface runoff and a very slow internal drainage. This soil is subject to underground seepage from surrounding higher lands and baseflow from nearby streams and uplands. This soil is used primarily for pasture or is idle. Wooded areas can support maple, beech, and elm.

Table 1. Soils Identified Within the Project Site Boundaries.

| Soil Symbol | Soil Name | Acres Within the Project Site | Percentage Within the Project Site |
|---|---|---|---|
| Wy | Wyalusing silt loam | 41.5 | 40% |
| Bc and Bh | Basher silt loam | 24.9 | 24% |
| Mn | Mixed alluvial land | 12.6 | 12% |
| MgD | Mardin channery silt loam, 8% to 25% slopes, very stony | 10.8 | 10% |
| 7B | Shohola-Edgemere complex, 0% to 8% slopes, very rubbly | 4.4 | 4% |
| WoD | Wellsboro extremely stony loam, 8% to 25% slopes | 3.6 | 4% |
| OyF | Oquaga and Lordstown extremely stony loam, 25% to 70% slopes | 2.4 | 2% |
| VsB | Volusia channery silt loam, 0% to 8% slopes, extremely stony | 2.1 | 2% |
| LgF | Lackawanna very stony silt loam 30% to 50% slopes | 0.8 | 1% |
| BsF | Bath very stony loam, 30% to 60% slopes | 0.6 | 1% |

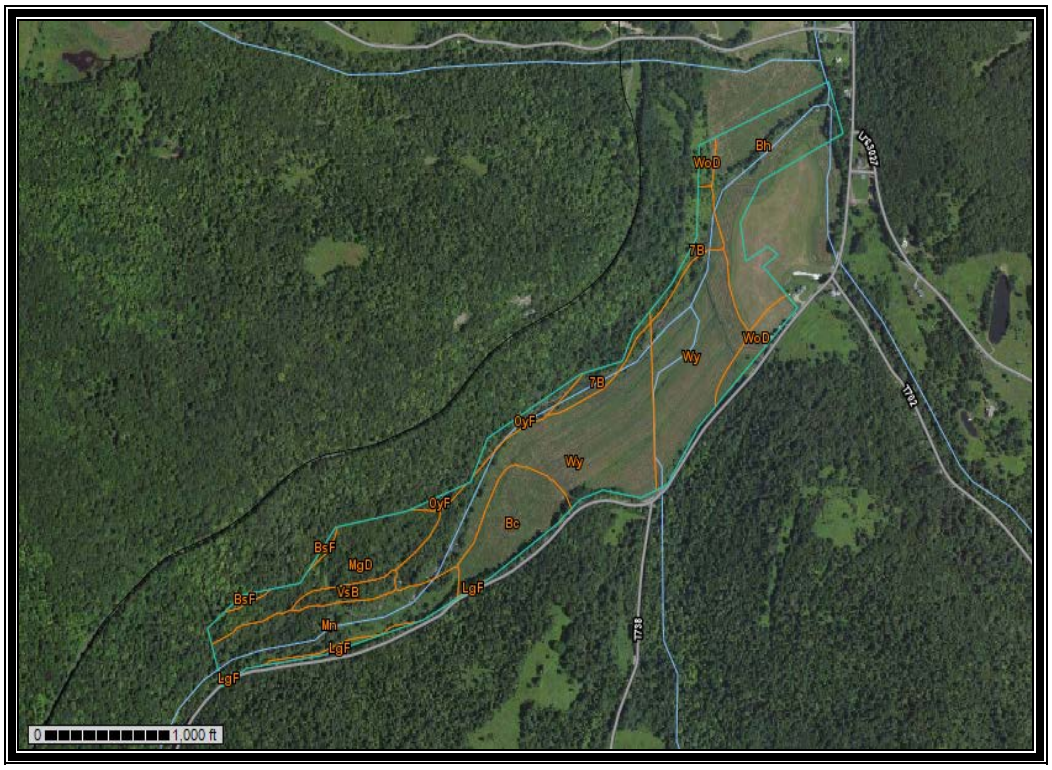

Figure 8. Project Site soil map, from NRCS website.

*Basher Silt Loam (Bc and Bh)*
Basher soil is a very-deep, moderately-well-drained, moderately-permeable soil formed in recent alluvial deposits derived from acid, reddish siltstone, sandstone, and shale found on floodplains and low terraces (NRCS 2015). Solum thickness ranges from 16 inches to 40 inches and depth to bedrock is over 60 inches in this extremely acid to moderately acid soil. Rock fragments range from 0% to 20% above 40 inches. This soil features a low surface runoff. Most of this soil is cleared and used to grown corn, small grains, hay, vegetable crops, and pasture. Woodlots within this soil contain maple, oak, hemlock, and white pine.

*Mixed Alluvial Land (Mn)*
Mixed alluvial land consists of areas of unconsolidated alluvium that is generally stratified (NRCS 2015). It usually varies widely in texture. These soils are usually recently deposited by streams and are subject to frequent flooding.

*Mardin Channery Silt Loam (MgD)*
Mardin soil is a very-deep, moderately-well-drained soil formed in loamy till found on glaciated uplands, mostly on broad hilltops, shoulder slopes, and back slopes (NRCS 2015). Solum thickness ranges from 38 inches to 72 inches and depth to bedrock is 60 inches to 20 feet with a dense fragipan ranging from 14 inches to 26 inches below the surface in this extremely acid to moderately acid soil. Approximately 60% or more silt plus very fine sandy is possible in the fine-earth fraction above the fragipan and rock fragments, dominantly channers, flagstones, or gravel range from 5% to 35% in the horizon above the fragipan and 15% to 60% in the horizon below the fragipan. This soil

features a medium to high surface runoff with a seasonal water table that typically occurs at 14 inches to 24 inches below the surface. Most areas of this soil are cleared and used for producing silage corn, small grains, hay, and pasture. A significant acreage of this soil is idle or has reverted to brush and trees. Where wooded, this soil can support sugar maple, beech, white ash, black cherry, hemlock, red oak, and white pine.

*Shohola Complex (7B)*
Shohola soil is a very-deep, somewhat-poorly-drained, moderately-permeable soil formed in loamy till, mainly from areas of sandstone and shale, found in drainageways and structural benches below seep areas (NRCS 2015). Solum thickness ranges from 40 inches to 70 inches and depth to bedrock ranges from six feet to 15 feet in this extremely acid to very strongly acid soil. Coarse rock fragments range from 35% to 75% by weight throughout the solum. This soil features a low to very high surface runoff and a very slow internal drainage. Most of this soil is wooded and used for timber. Few areas have been cleared at one time for use as pasture.

*Edgemere Complex (7B)*
Edgemere soil is a very-deep, very-poorly- to poorly-drained, moderately- to slowly-permeable soil formed in till, mainly from areas of sandstone and shale, found in drainageways and structural benches below seep areas (NRCS 2015). Depth to bedrock ranges from six feet to 15 feet and depth to the top of the fragipan ranges from 20 inches to 30 inches in this extremely acid to strongly acid soil. Coarse rock fragments range from 35% to 75% by weight throughout the solum. This soil features a low to very high surface runoff and a very slow internal drainage. Most of this soil is wooded and used for timber. Few areas have been cleared at one time for use as pasture.

*Wellsboro Extremely Stony Loam (WoD)*
Wellsboro soil is a very-deep, moderately-well- to somewhat-poorly-drained, moderately-permeable soil formed in till derived from red sandstone, siltstone, and shale found on nearly level to steep glaciated uplands (NRCS 2015). Solum thickness is over 40 inches and depth to bedrock is over 60 inches in this very strongly acid to moderately acid soil. A dense fragipan is present starting at a depth of 12 inches to 30 inches below the soil surface. Content of rock fragments is 5% to 40% throughout the solum and the rock fragments are sub-angular or rounded sandstone, siltstone, or shale. This soil features a low to very high surface runoff. Where cleared, this soil can be used for growing hay, small grains, pasture, and potatoes. Where wooded, this soil can support sugar maple, American beech, red oak, and white pine. Some areas of this soil area idle.

*Oquaga Extremely Stony Loam (OyF)*
Oquaga soil is a moderately-deep, somewhat-excessively-drained, moderately-permeable soil formed in a thin mantle of till over sandstone, siltstone, and shale bedrock found on nearly level to very steep uplands (NRCS 2015). Depth to bedrock is 20 inches to 40 inches in this extremely acid to moderately acid soil. Content of rock fragments is 15% to 60% in the surface horizons. This soil features a medium internal drainage and a negligible to very high surface runoff. Most of this soil is forested or used for unimproved native pasture and can support hay, small grains, and corn on gentler slopes.

Where wooded, native vegetation includes sugar maple, beech, white pine, white ash, oak, and hemlock.

*Lordstown Extremely Stony Loam (OyF)*
Lordstown soil is a moderately-deep, well-drained, moderately-permeable soil formed in till and cryoturbated material derived from siltstone and sandstone found on nearly level to very steep slopes on hillsides and hill tops in glaciated bedrock controlled uplands and glaciated dissected plateaus (NRCS 2015). Solum thickness ranges from 20 inches to 40 inches and depth to bedrock is 20 inches to 40 inches in this very strongly acid to neutral soil. Content of rock fragments is 10% to 35% within the solum and the rock fragments are dominantly flat angular fragments and flagstones. This soil features a low to very high surface runoff. Large areas of this soil are in cutover forests that contain American beech, oak, and sugar maple. Some areas are cleared and used for pasture or hay. Most of this soil is idle or has reverted to woodland or brush. There is however, a limited acreage in corn, small grains, and potatoes and some areas have reforested mainly with red pine.

*Volusia Channery Silt Loam (VsB)*
Volusia soil is a very-deep, somewhat-poorly-drained, slowly- to very slowly-permeable soil formed in loamy till derived from siltstone, sandstone, and brittle shale or slate found on lower valley sides and on broad divides of maturely dissected glaciated plateaus (NRCS 2015). Solum thickness ranges between 40 inches and 72 inches and depth to bedrock is over 60 inches. There is also a dense fragipan approximately 10 inches to 20 inches below the soil surface. Rock fragments, made mostly of channers, gravel, and flagstones, range from 5% to 60% throughout the solum. This soil features a low to very high surface runoff. This soil is mostly cleared and can support pasture, hay, oats, and corn. Native vegetative consists of sugar maple, red maple, American beech, and hemlock.

*Lackawanna Very Stony Silt Loam (LgF)*
Lackawanna soil is a very-deep, well-drained, moderately permeable soil formed in till derived from reddish colored sandstone, siltstone, and shale found on nearly level to steep glaciated uplands (NRCS 2015). Solum thickness ranges from 40 inches to 75 inches and depth to bedrock is over 60 inches in this extremely acid to moderately acid soil. A dense fragipan is present starting at a depth of 17 inches to 36 inches below the soil surface. Content of rock fragments is 10% to 40% above the fragipan and 15% to 65% within and below the fragipan and the rock fragments are sub-angular or sub-rounded sandstone, siltstone, or shall. This soil features a low to very high surface runoff. Where cleared, this soil can be used for growing hay, small grains, corns, pasture, and potatoes. A significant acreage has reverted to woodland or brush with dominant species of sugar maple, American beech, red oak, white pine, and birch.

*Bath Very Stony Loam (BsF)*
Bath soil is a very-deep, well-drained soil formed in loamy till, derived mainly from gray and brown siltstone, sandstone, and shale found on nearly level to steep slopes on glaciated uplands (NRCS 2015). Solum thickness ranges from 40 inches to 80 inches and

depth to bedrock ranges from 40 inches to 20 feet in this moderately acid to very strongly acid soil. Depth to fragipan ranged from 26 inches to 38 inches below the surface and rock fragments, primarily angular or sub-rounded sandstone or siltstone ranges from 2% to 40% in individual horizons above the fragipan and from 15% to 65% in the fragipan. This soil features a medium to high surface runoff. Many areas of this soil are cleared and used form general farm crops. Wooded areas can support northern hardwoods and some white pine.

***Soils Identified Within the APE***

Most of the soils found in the APE contain slopes ranging from 8% to 70% (Table 2 and Figure 9). These soils are typically poorly-drained with a slow to very slow internal drainage. Large portions of these soils have reverted to woodland or brush, as they are unsuitable for crops.

Table 2. Soils Identified Within the APE.

| Soil Symbol | Soil Name | Acres Within the Project Site | Percentage Within the Project Site |
|---|---|---|---|
| Wy | Wyalusing silt loam | 7.0 | 36% |
| Mn | Mixed alluvial land | 4.5 | 23% |
| Bh | Basher silt loam | 3.5 | 18% |
| 7B | Shohola-Edgemere complex, 0% to 8% slopes, very rubbly | 2.2 | 11% |
| MgD | Mardin channery silt loam, 8% to 25% slopes, very stony | 10.8 | 10% |
| OyF | Oquaga and Lordstown extremely stony loam, 25% to 70% slopes | 1.9 | 10% |
| WoD | Wellsboro extremely stony loam, 8% to 25% slopes | 0.3 | 2% |
| LgF | Lackawanna very stony silt loam 30% to 50% slopes | 0.1 | Less than 1% |

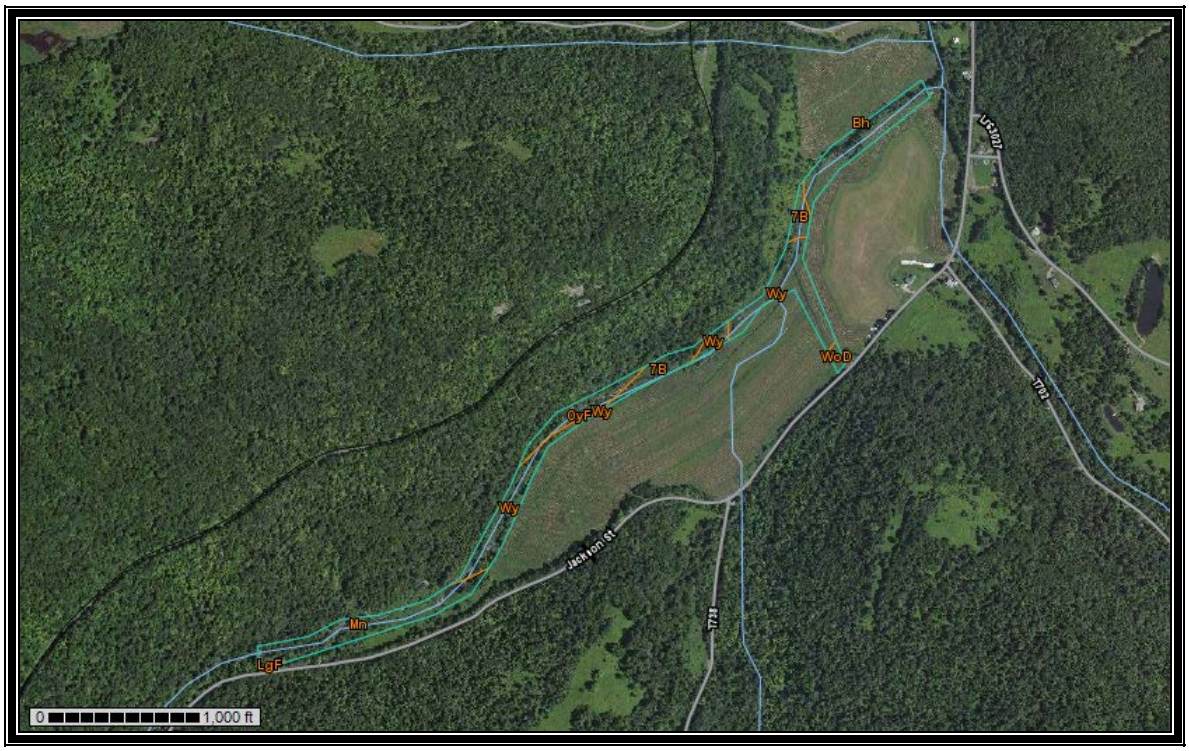

Figure 9. APE soil map, from NRCS website.

## BACKGROUND RESEARCH

The following section provides the Native American and historic background information necessary to assess the archaeological potential of the proposed Project Site. Previous investigations in the general vicinity of the Project Site are outlined, while specific documents and resources employed in this survey are discussed.

### Historic Context

#### *Native American Sites Context*

The Project Site is situated within the Upper Delaware watershed. This watershed is approximately 12,800 square miles and covers parts of New York, Pennsylvania, New Jersey and Delaware. The headwaters of the watershed originate in the Catskill Mountains and eventually flow into Delaware Bay and the Atlantic Ocean. The Delaware River, and a portion of the West Branch, serves as the border between New York and Pennsylvania.

Paleoindian occupation, the first human occupation of the region, began sometime between 13,955 B.C. and 14,555 B.C. (Prufer et. al. 2001, Adovasio et. al. 1990). Most current views now hold that eastern Paleoindians were generalized foragers with an emphasis on hunting. Social organization apparently consisted of relatively small bands that exploited a wide but defined territory. These groups existed in the upper Ohio Valley and the lower reaches of the northeast and eastern regions of North America (Meltzer 1988).

Small, short-term camps along the edges of ridges and terraces represent the majority of Paleoindian remains in Pennsylvania. No previously located Paleoindian resources are located within the Project Site. Due to this scenario and the distance of high-quality cryptocrystalline lithic material and level well-drained landforms, the likelihood of the recovery of Native American materials that date to this period remains low.

The beginning of the Archaic period generally coincides with the end of the Pleistocene epoch, marked in the region by a climatic shift from a moist, cool period to a warmer, dryer climate. Vegetation also changed at this time from a largely boreal forest setting to a mixed conifer-deciduous forest. Increasing differences in seasonal availability of resources brought on by post-Pleistocene changes are thought to coincide with increasing emphasis on strategies of seasonally geared mobility.

Researchers believe Archaic populations are primarily characterized by a band-level social organization involving seasonal movements corresponding to the seasonal availability of resources and, in some instances, shorter-interval movements. Settlement during the Archaic period probably involved the occupation of relatively large regions by single band-sized groups, living in base camps during part of the year and dispersing as necessary on an as-needed or seasonal basis, creating smaller microband camps, possibly consisting of no more than single families. In many cases, these camps were located near the confluence of two or more streams. This location provided easy access to valley floors and adjacent major drainages. It also allowed for using local lithic materials (Prufer et. al. 2001)

The development of more specialized resource procurement activities as well as the development of the technology to accomplish these activities characterized the Archaic period. These differences in the material culture of the period are believed to reflect larger, more localized populations and changes in methods of food procurement and processing.

Corner and side notching became a common characteristic of projectile points at the beginning of the Archaic period (Early Archaic subperiod), indicating changes in hafting technology and possibly the invention of the spear-thrower (atlatl). The Middle Archaic, subperiod sees the rise of various stemmed projectile point forms. Stemmed and notched forms dominated the Late Archaic subperiod, including various large, broad-bladed stemmed knives and projectile points that generally diminish in size by the succeeding Early Woodland subperiod. Also found, though more rarely, are stemmed and notched-stem forms like those generally associated more prominently with areas of Pennsylvania and adjoining parts of the northeast.

The Archaic period also marks the beginning of ground stone technology, with the occurrence of ground atlatl weights and celts. New tool categories developed during the Archaic period include chipped and ground stone celts; ground stone net sinkers, pestles, pecked stones, millers, axes and, during the more recent end of the Late Archaic subperiod, vessels carved from steatite.

Marked increases in population density and decreased mobility characterize the Late Archaic subperiod in eastern North America. Because population growth necessitated a larger and more predictable food supply, agriculture probably has its origins in the Middle Atlantic region during this subperiod.

The likelihood of the recovery of Archaic period Native American materials or similar sites that date to this period is low namely due to the lack of level, well-drained soils within the Project Site.

Ceramic technology, a gradually developing dependence on horticulture, and increased sedentism characterized the Woodland period. The appearance of ceramics in the archaeological record generally defined the Early Woodland subperiod. The earliest Woodland ceramics in the Project Site vicinity consist of half-moon cord-marked ceramics as well as several new projectile point types including Cresap stemmed, Adena ovate-base, and Robbins stemmed (Prufer et. al. 2001). After this subperiod, the habitation center shifts to larger drainages such as Buffalo Creek, where major agricultural villages are established (Adovasio et. al. 1982).

By the Late Woodland subperiod, agriculture had assumed a role of major importance in the Native American subsistence system. The adoption of agriculture represents a major change in the Native American subsistence economy and settlement patterns. Expanses of arable land became a dominant settlement factor, and sites were located on fertile floodplain soils or, in many cases, on higher terraces or ridges adjacent to them.

Settlements dating to this time consist of both villages and small hamlets. Some villages were highly nucleated, while others were internally dispersed over a wide area. Some were completely fortified by circular or oval palisades, while others contained a fortified core area and outlying houses, indicating a rise in intercrop conflict. The more dispersed villages and hamlets were scattered over a wide area with indications of internally fluid settlement within a loosely defined town or village territory. The large base camps, hamlets, and villages are typically located on bluffs, terraces, or high floodplains adjacent to rivers or major tributaries. Small seasonal camps and non-seasonally based satellite camps supporting nearby sedentary villages and hamlets are located along smaller streams in the interior. Limited concentrations and sparse scatters of lithics and ceramics typically characterize these campsites.

The likelihood of the recovery of Woodland period Native American materials or similar sites that date to this period remains low due to the lack of level, well-drained soils within the Project Site.

***Historic Context***

The earliest exploration of this part of Pennsylvania came in the mid-1600s as French explorers moved toward the area to establish a fur trade with the local Indians. Later settlers from Philadelphia and the nearby Connecticut territory began moving into the area. As more people from Connecticut moved into Pennsylvania, conflicts erupted. Connecticut's land grant stated that they owned everything from present day Connecticut

to the Pacific Ocean. This overlapped with Pennsylvania's land grant, which led to fighting among the settlers. Eventually Connecticut was asked to surrender their claim that included Pennsylvania territory and they agreed (Day 1843).

During the first quarter of the 19th century, settlers began establishing counties and townships in northern Pennsylvania. In February 1810, an act from the legislature established Susquehanna County from Luzerne County. Two years later, Montrose was named as the County seat. When the County was first established the area known as Thompson, just to the west of the Project Site was part of Jackson Township. The first settler who came to the area was John Wrighter, a blacksmith. Later other settlers came, including Joseph Porter, who cleared a farm on Starruca Creek (Blackman 1873).

In May 1833, Jackson was divided in two equal parts creating Thompson in the eastern portion (Blackman 1873). By the middle of the 19th century, Thompson boasted a blacksmith shop, an inn, two sawmills, one church, one store, and one post office. The Jefferson Railroad also ran through the area and the Starruca Depot was created just across the county line in neighboring Wayne County. With the railroad and a few turnpikes and roads in place, industry began to flourish. In particular, coalmines opened and began to dominate the rural landscape.

After the Civil War, coalmines dominated the area's economy. With this new industry came more road and railroad improvements. Eventually coal mining became the backbone of the County's economy (Day 1843). The coal mining industry suffered during the Great Depression but recovered during World War II. However, the recovery was short lived and many of the mines closed during the second half of the 20th century. Today, the Project Site and surrounding area maintains is rural nature with small towns and little development. Maps of the area drawn during the 19th and 20th century show no development with the Project Site (Figures 10 - 13).

**Previous Investigations**

Circa~ performed an archival search for the Project Site using the CRGIS on the PHMC website on September 14, 2015. This research was completed to determine if historic resources exist within the Project Site. The search identified three archaeological resources and one architectural resource within 1,000 feet of the Project Site. Site 36WY0188 is identified as the Starruca Falls Gristmill. Site 36WY0277 is identified as the circa 1842 Mumford Gristmill. Site 36WY0293 is identified as the J. Mumford Sawmill. According to the CRGIS, an informant identified all three of these sites and no formal survey or determination of eligibility for listing on the National Register of Historic Places has been made for any of the sites. Some of these sites appear to be on the 1860 Hopkins map (see Figure 10). Site 139591 is identified as a circa 1940 bridge. The PHMC has determined that this site is not eligible for listing on the National Register of Historic Places.

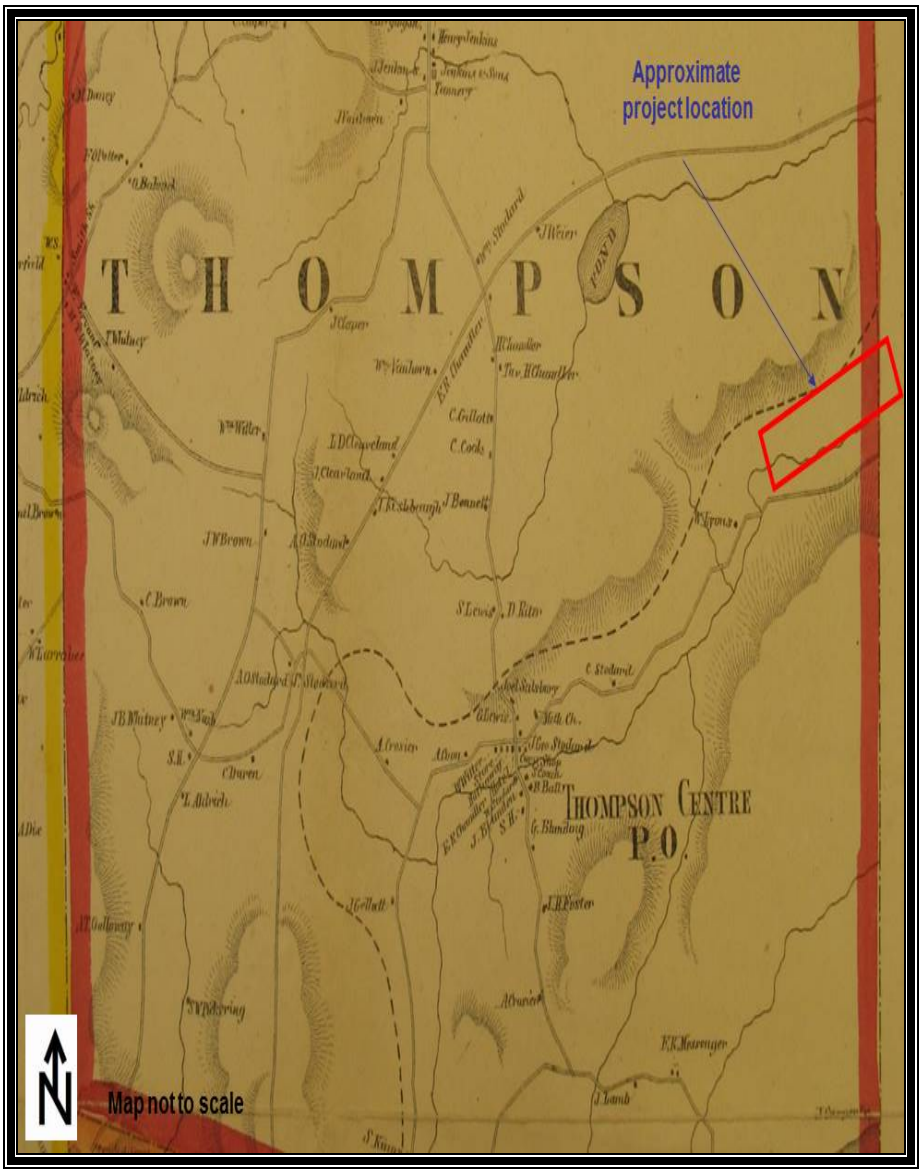

Figure 10. Detail of *Susquehanna Co. Pennsylvania from Actual Surveys* by G. M. Hopkins, C.E., 1858.

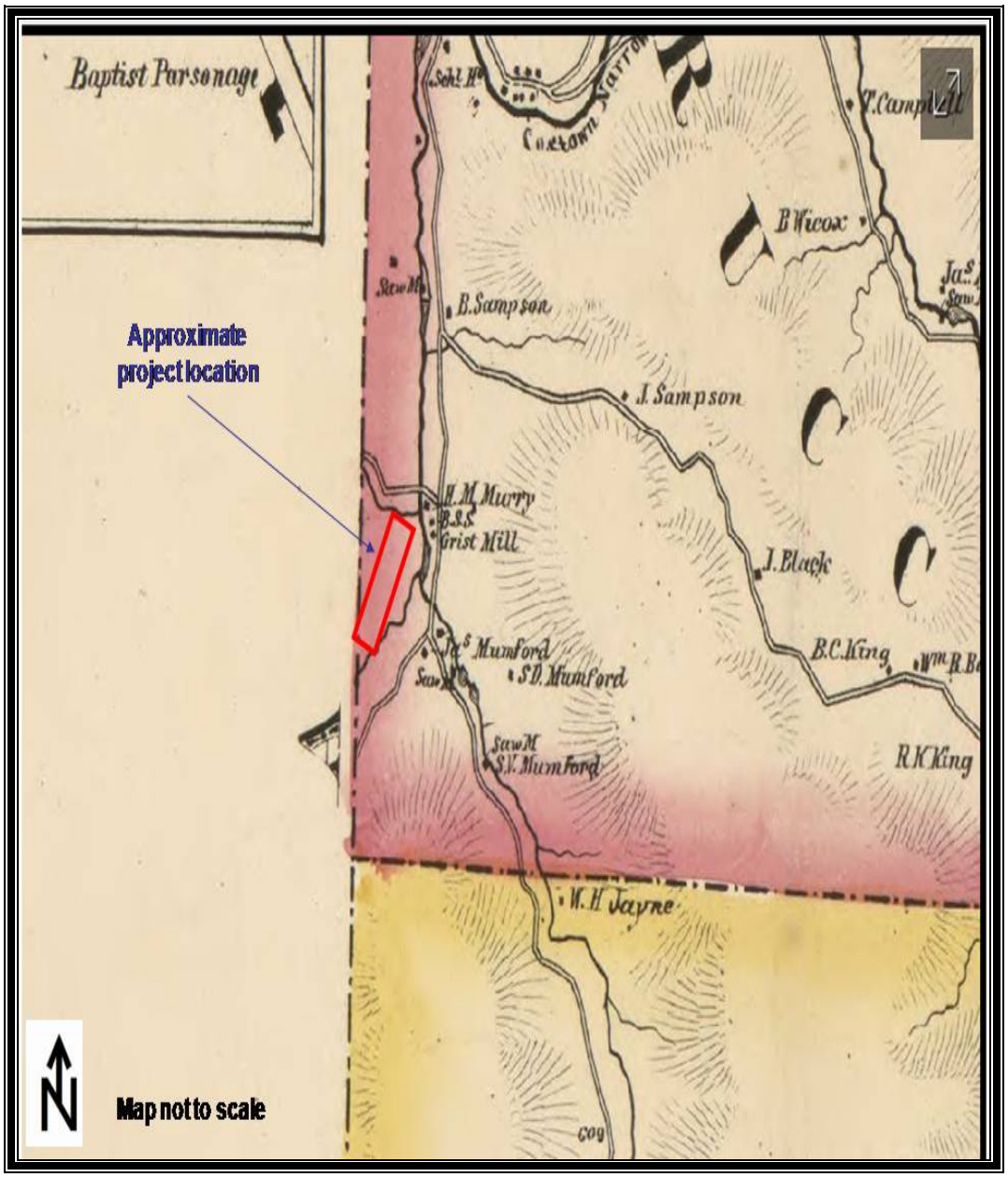


Figure 11. Detail of *Map of Wayne Co., Pennsylvania*, by G. M. Hopkins, 1860.

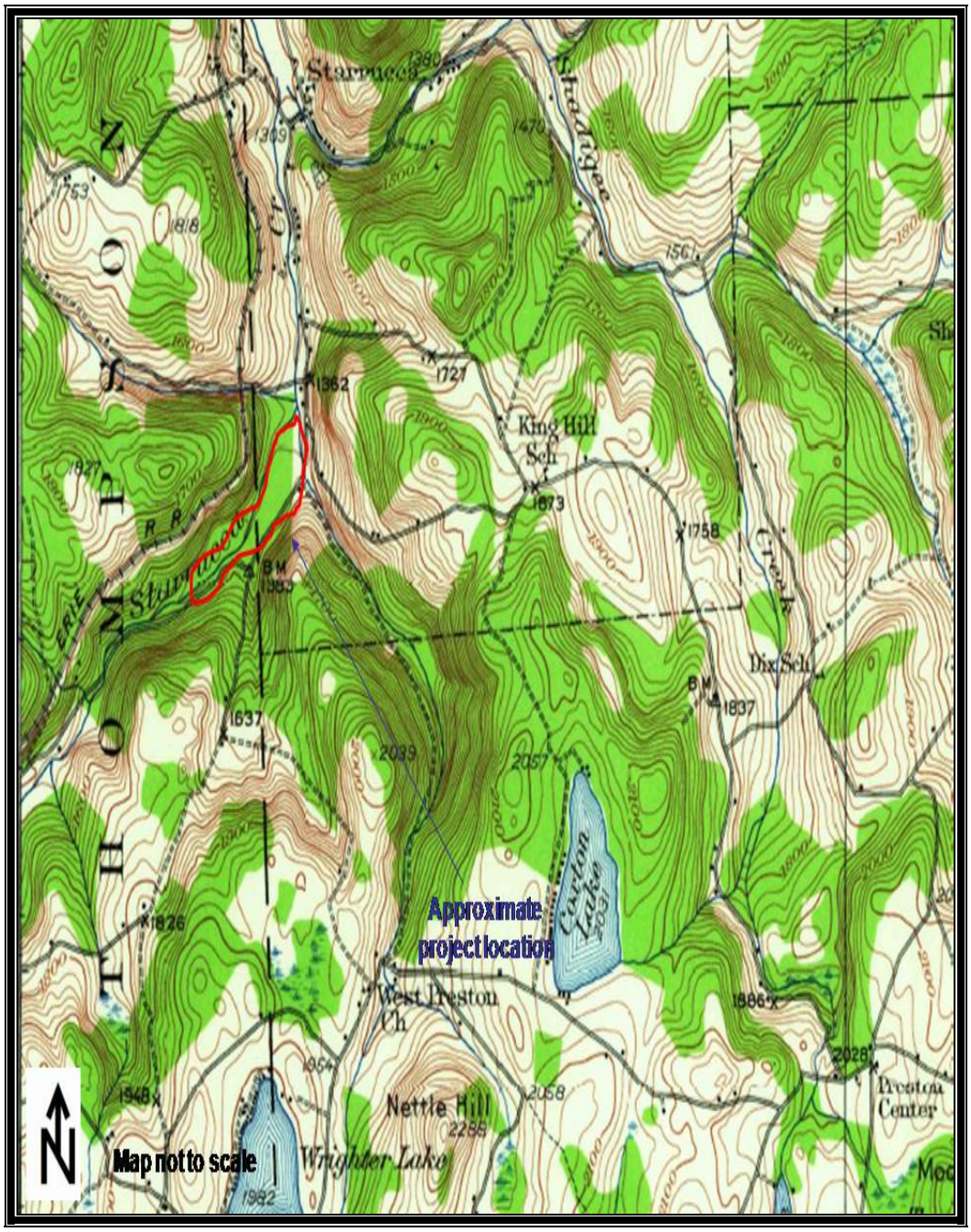

Figure 12. Detail of 1930 Starruca quad map.


Figure 13. Detail of 1950 Scranton quad map.

## RESEARCH STRATEGY AND METHODOLOGY

### Research Strategy

The survey was designed to identify all cultural resources present in the Project Site and to obtain sufficient information to make recommendations about the further research potential of each resource based on potential eligibility to the National Register of Historic Places. To accomplish this, both documentary research and archaeological field testing was performed at a level in compliance with the *Secretary of the Interior's Standards* (Department of the Interior 1983, 48 FR 44720-44723), as well as VDHR guidelines for Phase I archaeological surveys. Moreover, the field survey was conducted in compliance with statutes regarding the impact of undertakings on historic properties as summarized by the Advisory Council on Historic Preservation (36 CFR 800 [1986]). To meet Advisory Council on Historic Preservation standards, a Phase I archaeological survey must be conducted in "a reasonable and good faith effort to identify historic properties that may be affected by the undertaking" (36 CFR 800.4). The Phase I survey was performed and documented at a level that meets or exceeds these standards.

A cultural resource is gauged to be significant if at least one of four National Register of Historic Places criteria can be applied to it:

A. Associated with significant events in the broad patterns of national history;
B. Associated with the lives of persons significant in our past;
C. Representative of a type, period, or method of construction, or the work of a master; and
D. Capable of yielding important information about the past.

Typically, Criterion D applies to archaeological sites. In order to be capable of yielding important information about the past, generally a site must possess artifacts, soil strata, structural remains, or other cultural features that make it possible to test historical hypotheses, corroborate and amplify currently available information, or reconstruct the sequence of the local archaeological record.

### Methods

#### *Archival Research*

Archival research commenced with the examination of cartographic and historic works that are on file online with the Library of Congress, the PHMC, and Susquehanna and Wayne counties. Efforts were made to determine whether historic road right-of-ways passed close to the Project Site and whether subsurface cultural deposits were likely to be present. Data accumulated during the course of previous archival research on historic sites throughout the region also were examined.

#### *Architectural Field Methods*

Field survey of all historic structures was conducted according to BHP PHMC survey procedures. Digital color photographs were taken of all structures located adjacent to the tract.

***Archaeological Field Methods***

Prior to subsurface testing, the entire Project Site was visually inspected via pedestrian survey and all aboveground evidence of cultural activity noted and recorded. Shovel tests, approximately 1.50-foot in diameter, were excavated at 50-foot intervals. In addition, shovel test intervals were reduced to 25-foot intervals around positives and isolated positive shovel tests. Waterlogged areas, or portions of the Project Site with slopes in excess of 15%, were carefully examined for cultural material, but were not subjected to subsurface testing. All shovel tests were excavated according to natural levels to sterile subsoil, and all soils screened through ¼-inch wire mesh. Profiles were recorded for representative shovel tests and soil color recorded in accordance with the Munsell classification system. All positive shovel tests were recorded on standard field forms and all cultural material retained.

***Laboratory Methods***

Once removed from the field, all archaeological data and specimens were transported to Circa~'s laboratory for processing and analysis. Prior to washing, artifacts from a given provenience were first emptied into a screened basket and sorted. Items determined to be unstable will be either dry brushed or in some cases not washed and re-bagged with the appropriate provenience information. These items may include unstable organic objects, such as wood or other plant material, leather, bone, fabric, metal requiring immediate conservation, and overglaze painted delftware, and other soft-bodied ceramics such as some local wares. Stable objects will be washed with a soft brush and edges of ceramics and glass will be thoroughly cleaned to aid in the identification of body type and mending. Items will be then placed by provenience on a drying rack.

In a given provenience, artifacts were sorted first by material and checked for mends. Stylistic attributes were described with current terminology and recorded by count into a database for analysis. Non-diagnostic artifacts with like attributes will be grouped together - i.e., clear, amber, etc. bottle body glass fragments, unrecognizable nail fragments, corroded metal fragments, and aqua window glass. Diagnostic artifacts were sorted and grouped together based on type or ware and/or vessel or function.

## FIELD RESULTS

The purpose of the field survey is to provide specific information concerning the location, nature, and distribution of archaeological resources within the permit areas. Circa~ uses two types of designations for the grouping of archaeological resources: isolated finds and sites. An isolated find is defined when a limited number of artifacts are recovered from the ground surface or from shovel testing. This event may be either a casual or single-episode discard such as a projectile point or a bottle break or may be a small collection of artifacts related to various periods, such as a projectile point from the Woodland period and a bottle fragment from the 20$^{th}$ century. An archaeological site is defined as a grouping of artifacts that date to specific periods and that reveal the location of human activity and land use.

**Survey Results**

The Circa~ grid across the entire project area called for the excavation of 1,139 shovel tests; the development area is restricted to roughly 50 acres along the stream corridor to enhance the flow of the stream and within the flood plain for replanting trees. Of these, Circa~ excavated 248 shovel tests during the course of the Phase I survey. Shovel tests were skipped for steep slopes, wetlands, and previous construction along the existing roads. Plates 1 through 14 show the current conditions of the Project Site. The project maps with the shovel test locations are in Appendix A.

***Architectural Resources***

No architectural resources are located within the Project Site.

***Archaeological Resources***

The headwaters of Starruca Creek begin near Thompson, Pennsylvania just to the west of the Project Site. The stream valley is narrow and hugs a steep slope to the north and the road to the south. Within a few hundred feet of the Project Site, the stream valley widens and Starrucca Creek shifts to the north and flows east along the edge of the steep slope. The first 2,250 feet of the western end of the Project Site is wooded with mature trees. The area is wet with pockets of elevated landforms, built up over the years from flooding episodes. Shovel tests placed on these landforms revealed a mixed soils profile of various layers of sand and silt mixed with stones, tree limbs, and pinecones. These flooding episode stratums ranged in depth from 1.87 feet to 2.49 feet thick over the original ground surface (Figure 14). The shovel tests were terminated at the original ground surface due to water ponding in the base of the shovel tests. The stream valley, in this area, is crossed by four drainages that flow from the north from the uplands to the south to connect to Starrucca Creek. Elevations within this area are 10,220 feet AMSL at the western edge of the Project Site. All of the shovel tests were negative.

Plate 1. View of western section of stream, looking west.

Plate 2. View of stream in the wooded section, western portion of the Project Site, looking east.

Plate 3. View of stream in the eastern section of the Project Site.

Plate 4. View of stream in the middle section of the Project Site.

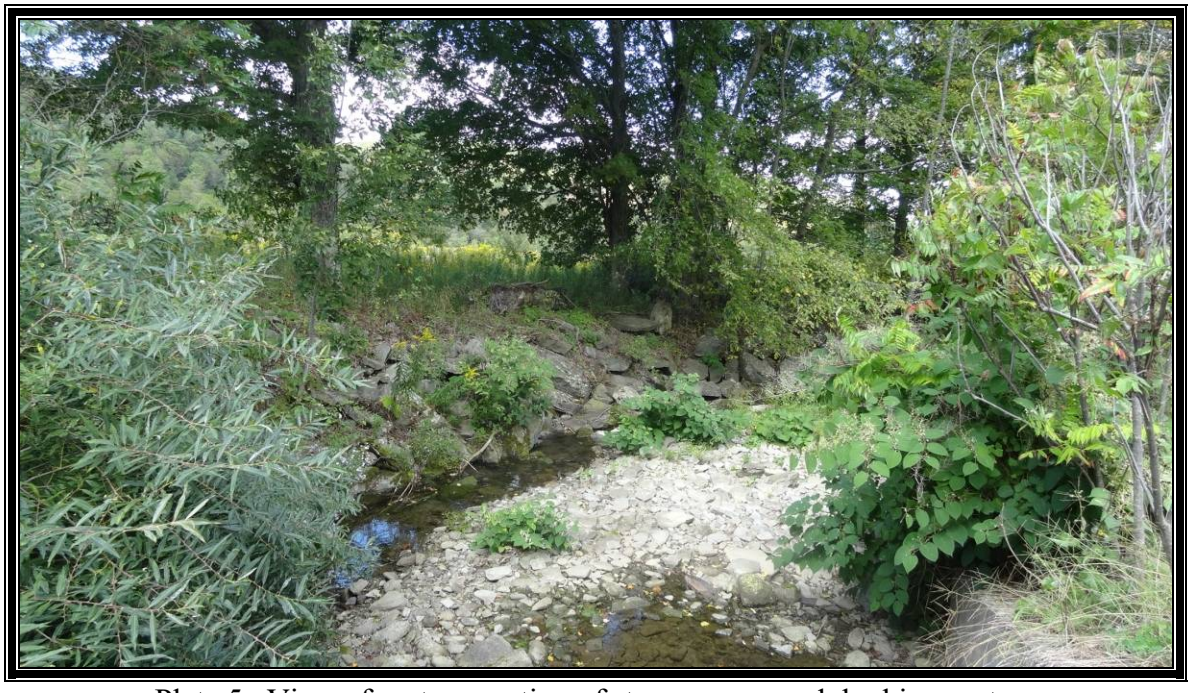

Plate 5. View of eastern portion of stream near road, looking east.

Plate 6. View of built-up area in the wooded section, looking northeast.

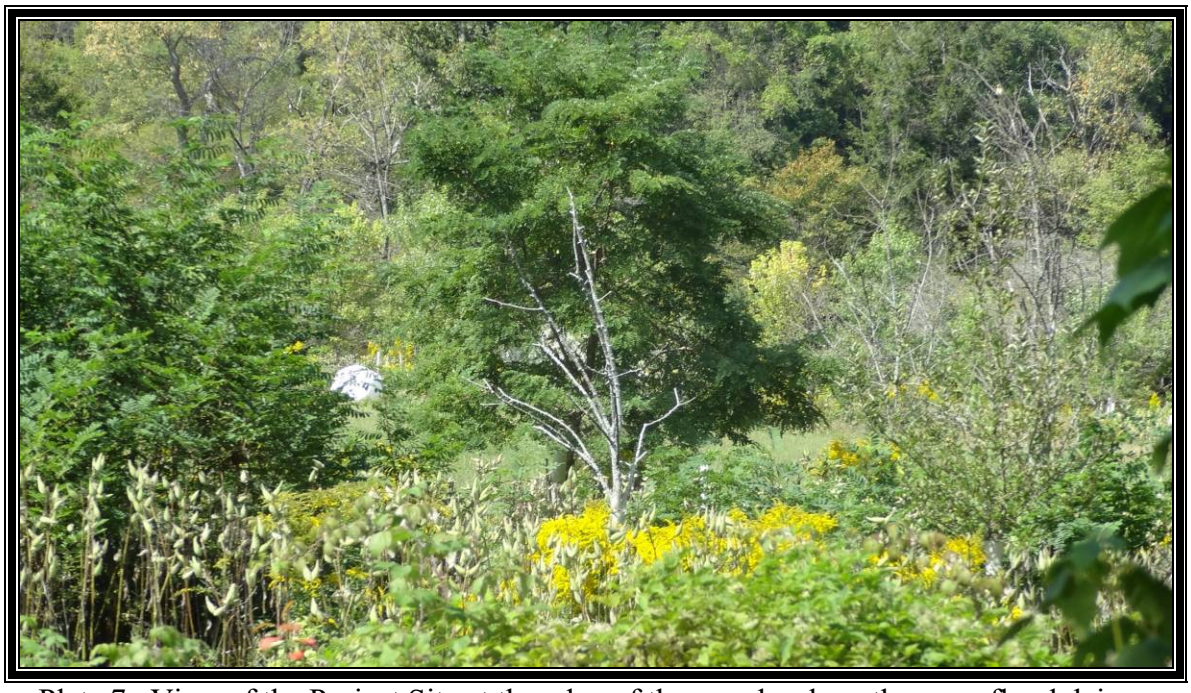

Plate 7. View of the Project Site at the edge of the woods where the open floodplain begins, looking northwest.

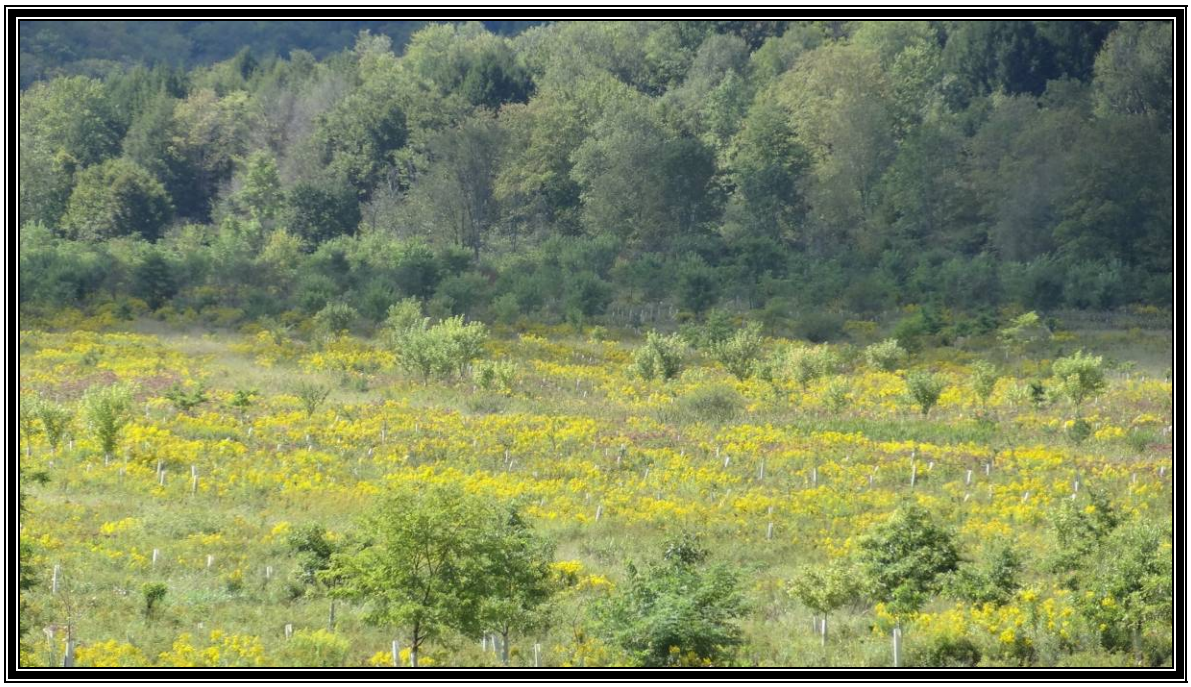

Plate 8. View of the western portion of the open floodplain, looking northwest. Note plastic pipes around the planted trees.

Plate 9. View of a wetland with the slightly elevated area within the floodplain, looking northeast.

Plate 10. View of the stream valley, looking east.

Plate 11. View of the stream valley, looking west.

Plate 12. View of elevated area where the trees were previously planted, looking west.

Plate 13. Detail view of recent flooding.

Plate 14. View of wetlands in the eastern portion of the Project Site.

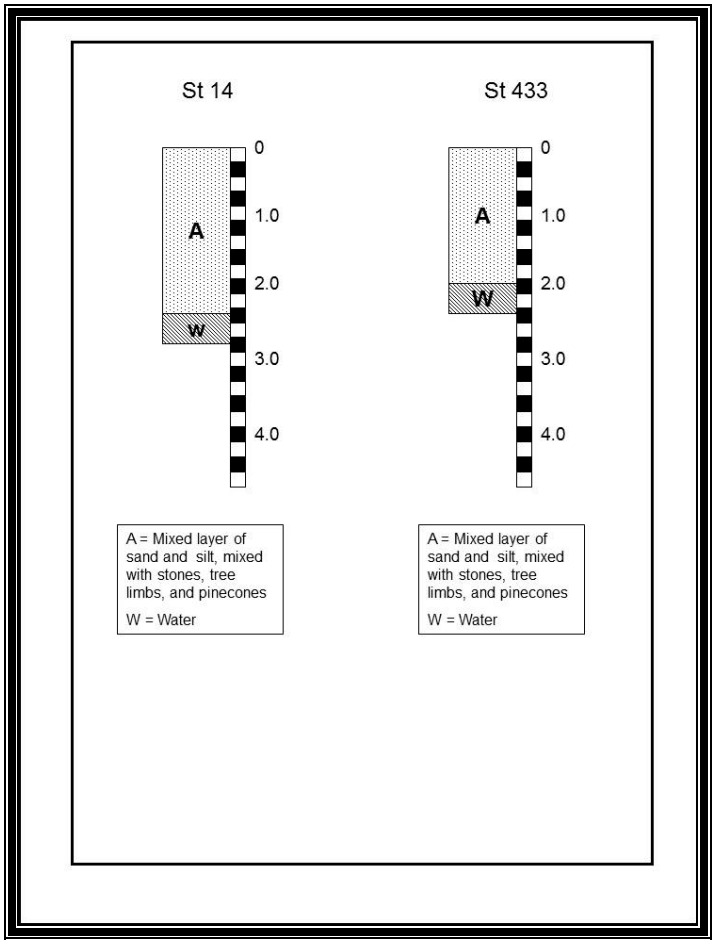


Figure 14. Representative shovel test profiles.

The floodplain then widens to roughly 700 feet the next 1,000 feet of the Project Site and is slightly elevated by roughly one foot from the surrounding area. Shovel tests in this area also show a build-up of soils from flooding episodes, although the build-up appears to have occurred further in the past, as there were no tree limbs evident in the soil profiles. Shovel tests placed in this area revealed flooding episode stratums that ranged in depth from 1.23 feet to 1.54 feet over the original ground surface (Figure 15). The shovel tests were terminated due to water ponding in the base of the tests. The original ground surface was evident as a darker brownish gray buried A horizon with some traces of grasses and wetland plants. However, 10 shovel tests were excavated through the original ground surface and water to verify the depth of the buried A horizon. This stratum consisted of a saturated dark brownish gray loamy clay 0.47 to 0.59 feet thick. This layer was underlain by a very saturated mottled yellowish orange clay. All of the shovel tests were negative.

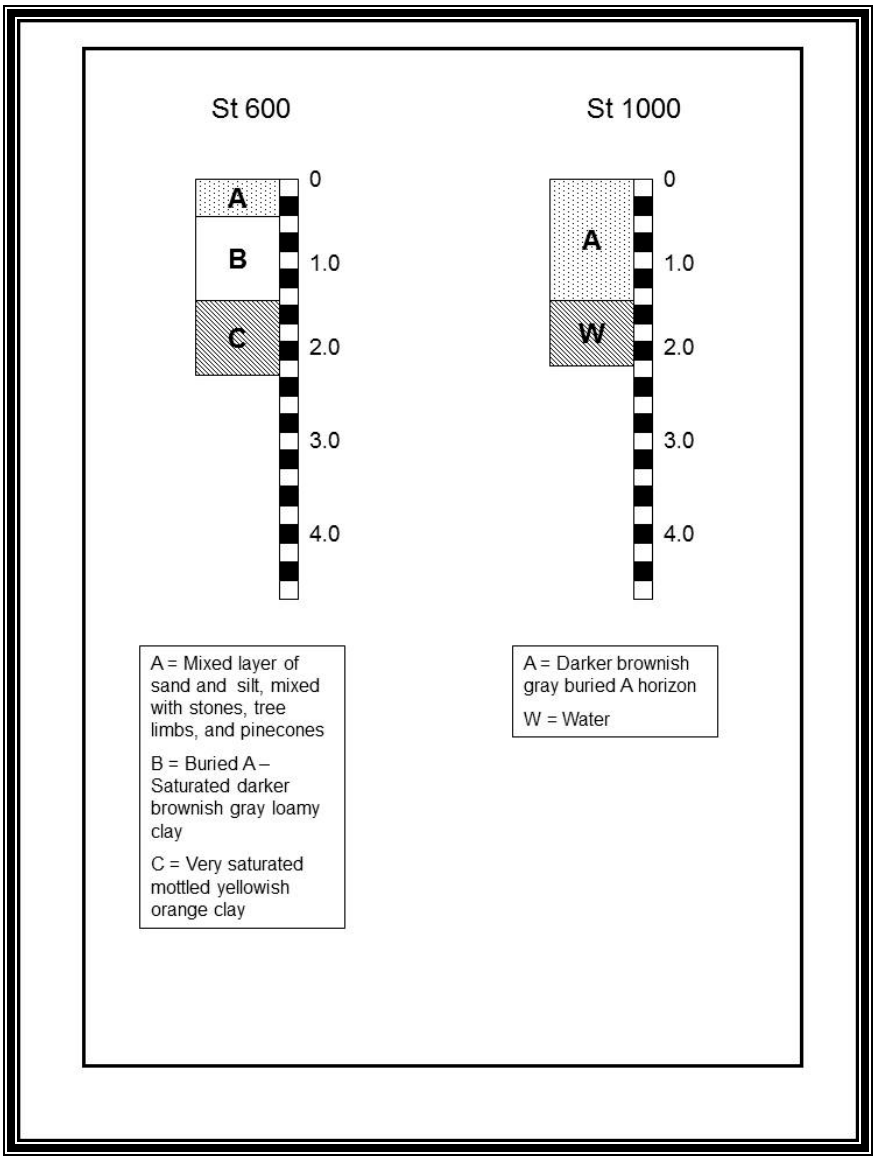


Figure 15. Additional representative shovel test profiles.

## CONCLUSIONS AND RECOMMENDATIONS

The topography of the stream channels consists of a narrow to wide active stream valley surrounded by steep slopes to the north and south. Elevations adjacent to the Project Site range from 14,305 feet AMSL at the top of the side slopes along the northern side of the Project Site and drops to 10,200 feet AMSL along the stream channel. The elevation of the adjacent slope top to the south is at 14,685 feet AMSL and falls to 11,183 feet AMSL along the Project Site near the road. The stream's headwaters are located to the west and the floodplain drops in elevation as the channel makes its way east through the steep upland ridges. In some sections, the stream appears to have moved over time in the floodplain changing its path during storm episodes. In addition, there are two small drainages to the north and six drainages to the south that empties the uplands into the floodplain. Vegetation was thick within the stream valley, with tall grasses, thick brambles, and saplings. In addition, the Project Site is with an existing restoration area previously planted with native species.

The Phase I shovel testing did not locate any archaeological resources or surface deposits of artifacts within the Project Site. No architectural resources were identified within the Project Site. In sum, the Project Site consists of a narrow to wide stream valley with low potential areas for site locations along the upland stream channel. In addition, the low areas along the stream channel and further into the floodplain contain poorly-drained soils that are currently either wetlands or marsh. Some slightly elevated areas were noted within the floodplain. Shovel test within these areas show that the landforms were created from flooding episodes. Circa~ recommends no further work for the stream and wetland mitigation areas. There should also be no effect to any viewsheds as the project is limited to restoration.

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1930 Starruca quadrangle sheet.

1950 Scranton quadrangle sheet

**APPENDIX A**
**PROJECT AREA MAP**

Project limits are approximate.
The parcel data information/property boundaries depicted on this map is for prospect assessment purposes only. It is not to be used as final boundaries.

SHEET 1
SHEET 2
SHEET 3
SHEET 4
SHEET 5
SHEET 6
SHEET 7
SHEET 8

Legend
Sheet Index
Easement Boundary



0 437.5 875
Feet

**CULTURAL RESOURCE MAPPING**

**INDEX SHEET**

**STARRUCCA CREEK MITIGATION BANK**

**SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA**

Date: 11/20/2015
Drawn by: ADS

PROJECT LOCATION

Project limits are approximate.
The parcel data information/property boundaries depicted on this map is for project assessment purposes only. It is not to be used as final boundaries.

346
325
275
250
225
300
208
150
207
200
139
175
125
140
115

Negative shovel test
Skipped shovel test



CULTURAL RESOURCE MAPPING
SHEET 2 OF 8
STARRUCCA CREEK MITIGATION BANK
SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA

PROJECT LOCATION

Project limits are approximate.
The parcel data information/property boundaries depicted on this map is for project assessment purposes only. It is not to be used as final boundaries.

558
550
525
500
475
450
425
400
375
350
347

Negative shovel test

Skipped shovel test



SHEET INDEX

CULTURAL RESOURCE MAPPING

SHEET 3 OF 8

STARRUCCA CREEK MITIGATION BANK

SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA

res

PROJECT LOCATION

Project limits are approximate.
The parcel data information/property boundaries
depicted on this map is for prospect assessment
purposes only. It is not to be used as final boundaries.

559

575

600

625

650

675

700

Negative shovel test

Skipped shovel tests

CULTURAL RESOURCE MAPPING

SHEET 4 OF 8

STARRUCCA CREEK MITIGATION BANK

SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA

SHEET INDEX

PROJECT LOCATION

res

725

743

717

716

701

Negative shovel test

Skipped shovel test

CULTURAL RESOURCE MAPPING

SHEET 5 OF 8

STARRUCCA CREEK MITIGATION BANK

SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA

PROJECT LOCATION

Project limits are approximate.
The parcel data information/property boundaries
depicted on this map is for prospect assessment
purposes only. It is not to be used as final boundaries.

744

750

773

Negative shovel test

Skipped shovel test

SHEET INDEX

CULTURAL RESOURCE MAPPING

SHEET 6 OF 8

STARRUCCA CREEK MITIGATION BANK

SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA

res

PROJECT LOCATION

Project limits are approximate.
The parcel data information/property boundaries
depicted on this map is for prospect assessment
purposes only. It is not to be used as final boundaries.

893
875
800
894
900
925
825
939
850
775
774

Negative shovel test
Skipped shovel test

CULTURAL RESOURCE MAPPING
SHEET 7 OF 8
STARRUCCA CREEK MITIGATION BANK
SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA

res

SHEET INDEX

PROJECT LOCATION

Project limits are approximate.
The parcel data information/property boundaries depicted on this map is for prospect assessment purposes only. It is not to be used as final boundaries.

950
975
940
1025
1000
1075
1100
1050
1125
1139
774

Negative shovel test
Skipped shovel test

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SHEET INDEX

CULTURAL RESOURCE MAPPING
SHEET 8 OF 8
STARRUCCA CREEK MITIGATION BANK
SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA

res

PROJECT LOCATION

Project limits are approximate.
The parcel data information/property boundaries depicted on this map is for prospect assessment purposes only. It is not to be used as final boundaries.

114

100

75

50

25

1

Negative shovel test

Skipped shovel test

Legend

Stream

Drainage Ditch

Retention Dam

Berm

Riparian Wetlands

Rip Rap

Active Headcut

Active Headcut Contours

Wetlands

Watershed Boundary

Municipal Boundary

County Boundary



SHEET INDEX

CULTURAL RESOURCE MAPPING

SHEET 1 OF 8

STARRUCCA CREEK MITIGATION BANK

SUSQUEHANNA AND WAYNE COUNTIES, PENNSYLVANIA

res

PROJECT LOCATION

# APPENDIX H
# BANK LEDGER

## STREAM CREDIT LEDGER - RATIO METHOD

| Date | Event | Permitee | Permit Number (PADEP) | Permit Number (USACE) | Subbasin | Project Credits Committed / Withdrawn | Project Credits Utilized | Released Credits Remaining | Credits Released | Expected Future Credits Released |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| xx/xx/xxxx | Bank Approval | FPR | TBD | TBD | 4 | - | - | - | - | 14,443.82 |

## STREAM CREDIT LEDGER - FUNCTIONAL METHOD

| Functional Group | Date | Event | Permitee | Permit Number (PADEP) | Permit Number (USACE) | Subbasin | Project Credits Committed / Withdrawn | Project Credits Utilized | Released Credits Remaining | Credits Released | Expected Future Credits Released |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| Hydrologic (HYD1) | xx/xx/xxxx | Bank Approved | FPR | TBD | TBD | 4 | - | - | - | - | 128.48 |
| Resource Support (RS1) | xx/xx/xxxx | Bank Approved | FPR | TBD | TBD | 4 | - | - | - | - | 25.57 |
| Biogeochemical (BGC1) | xx/xx/xxxx | Bank Approved | FPR | TBD | TBD | 4 | - | - | - | - | 145.14 |
| Habitat (HAB1) | xx/xx/xxxx | Bank Approved | FPR | TBD | TBD | 4 | - | - | - | - | 8.91 |

## WETLAND CREDIT LEDGER - RATIO METHOD

| Date | Event | Permitee | Permit Number (PADEP) | Permit Number (USACE) | Subbasin | Project Credits Committed / Withdrawn | Project Credits Utilized | Released Credits Remaining | Credits Released | Expected Future Credits Released |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| xx/xx/xxxx | Bank Approval | FPR | TBD | TBD | 4 | - | - | - | - | 46.83 |

## WETLAND CREDIT LEDGER - FUNCTIONAL METHOD

| Functional Group | Date | Event | Permitee | Permit Number (PADEP) | Permit Number (USACE) | Subbasin | Project Credits Committed / Withdrawn | Project Credits Utilized | Released Credits Remaining | Credits Released | Expected Future Credits Released |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| Hydrologic (HYD2) | xx/xx/xxxx | Bank Approved | FPR | TBD | TBD | 4 | - | - | - | - | 242.84 |
| Biogeochemical (BGC2) | xx/xx/xxxx | Bank Approved | FPR | TBD | TBD | 4 | - | - | - | - | 242.84 |
| Habitat (HAB2) | xx/xx/xxxx | Bank Approved | FPR | TBD | TBD | 4 | - | - | - | - | 242.84 |

# APPENDIX I
# DESIGN PLANS
# (PROVIDED SEPARATELY)

# STARRUCCA CREEK MITIGATION BANK
# DESIGN PLANS

## Thompson Township, Susquehanna County, Pennsylvania
## and Starrucca Borough, Wayne County, Pennsylvania

### 1. PROJECT DESCRIPTION:

FIRST PENNSYLVANIA RESOURCE, LLC (FPR, SPONSOR), A WHOLLY-OWNED SUBSIDIARY OF RESOURCE ENVIRONMENTAL SOLUTIONS, LLC (RES) PROPOSES TO ESTABLISH THE STARRUCCA CREEK MITIGATION BANK - (BANK SITE, PROJECT) WITHIN THE APPROVED PENNSYLVANIA STATEWIDE UMBRELLA MITIGATION BANKING INSTRUMENT (PSUMBI). THE PURPOSE OF THE PSUMBI IS TO PROVIDE COMPENSATORY MITIGATION FOR UNAVOIDABLE IMPACTS TO WATERS OF THE UNITED STATES (U.S.) OCCURRING AS A RESULT OF ACTIVITIES AUTHORIZED UNDER SECTION 401 AND 404 OF THE CLEAN WATER ACT; SECTION 10 OF THE RIVERS AND HARBORS ACT; PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (PADEP) CHAPTERS 102, 105, AND 106 REGULATORY PROGRAMS; AND DEPARTMENT OF THE ARMY PERMITS, PROVIDED SUCH ACTIVITIES HAVE MET ALL APPLICABLE REQUIREMENTS AND ARE AUTHORIZED BY THE APPROPRIATE AGENCIES.

### 2. SITE ADDRESS:

73 STARRUCCA CREEK ROAD
SUSQUEHANNA, PA 18847

### 3. SITE COORDINATES:

41° 52' 43.26" N (41.878683)
75° 28' 47.91" W (-75.479975)

### 4. MITIGATION BANK SPONSOR:

FIRST PENNSYLVANIA RESOURCE, LLC
33 TERMINAL WAY, SUITE W445A
PITTSBURGH, PA 15219

### 5. LANDOWNERS:

ROBERT E. & LILLIAN BUCK
AND KIRK O. & ALICE K. RHONE
WAYNE COUNTY: 25-0-0140-0005.0001
WAYNE COUNTY: 25-0-0140-0017.0002
SUSQUEHANNA COUNTY: 096.00-1018.00

### 6. SURVEY INFORMATION:

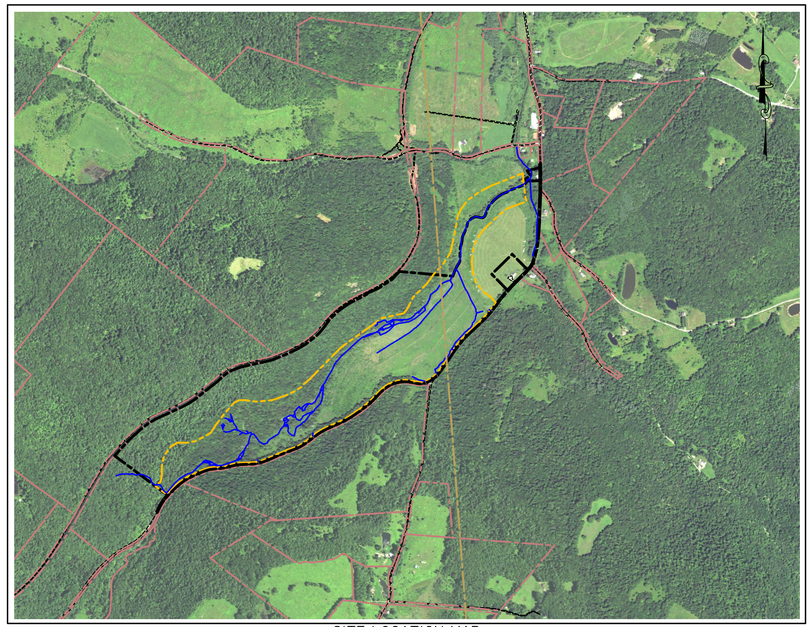
BOUNDARY SURVEY PERFORMED BY CIVIL AND ENVIRONMENTAL CONSULTANTS (CEC) IN 2015.
EXISTING CONDITIONS TOPOGRAPHY SURVEY PERFORMED BY STANTEC IN 2015 AND 2016.
ADDITIONAL TOPOGRAPHY SURVEYS PERFORMED BY RES IN 2016 AND 2018.
AERIAL IMAGERY, USGS QUAD MAP AND ADDITIONAL CONTOUR DATA PROVIDED BY THE PENNSYLVANIA SPATIAL DATA AND ACCESS LIBRARY (PASDA) WEBSITE.

### 7. WETLAND INFORMATION:

WETLAND DELINEATION PERFORMED BY BLUACES, LLC IN 2015.
WATERCOURSE DELINEATION SUPPLEMENT PERFORMED BY RES IN 2015.

### 8. SITE AREA:

PARCEL AREA: 171.86 ACRES
PROJECT AREA: 104.98 ACRES

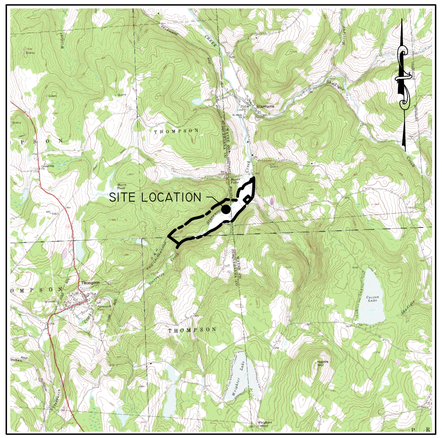


SITE LOCATION MAP

0 1000 2000 4000 Feet
SCALE: 1" = 1000'

MAP LEGEND

- PARCEL BOUNDARY
- ADJOINER BOUNDARY
- MUNICIPAL BOUNDARY
- PROJECT BOUNDARY
- STREAM CENTERLINE



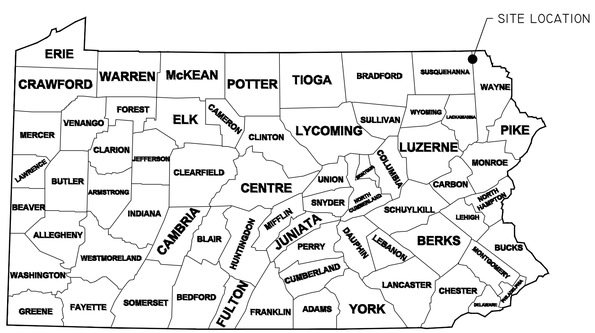

PROJECT LOCATION MAP

0 5000 10000 20000 Feet
SCALE: 1" = 5000'

| SHEET INDEX | |
|---|---|
| SHEET # | SHEET TITLE |
| C000 | COVER SHEET |
| C100 | EXISTING CONDITIONS |
| C200 | LAYOUT PLAN |
| C300 | GRADING PLANS - BASELINE 12+00 TO 29+00 |
| C301 | GRADING PLANS - BASELINE 29+00 TO 45+00 |
| C302 | GRADING PLANS - BASELINE 45+00 TO 62+00 |
| C303 | GRADING PLANS - BASELINE 62+00 TO 80+00 |
| C600 | EXISTING THALWEG PROFILES |
| C601 | EXISTING THALWEG PROFILES |
| C602 | EXISTING THALWEG PROFILES |
| C603 | EXISTING THALWEG PROFILES |
| C604 | EXISTING THALWEG PROFILES |
| C605 | PROPOSED BASELINE PROFILES |
| C606 | PROPOSED BASELINE PROFILES |
| C607 | PROPOSED BASELINE PROFILES |
| C608 | PROPOSED BASELINE PROFILES |
| C609 | PROPOSED THALWEG PROFILES |
| C610 | PROPOSED THALWEG PROFILES |
| C611 | PROPOSED THALWEG PROFILES |
| C612 | DEGRADATION CROSS SECTIONS |
| C613 | CROSS SECTIONS |
| C614 | CROSS SECTIONS |
| C615 | CROSS SECTIONS |
| C616 | BOUNDARY CROSS SECTIONS |
| C700 | PLANTING PLAN |
| C701 | PLANTING LIST |
| C702 | PLANTING DETAILS |
| C800 | CONSTRUCTION DETAILS |
| C801 | CONSTRUCTION DETAILS |
| SI00 | Q2YR SHEAR STRESS MODELS |
| SI01 | Q10YR SHEAR STRESS MODELS |
| SI02 | Q100YR SHEAR STRESS MODELS |

## FIRST PENNSYLVANIA RESOURCE, LLC.


ATTN: SHAWYN YEAMANS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH, PA 15219
EMAIL: SYEAMANS@RES.US
PHONE: (412) 249-2452


RiverineSolutions

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL RICHARDSON SACHS
ENGINEER
PE079631

1/21/2019

ONE CALL SERIAL NO.: 20183392630 AND 20183392636

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. 1-800-242-1776

PENNSYLVANIA ACT 38 (1991) REQUIRES NO LESS THAN 3 WORKING DAYS NOTICE NOR MORE THAN 10 WORKING DAYS NOTICE FROM EXCAVATORS WHO ARE ABOUT TO: DIG, DRILL, BLAST, AUGER, BORE, GRADE, TRENCH, OR DEMOLISH WHEN IN THE CONSTRUCTION PHASE. FOR LOCATION REQUESTS IN THE STATE OF PENNSYLVANIA, CALL TOLL FREE 1-800-242-1776. UNDERGROUND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE INFORMATION AND THE LOCATION MUST BE CONSIDERED APPROXIMATE. OTHER UNDERGROUND UTILITIES MAY EXIST WHICH ARE NOT SHOWN. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO ASCERTAIN ALL PHYSICAL LOCATIONS OF UTILITY LINES PRIOR TO THE TIME OF CONSTRUCTION. IN NO WAY SHALL THE CONTRACTOR HOLD THE SURVEYOR RESPONSIBLE FOR ANY UTILITY LOCATION SHOWN ON THIS PLAN.

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | | | |

REVISIONS

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

DRAWN BY: RD
CHECKED BY: MS
APPROVED BY: SY
DATE: JANUARY 21, 2019

PENNSYLVANIA
SUSQUEHANNA COUNTY
WAYNE COUNTY

FILE NO: 007-06-004

SHEET: C000

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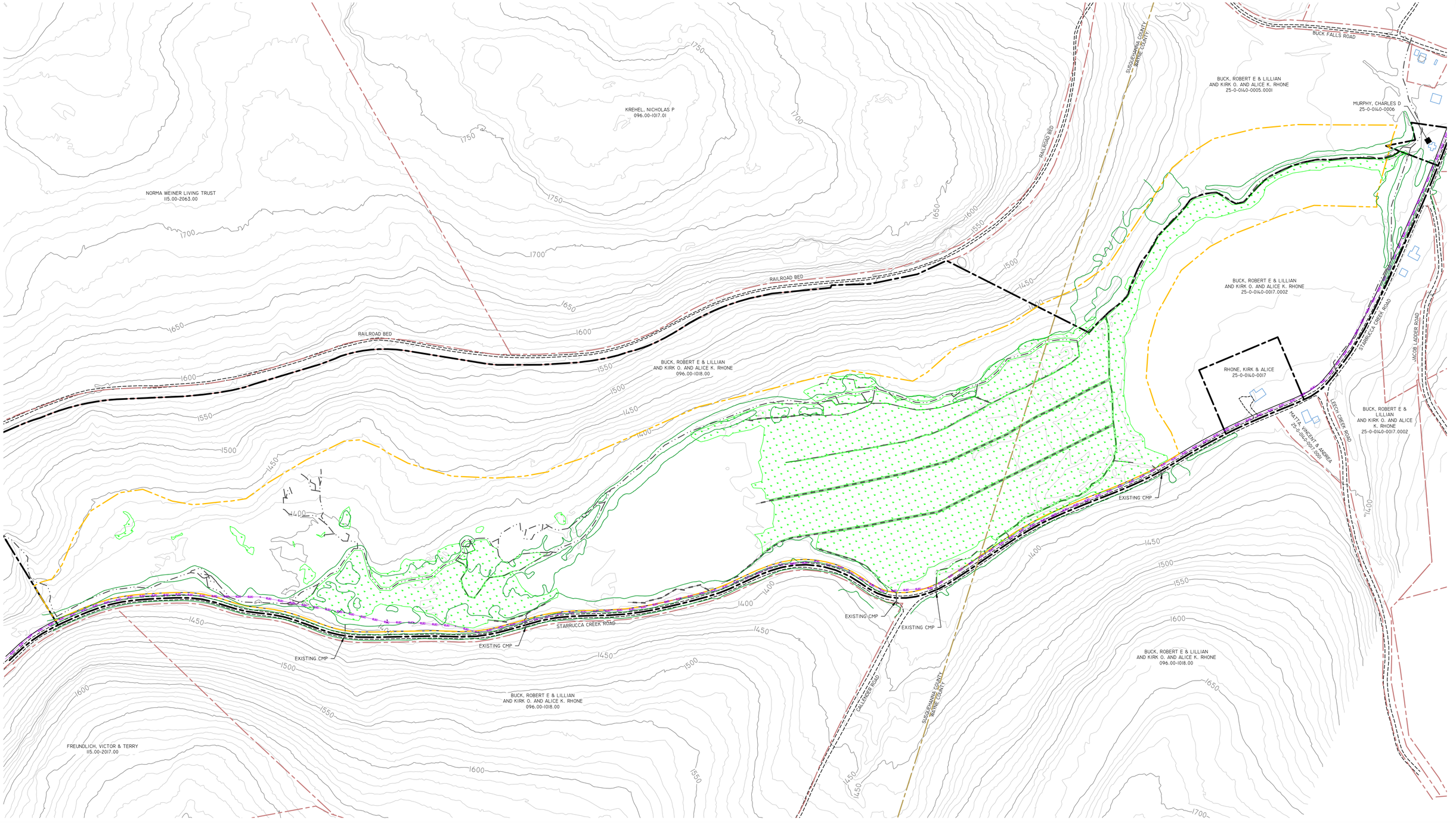


## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
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## LEGEND

- PROPERTY BOUNDARY
- PROJECT BOUNDARY
- ADJACENT BOUNDARY
- COUNTY BOUNDARY
- STRUCTURE
- EDGE OF ROAD
- CULVERT
- ELECTRIC UTILITY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING STREAM
- EXISTING DITCH
- EXISTING WETLAND
- EXISTING TREE LINE
- STORM

## NOTES

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL RICHARDSON SACHS
ENGINEER
PE079631
1/21/2019

## SCALE

0 200 400 800 Feet

SCALE: 1" = 200'


RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US


# STARRUCCA CREEK MITIGATION BANK
## DESIGN PLANS

### EXISTING CONDITIONS

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C100 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

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ARCH FULL BLEED D (24.00 X 36.00 INCHES)

C300
C301
C302
C303
CROSS SECTION 1
BOUNDARY CROSS SECTION 1
MAIN STEM D
MAIN STEM C
MAIN STEM B
MAIN STEM
MAIN STEM
PROPOSED CHANNEL BLOCK
CROSS SECTION 2
CROSS SECTION 3
CROSS SECTION 4
DEGRADATION CROSS SECTION 2
MAIN STEM A
PROPOSED SPOIL AREA
PROPOSED SPOIL AREA
CROSS SECTION 5
DEGRADATION CROSS SECTION 2
UNT 1
MAIN STEM A
UNT 1
UNT 2
UNT 2.1
UNT 2.2
UNT 2
BOUNDARY CROSS SECTION 2
MAIN STEM
DEGRADATION CROSS SECTION 3
CROSS SECTION 6
CROSS SECTION 7
BOUNDARY CROSS SECTION 3

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | | | |
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| | | | |

## LEGEND

- PROPERTY BOUNDARY
- PROJECT BOUNDARY
- ADJACENT BOUNDARY
- COUNTY BOUNDARY
- STRUCTURE
- EDGE OF ROAD
- CULVERT
- ELECTRIC UTILITY (ELEC)
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING STREAM
- EXISTING DITCH
- EXISTING WETLAND
- EXISTING TREE LINE
- PROPOSED BASELINE (0+00 – 1+00)
- PROPOSED THALWEG
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED DITCH
- STORM

## NOTES

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 200 400 800 Feet

SCALE: 1" = 200'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452 www.RES.US EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

LAYOUT PLAN

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C200 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

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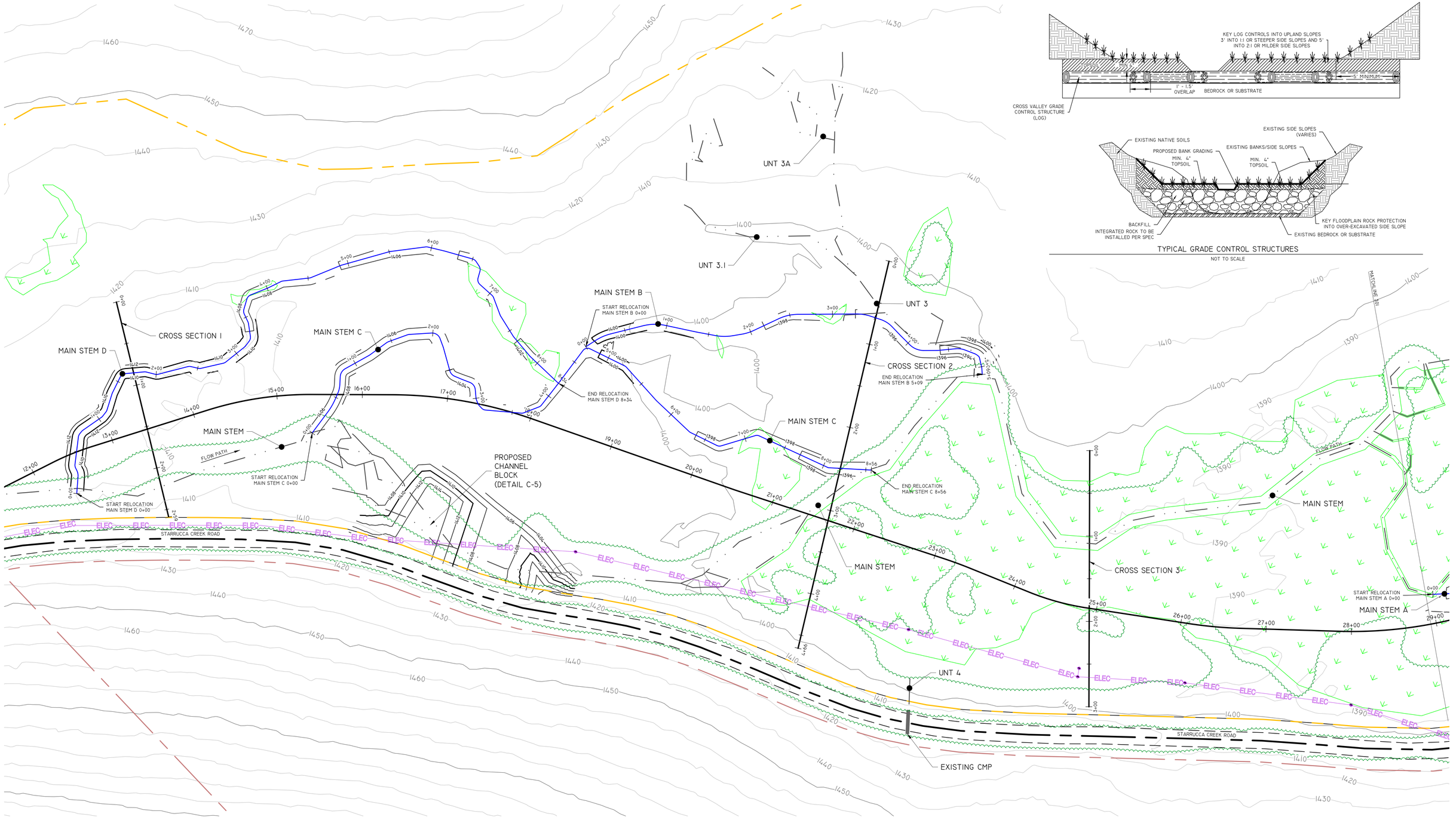





TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | | | |
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## LEGEND

| | | | |
|---|---|---|---|
| PROPERTY BOUNDARY | | EXISTING STREAM | |
| PROJECT BOUNDARY | | EXISTING DITCH | STORM |
| ADJACENT BOUNDARY | | EXISTING WETLAND | |
| COUNTY BOUNDARY | | EXISTING TREE LINE | |
| STRUCTURE | | PROPOSED BASELINE | 0+00 0+00 |
| EDGE OF ROAD | | PROPOSED THALWEG | |
| CULVERT | | PROPOSED MAJOR CONTOUR | |
| ELECTRIC UTILITY | ELEC | PROPOSED MINOR CONTOUR | |
| EXISTING MAJOR CONTOUR | | PROPOSED DITCH | STORM |
| EXISTING MINOR CONTOUR | | | |

## NOTES

1. POOLS ARE TO BE FIELD LOCATED DURING CONSTRUCTION BASED ON SITE CONDITIONS.
2. POOL HABITAT STRUCTURES NOT SHOWN ON PROFILES.
3. SURFACE WOOD TO BE FIELD LOCATED.

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 50 100 200 Feet

SCALE: 1" = 50'


RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452 WWW.RES.US EMAIL: SYEAMANS@RES.US


STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

GRADING PLANS
BASELINE 12+00 TO 29+00

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C300 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

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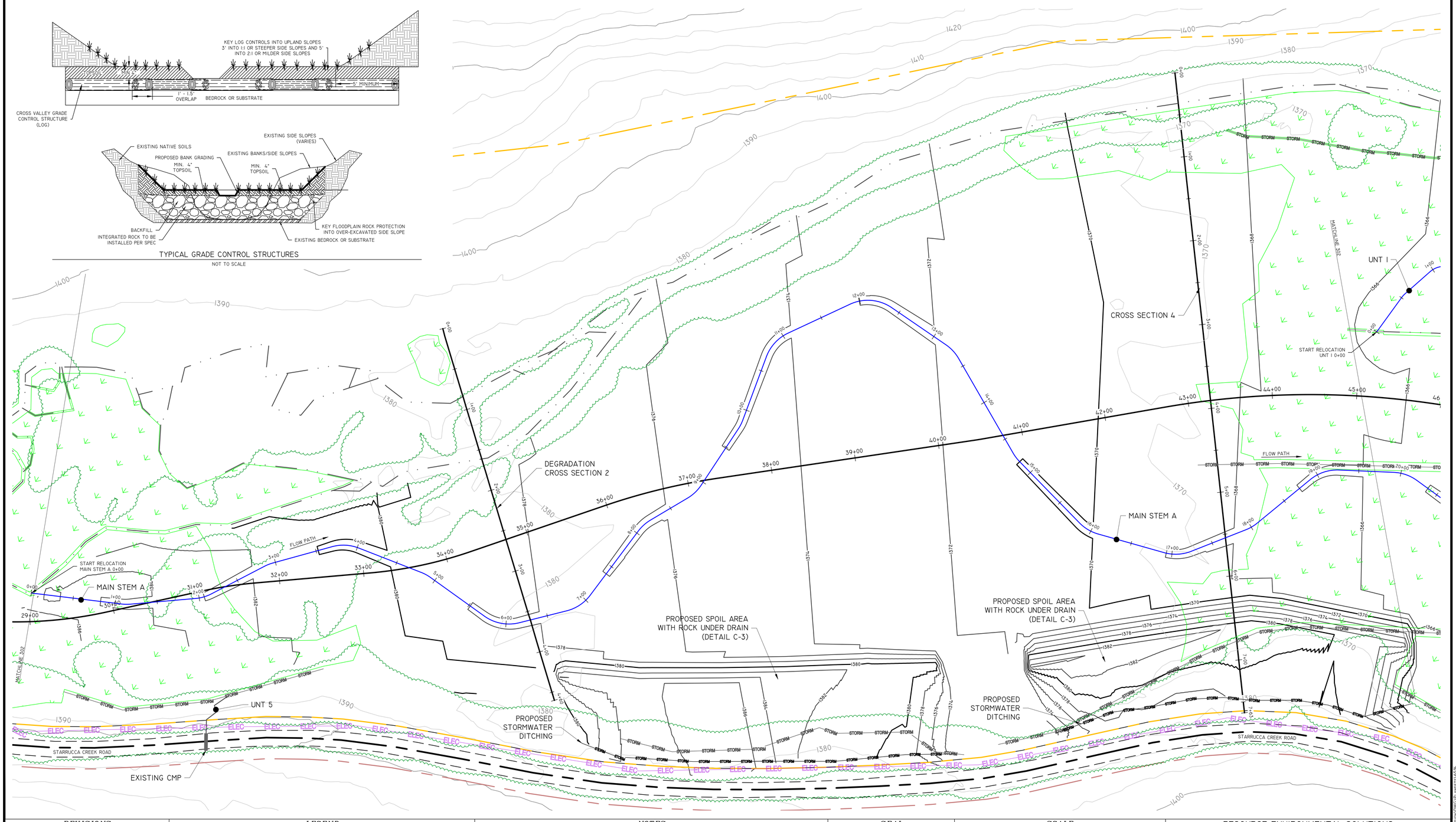
ARCH FULL BLEED D (24.00 X 36.00 INCHES)

TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE




## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
| | | | |
| | | | |
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| | | | |

## LEGEND

| | | | |
|---|---|---|---|
| PROPERTY BOUNDARY | | EXISTING STREAM | |
| PROJECT BOUNDARY | | EXISTING DITCH | STORM |
| ADJACENT BOUNDARY | | EXISTING WETLAND | |
| COUNTY BOUNDARY | | EXISTING TREE LINE | |
| STRUCTURE | | PROPOSED BASELINE | 0+00 0+00 |
| EDGE OF ROAD | | PROPOSED THALWEG | |
| CULVERT | | PROPOSED MAJOR CONTOUR | |
| ELECTRIC UTILITY | ELEC | PROPOSED MINOR CONTOUR | |
| EXISTING MAJOR CONTOUR | | PROPOSED DITCH | STORM |
| EXISTING MINOR CONTOUR | | | |

## NOTES

1. POOLS ARE TO BE FIELD LOCATED DURING CONSTRUCTION BASED ON SITE CONDITIONS.
2. POOL HABITAT STRUCTURES NOT SHOWN ON PROFILES.
3. SURFACE WOOD TO BE FIELD LOCATED.

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C.
PAROLA PROFESSIONAL
ENGINEER

## SCALE

0 50 100 200 Feet

SCALE: 1" = 50'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
www.RES.US
TELEPHONE: (412) 249-2452 EMAIL: SYEAMANS@RES.US

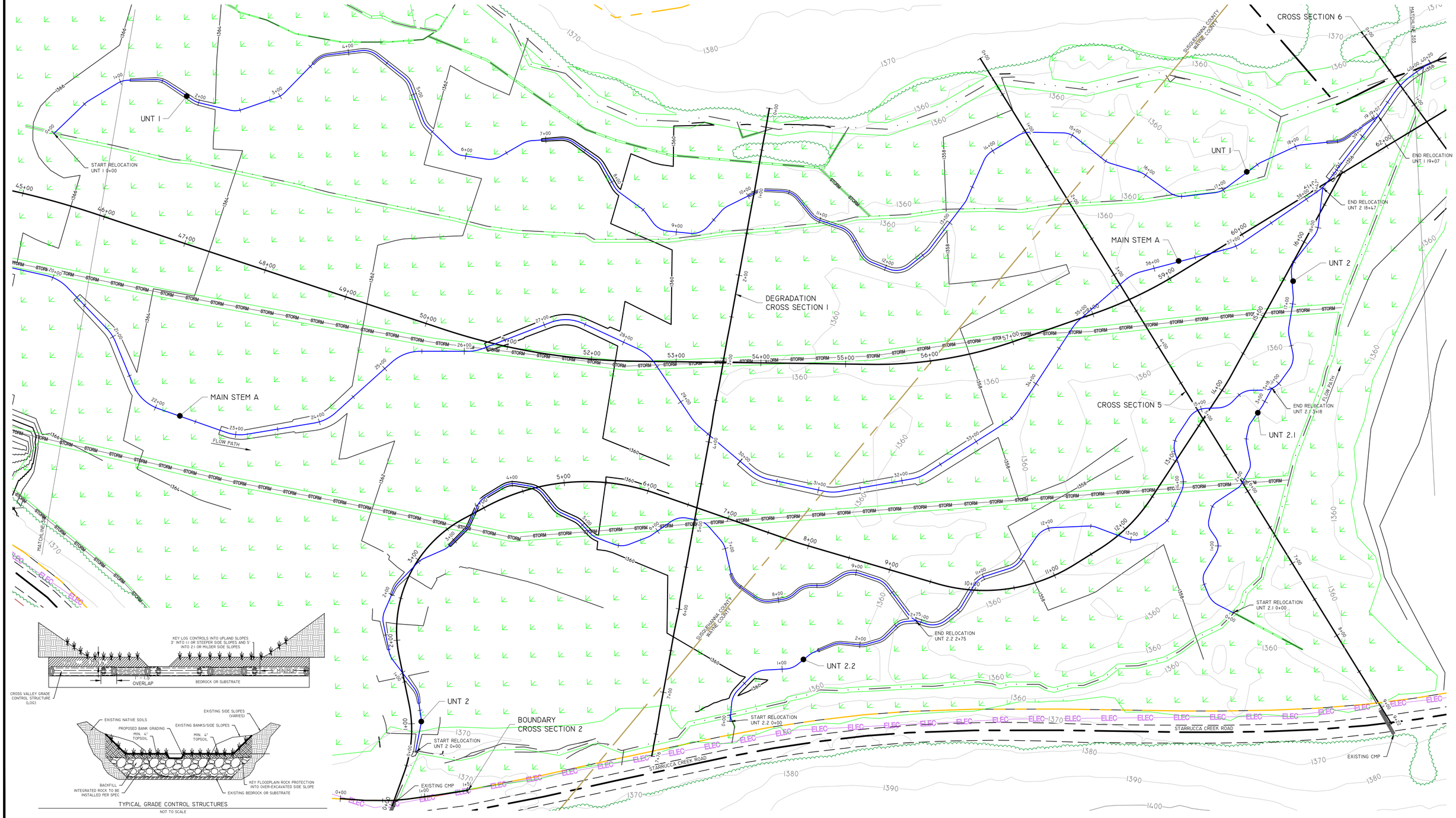
STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

GRADING PLANS
BASELINE 29+00 TO 45+00

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C301 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

S:\RES CAD\LEAD Working\027_STARRUCCA CREEK\Design\SW\PLANSET\1:50'S ARCH FULL BLEED D (24.00 X 36.00 INCHES)







TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
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## LEGEND

| | |
|---|---|
| PROPERTY BOUNDARY | EXISTING STREAM |
| PROJECT BOUNDARY | EXISTING DITCH |
| ADJACENT BOUNDARY | EXISTING WETLAND |
| COUNTY BOUNDARY | EXISTING TREE LINE |
| STRUCTURE | PROPOSED BASELINE |
| EDGE OF ROAD | PROPOSED THALWEG |
| CULVERT | PROPOSED MAJOR CONTOUR |
| ELECTRIC UTILITY | PROPOSED MINOR CONTOUR |
| EXISTING MAJOR CONTOUR | PROPOSED DITCH |
| EXISTING MINOR CONTOUR | |

## NOTES

1. POOLS ARE TO BE FIELD LOCATED DURING CONSTRUCTION BASED ON SITE CONDITIONS.
2. POOL HABITAT STRUCTURES NOT SHOWN ON PROFILES.
3. SURFACE WOOD TO BE FIELD LOCATED.

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
EXPIRES: 12/31/19
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 50 100 200 Feet

SCALE: 1" = 50'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
www.RES.US
TELEPHONE: (412) 249-2452 EMAIL: SYEAMANS@RES.US

# STARRUCCA CREEK MITIGATION BANK DESIGN PLANS

## GRADING PLANS BASELINE 45+00 TO 62+00

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C302 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

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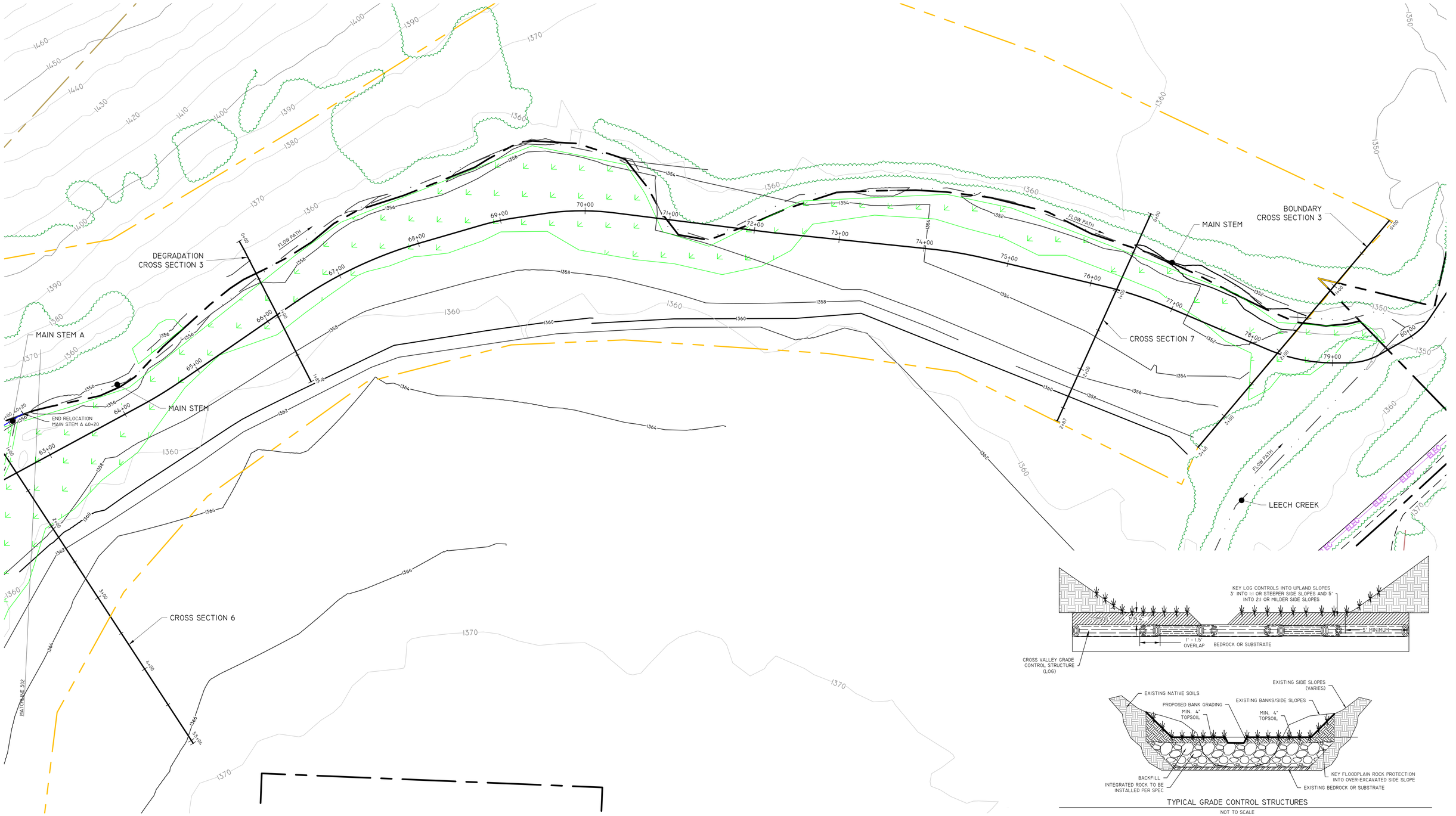
ARCH FULL BLEED D (24.00 X 36.00 INCHES)




TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
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## LEGEND

- PROPERTY BOUNDARY
- PROJECT BOUNDARY
- ADJACENT BOUNDARY
- COUNTY BOUNDARY
- STRUCTURE
- EDGE OF ROAD
- CULVERT
- ELECTRIC UTILITY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING STREAM
- EXISTING DITCH
- EXISTING WETLAND
- EXISTING TREE LINE
- PROPOSED BASELINE
- PROPOSED THALWEG
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED DITCH

## NOTES

1. POOLS ARE TO BE FIELD LOCATED DURING CONSTRUCTION BASED ON SITE CONDITIONS.
2. POOL HABITAT STRUCTURES NOT SHOWN ON PROFILES.
3. SURFACE WOOD TO BE FIELD LOCATED.

## SEAL

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL — ARTHUR C. PAROLA — ENGINEER — No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 50 100 200 Feet

SCALE: 1" = 50'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452 WWW.RES.US EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

GRADING PLANS
BASELINE 62+00 TO 80+00

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C303 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

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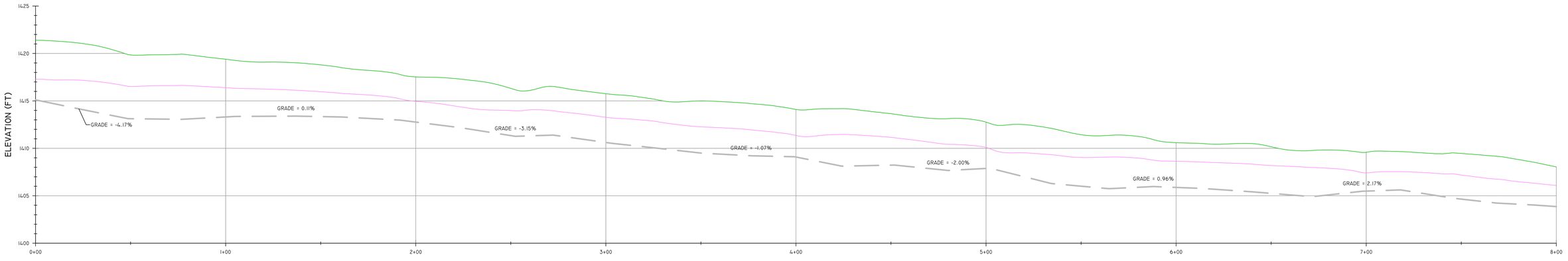
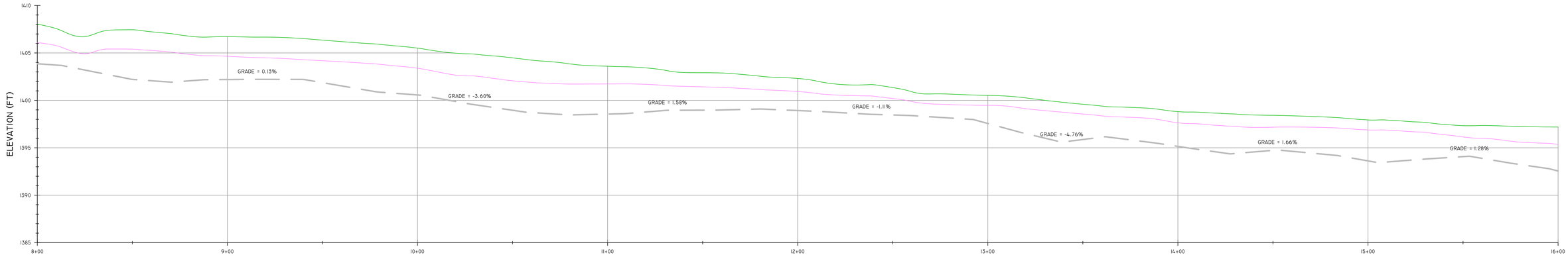
ARCH FULL BLEED D (24.00 X 36.00 INCHES)



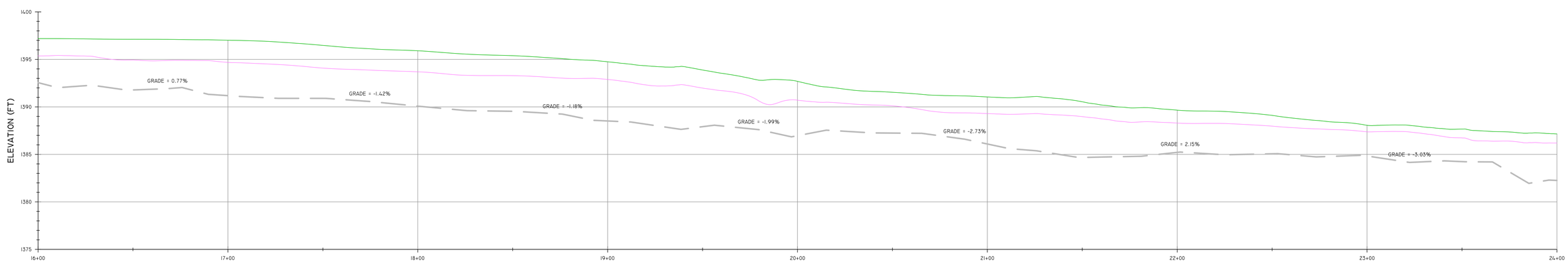

STATION

EXISTING MAIN STEM THALWEG - 0+00 TO 8+00




STATION

EXISTING MAIN STEM THALWEG - 8+00 TO 16+00




STATION

EXISTING MAIN STEM THALWEG - 16+00 TO 24+00

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
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## LEGEND

EXISTING THALWEG PROFILE

EXISTING 2 YR WSE PROFILE

EXISTING 100 YR WSE PROFILE

## NOTES

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'


RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452
WWW.RES.US
EMAIL: SYEAMANS@RES.US


STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

EXISTING THALWEG PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C600 | FILE NO: 0217-014-060 |
| DATE: | JANUARY 21, 2019 | | |

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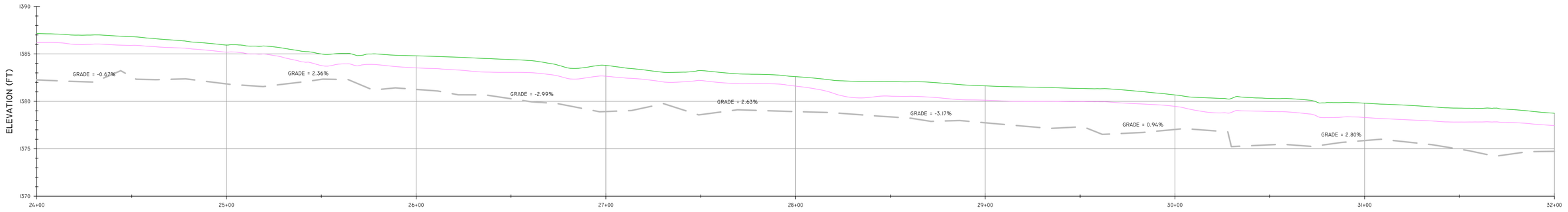
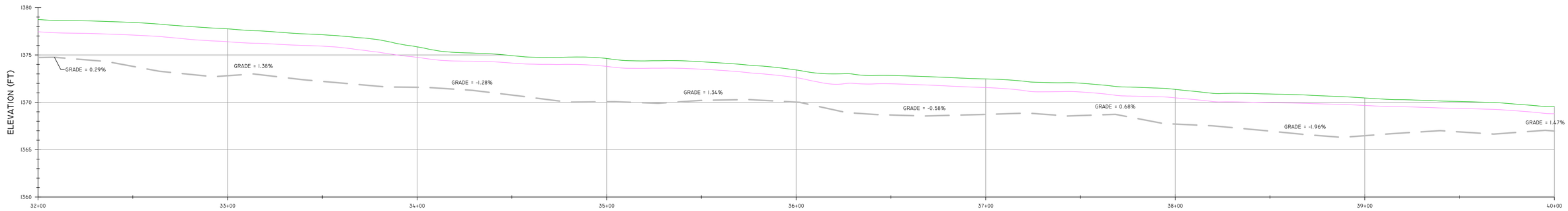
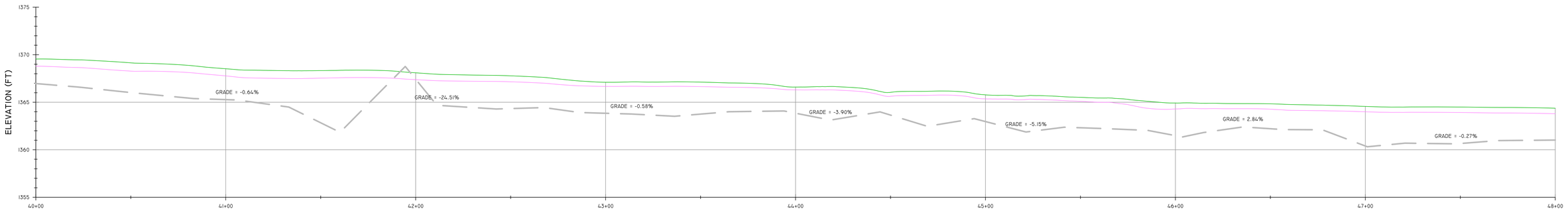



EXISTING MAIN STEM THALWEG - 24+00 TO 32+00




EXISTING MAIN STEM THALWEG - 32+00 TO 40+00




EXISTING MAIN STEM THALWEG - 40+00 TO 48+00

## REVISIONS

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## LEGEND

EXISTING THALWEG PROFILE

EXISTING 2 YR WSE PROFILE

EXISTING 100 YR WSE PROFILE

## NOTES

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

EXISTING THALWEG PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C601 | FILE NO: 0217-014-040 |
| DATE: | JANUARY 21, 2019 | | |

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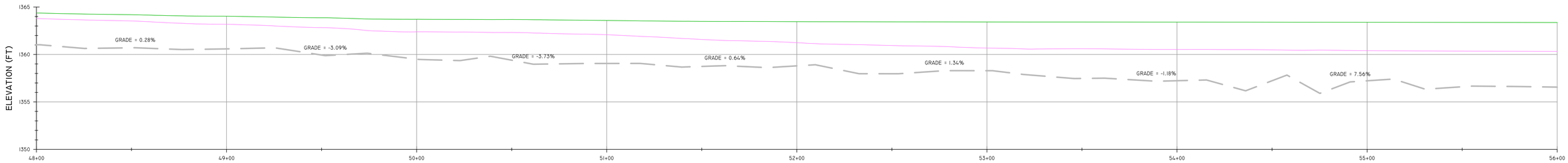
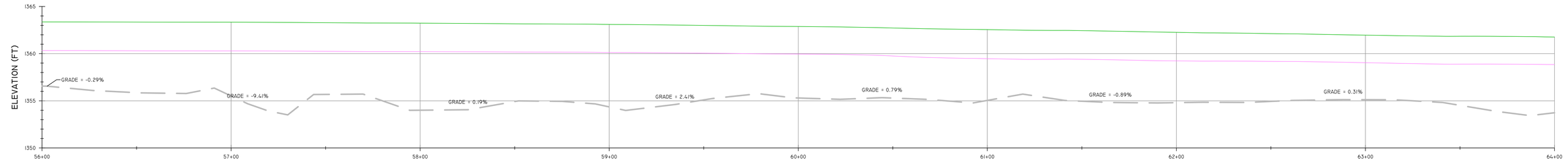
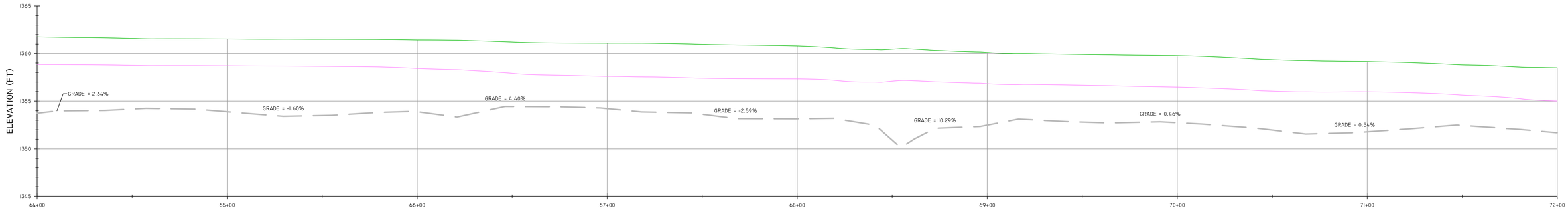
ARCH FULL BLEED D (24.00 X 36.00 INCHES)



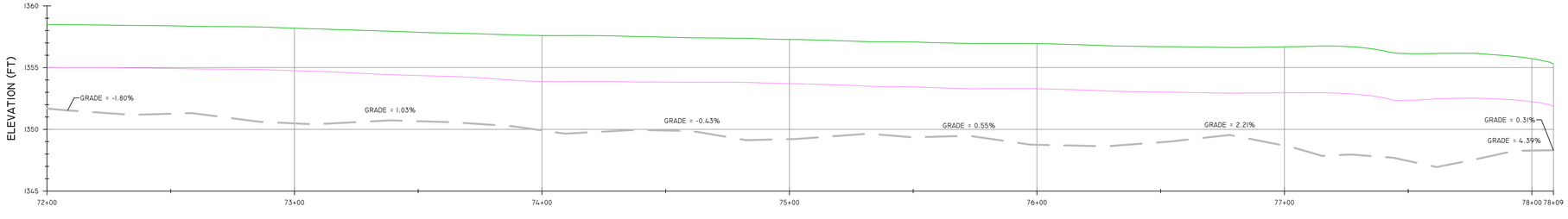

EXISTING MAIN STEM PROFILE - 48+00 TO 56+00




EXISTING MAIN STEM PROFILE - 56+00 TO 64+00




EXISTING MAIN STEM PROFILE - 64+00 TO 72+00




EXISTING MAIN STEM PROFILE - 72+00 TO 78+09

## REVISIONS

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## LEGEND

EXISTING THALWEG PROFILE

EXISTING 2 YR WSE PROFILE

EXISTING 100 YR WSE PROFILE

## NOTES

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

EXISTING THALWEG PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C602 | FILE NO: 0217-014-040 |
| DATE: | JANUARY 21, 2019 | | |

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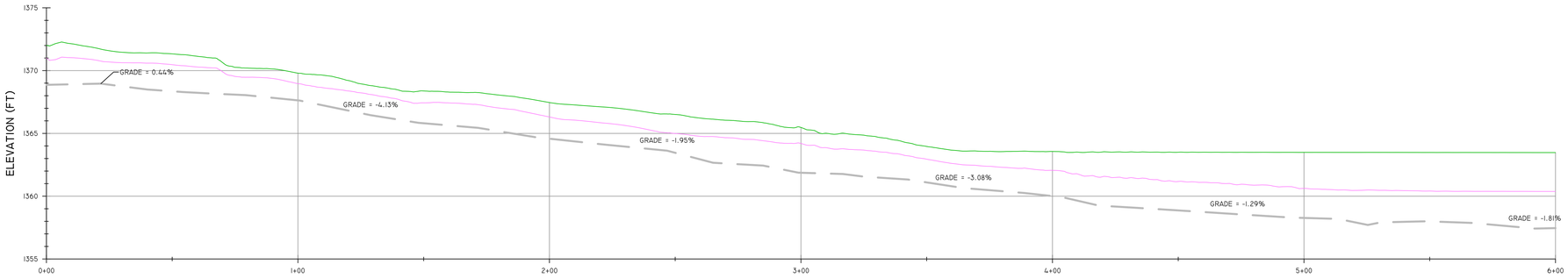
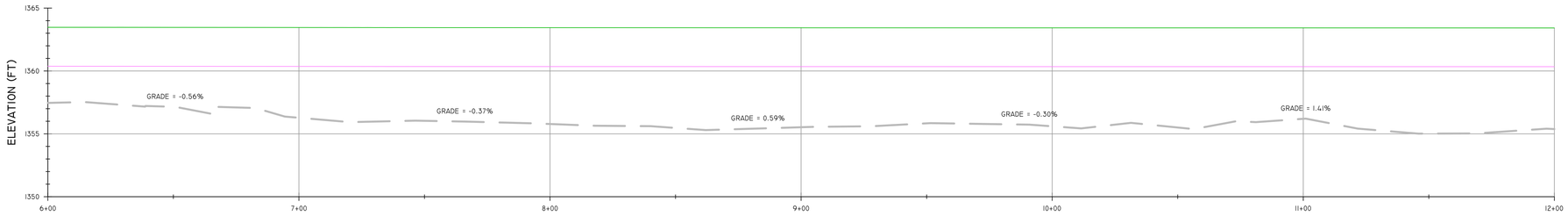


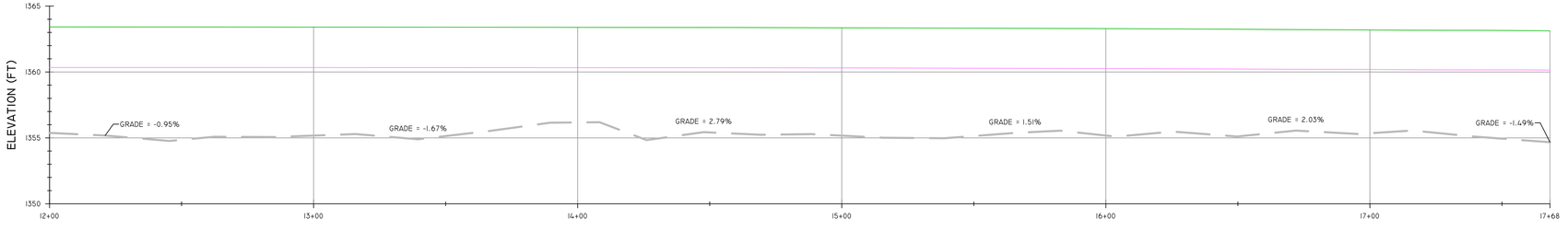

STATION

EXISTING TRIBUTARY I THALWEG - 0+00 TO 6+00




STATION

EXISTING TRIBUTARY I THALWEG - 6+00 TO 12+00




STATION

EXISTING TRIBUTARY I THALWEG - 12+00 - 17+68

*REVISIONS*

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*LEGEND*

EXISTING THALWEG PROFILE

EXISTING 2 YR WSE PROFILE

EXISTING 100 YR WSE PROFILE

*NOTES*

*SEAL*

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

*SCALE*

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US

# STARRUCCA CREEK MITIGATION BANK DESIGN PLANS

## EXISTING THALWEG PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C603 | FILE NO: 0217-014-040 |
| DATE: | JANUARY 21, 2019 | | |

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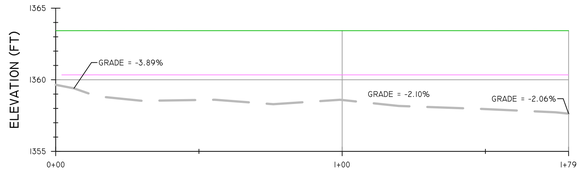
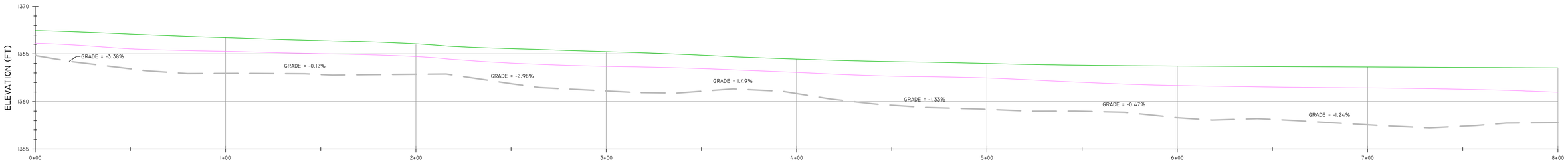


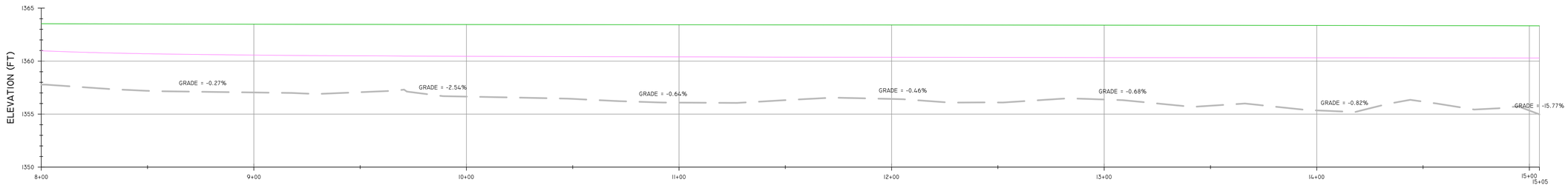

STATION

EXISTING TRIBUTARY 1.1 PROFILE




STATION

EXISTING TRIBUTARY 2 THALWEG - 0+00 TO 8+00




STATION

EXISTING TRIBUTARY 2 THALWEG - 8+00 TO 15+05

*REVISIONS*

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*LEGEND*

EXISTING THALWEG PROFILE

EXISTING 2 YR WSE PROFILE

EXISTING 100 YR WSE PROFILE

*NOTES*

*SEAL*

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C.
PAROLA PROFESSIONAL
ENGINEER

*SCALE*

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS

33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219

TELEPHONE: (412) 249-2452 WWW.RES.US EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

EXISTING THALWEG PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C604 | FILE NO: 0217-014-040 |
| DATE: | JANUARY 21, 2019 | | |

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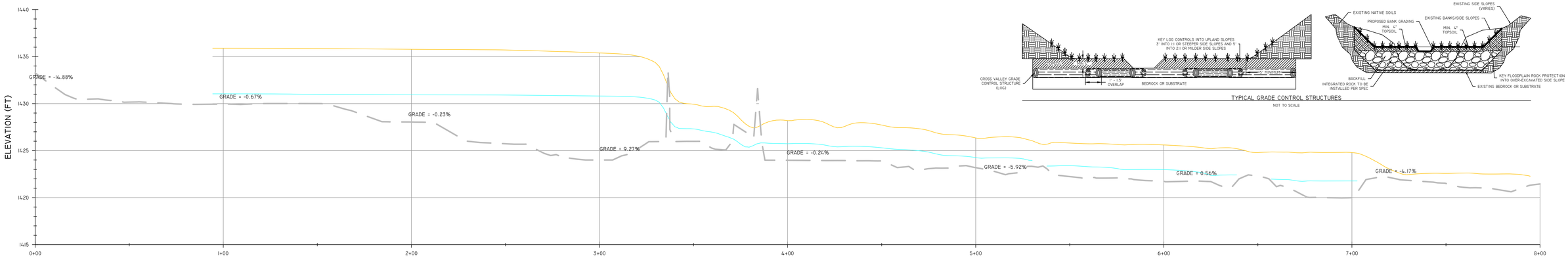


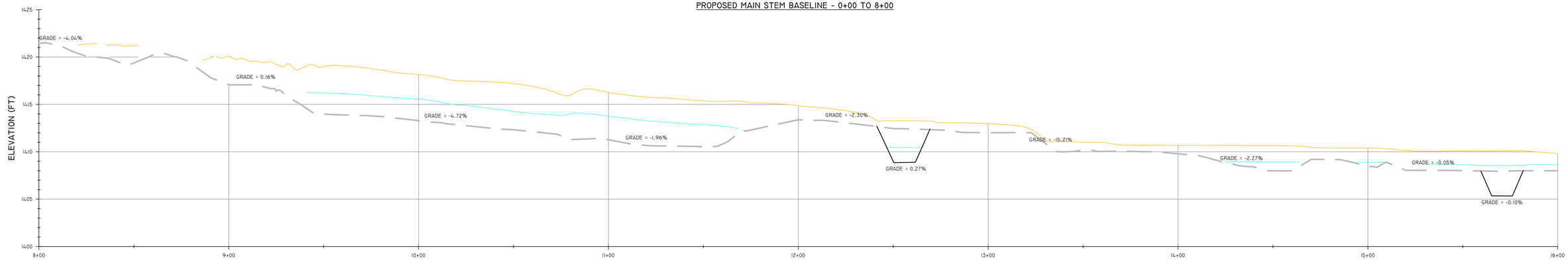

STATION

PROPOSED MAIN STEM BASELINE - 0+00 TO 8+00



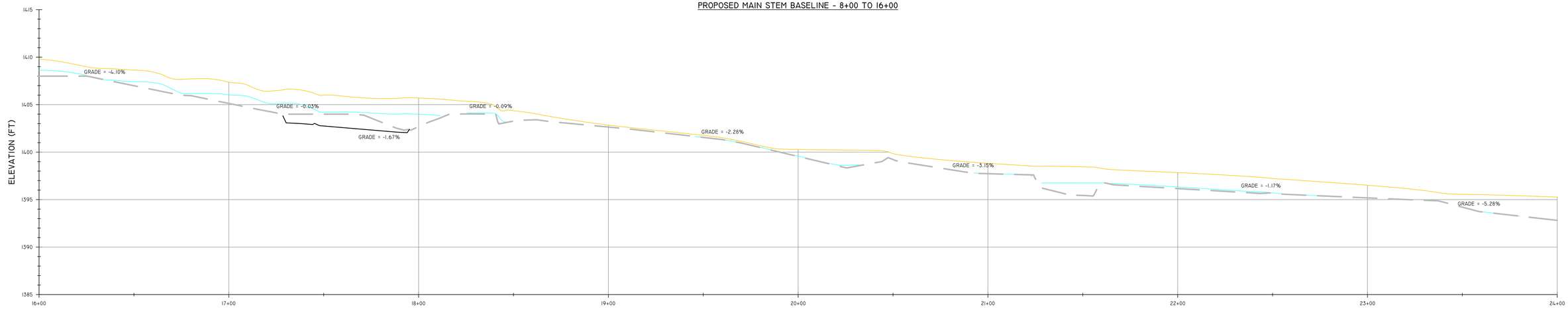

TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE




STATION

PROPOSED MAIN STEM BASELINE - 8+00 TO 16+00




STATION

PROPOSED MAIN STEM BASELINE - 16+00 TO 24+00

## REVISIONS

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## LEGEND

- EXISTING GROUND PROFILE
- PROPOSED 2 YR WSE PROFILE
- PROPOSED 100 YR WSE PROFILE
- PROPOSED BASELINE GROUND PROFILE

## NOTES

1. POOLS ARE TO BE FIELD LOCATED DURING CONSTRUCTION BASED ON SITE CONDITIONS.
2. POOL HABITAT STRUCTURES NOT SHOWN ON PROFILES.
3. SURFACE WOOD TO BE FIELD LOCATED.

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452
www.RES.US
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PROPOSED BASELINE PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C605 | FILE NO: 0217-014-060 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

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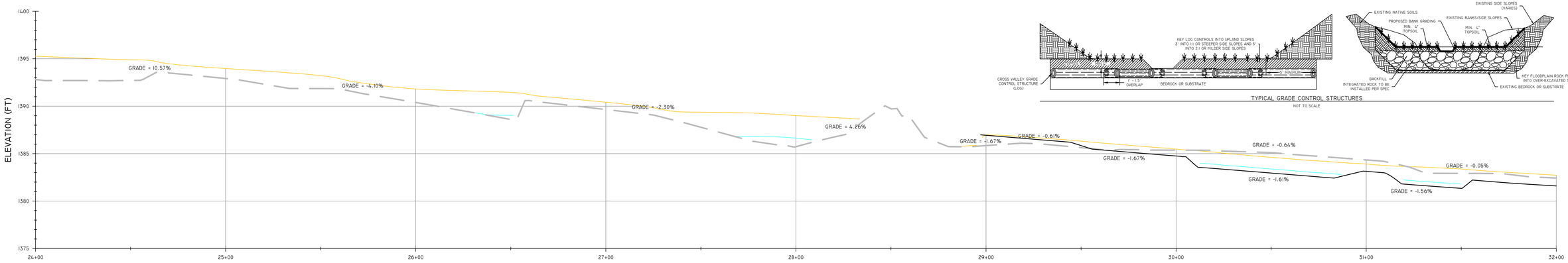
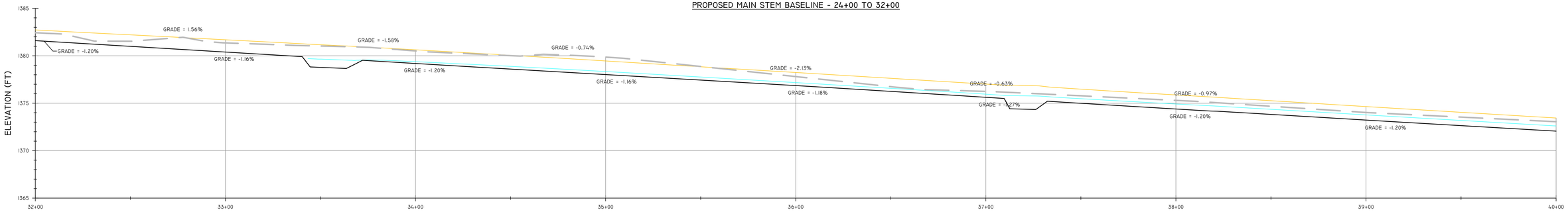
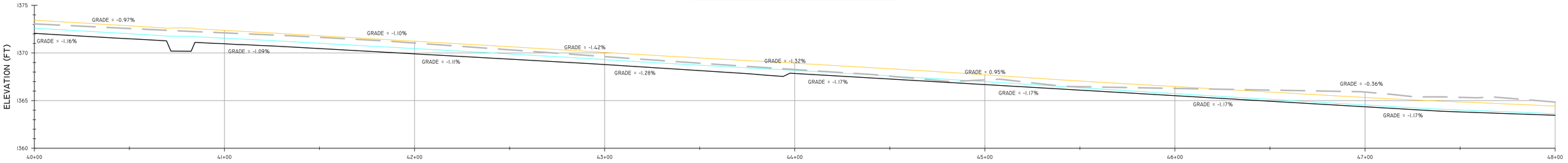
ARCH FULL BLEED D (24.00 X 36.00 INCHES)



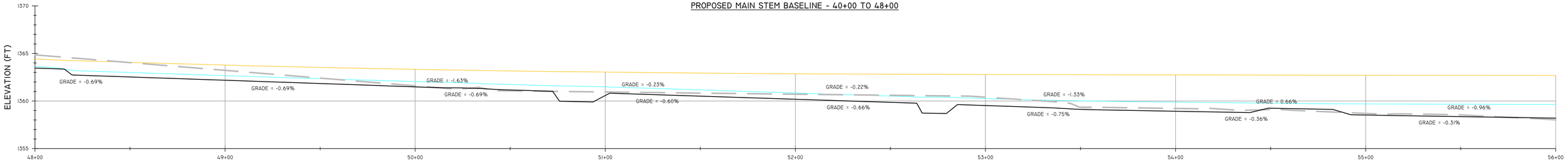

PROPOSED MAIN STEM BASELINE - 24+00 TO 32+00



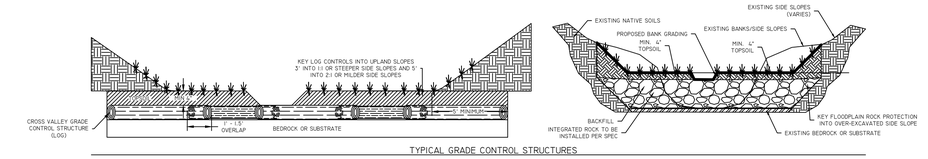

PROPOSED MAIN STEM BASELINE - 32+00 TO 40+00




PROPOSED MAIN STEM BASELINE - 40+00 TO 48+00




PROPOSED MAIN STEM BASELINE - 48+00 TO 56+00




TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
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## LEGEND

- EXISTING GROUND PROFILE
- PROPOSED 2 YR WSE PROFILE
- PROPOSED 100 YR WSE PROFILE
- PROPOSED BASELINE GROUND PROFILE

## NOTES

1. POOLS ARE TO BE FIELD LOCATED DURING CONSTRUCTION BASED ON SITE CONDITIONS.
2. POOL HABITAT STRUCTURES NOT SHOWN ON PROFILES.
3. SURFACE WOOD TO BE FIELD LOCATED.

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452
WWW.RES.US
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PROPOSED BASELINE PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C606 | FILE NO: 0217-014-040 |
| DATE: | JANUARY 21, 2019 | | |

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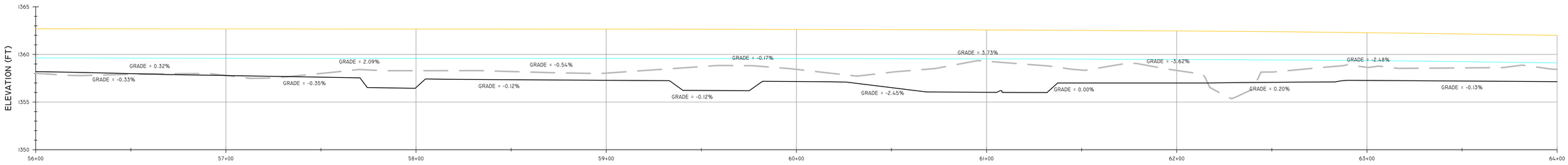
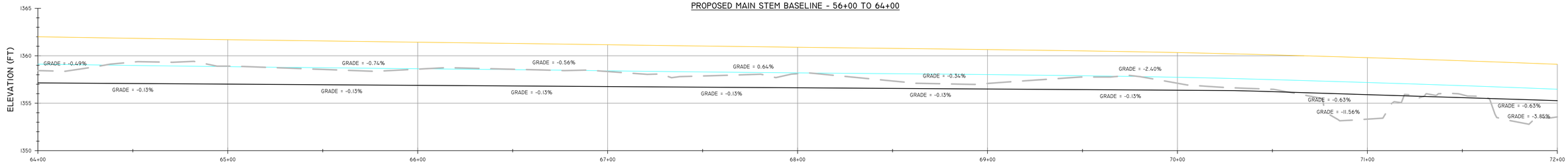
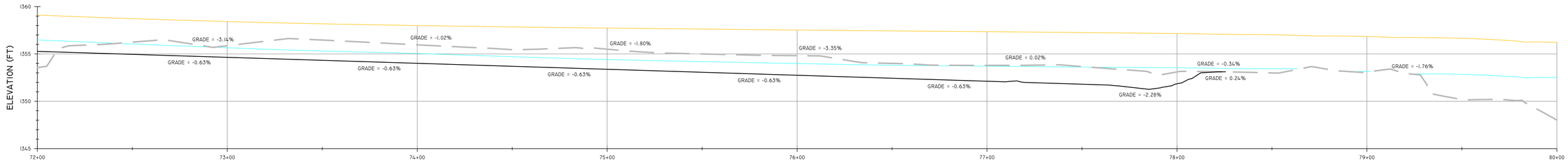
ARCH FULL BLEED D (24.00 X 36.00 INCHES)



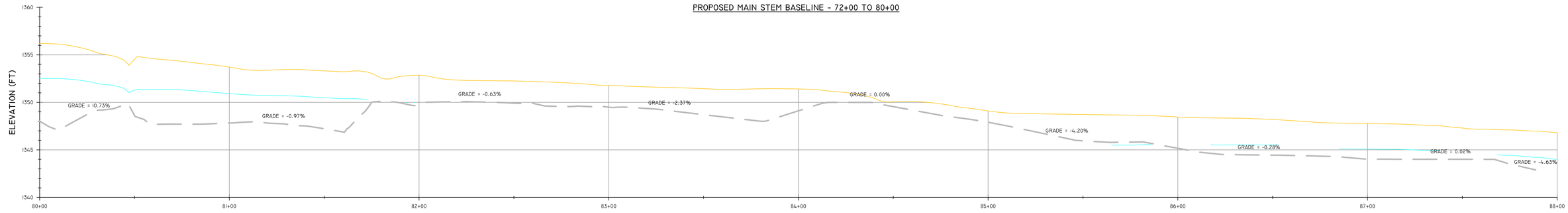

PROPOSED MAIN STEM BASELINE - 56+00 TO 64+00



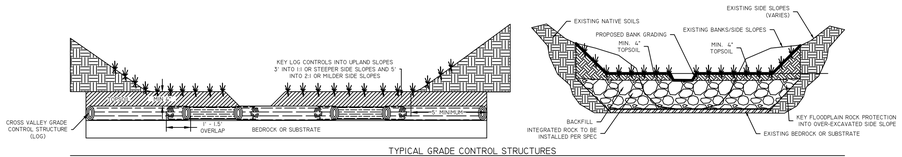

PROPOSED MAIN STEM BASELINE - 64+00 TO 72+00




PROPOSED MAIN STEM BASELINE - 72+00 TO 80+00




PROPOSED MAIN STEM BASELINE - 80+00 TO 88+00




TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
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## LEGEND

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- PROPOSED 100 YR WSE PROFILE
- PROPOSED BASELINE GROUND PROFILE

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## SEAL


PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PROPOSED BASELINE PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C607 | FILE NO: 0217-014-040 |
| DATE: | JANUARY 21, 2019 | | |

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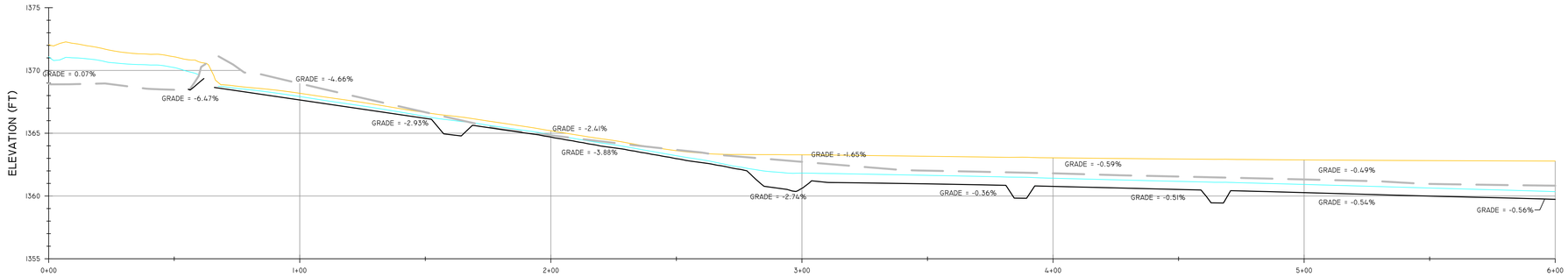
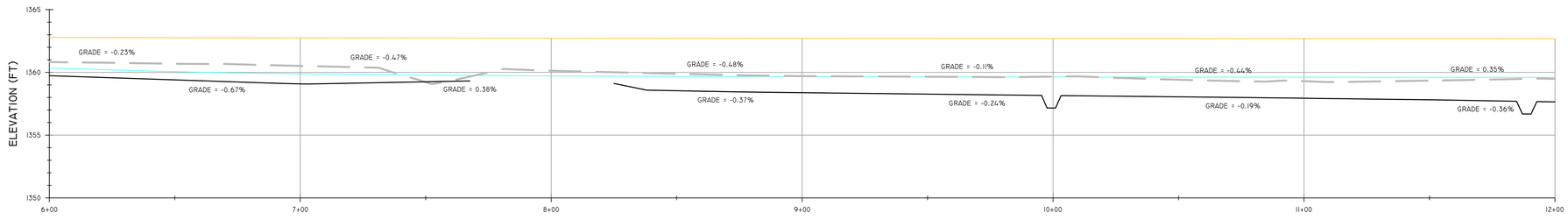
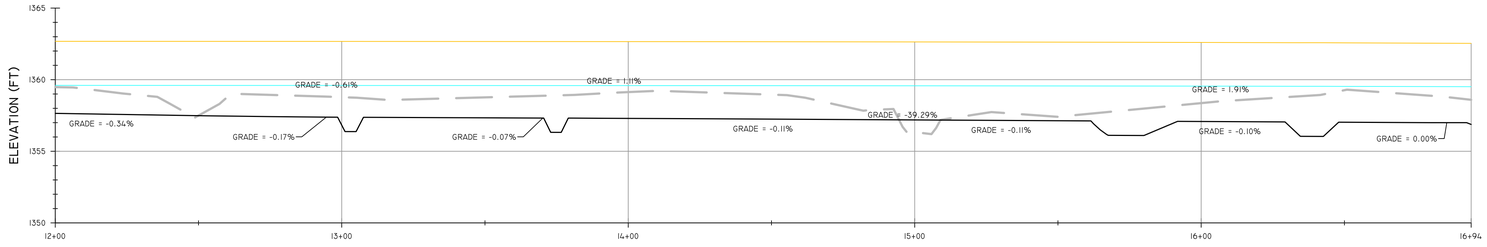
ARCH FULL BLEED D (24.00" X 36.00 INCHES)



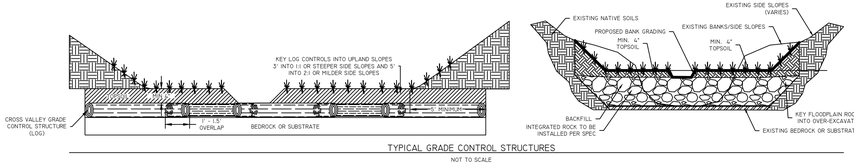

PROPOSED TRIBUTARY BASELINE - 0+00 TO 6+00




PROPOSED TRIBUTARY BASELINE - 6+00 TO 12+00




PROPOSED TRIBUTARY BASELINE - 12+00 TO 16+94




TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE

## REVISIONS

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## LEGEND

EXISTING GROUND PROFILE

PROPOSED 2 YR WSE PROFILE

PROPOSED 100 YR WSE PROFILE

PROPOSED BASELINE GROUND PROFILE

## NOTES

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COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452 WWW.RES.US EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PROPOSED BASELINE PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C608 | FILE NO: 0217-014-060 |
| DATE: | JANUARY 21, 2019 | | |

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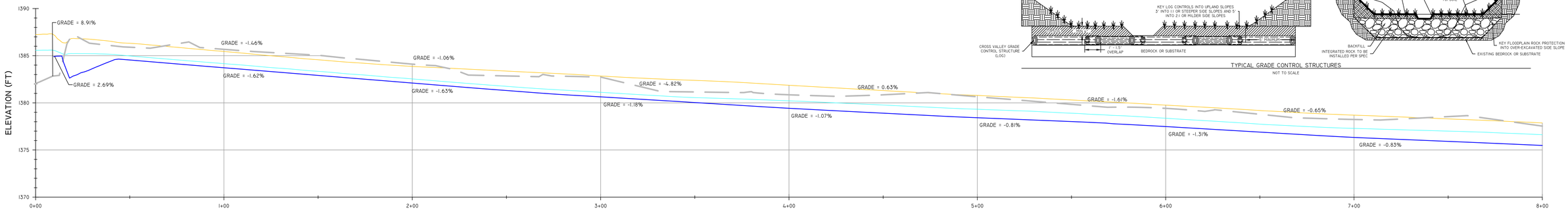
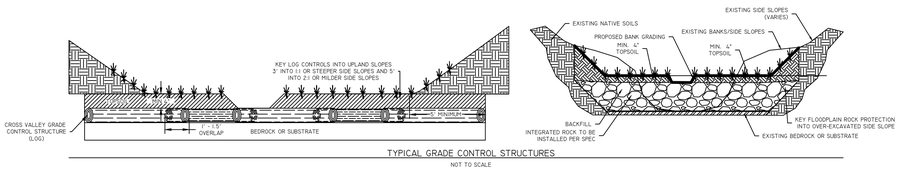
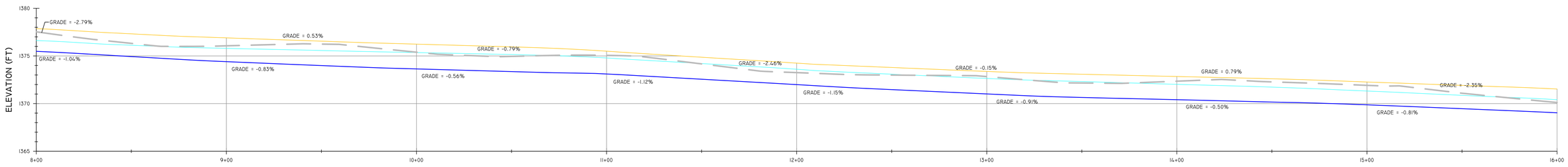



PROPOSED MAIN STEM A THALWEG - 0+00 TO 8+00

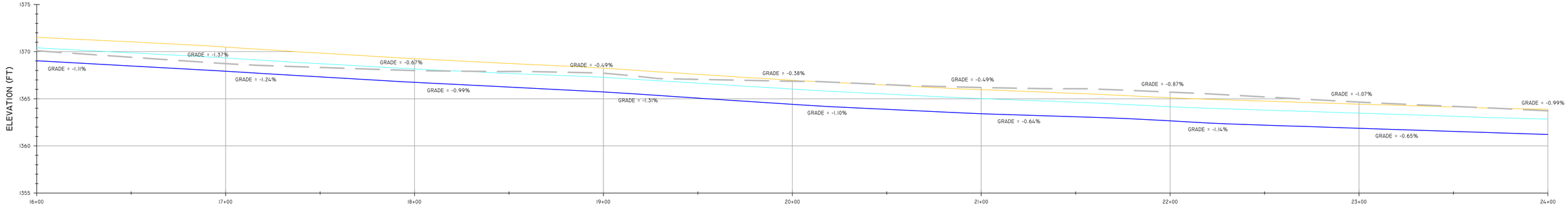



TYPICAL GRADE CONTROL STRUCTURES

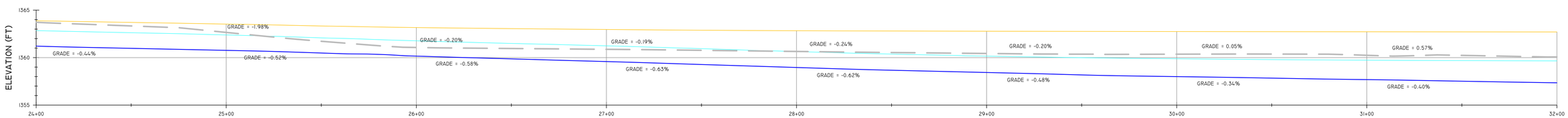
NOT TO SCALE




PROPOSED MAIN STEM A THALWEG - 8+00 TO 16+00




PROPOSED MAIN STEM A THALWEG - 16+00 TO 24+00




PROPOSED MAIN STEM A THALWEG - 24+00 TO 32+00

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
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## LEGEND

- EXISTING GROUND PROFILE
- PROPOSED 2 YR WSE PROFILE
- PROPOSED 100 YR WSE PROFILE
- PROPOSED RELOCATION THALWEG PROFILE

## NOTES

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## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PROPOSED THALWEG PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C609 | FILE NO: 0217-011-010 |
| DATE: | JANUARY 21, 2019 | | |

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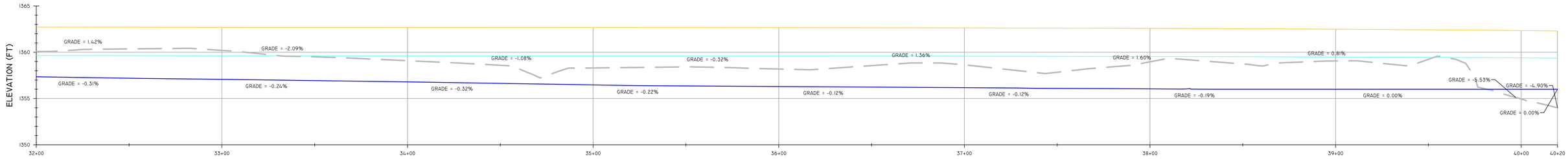
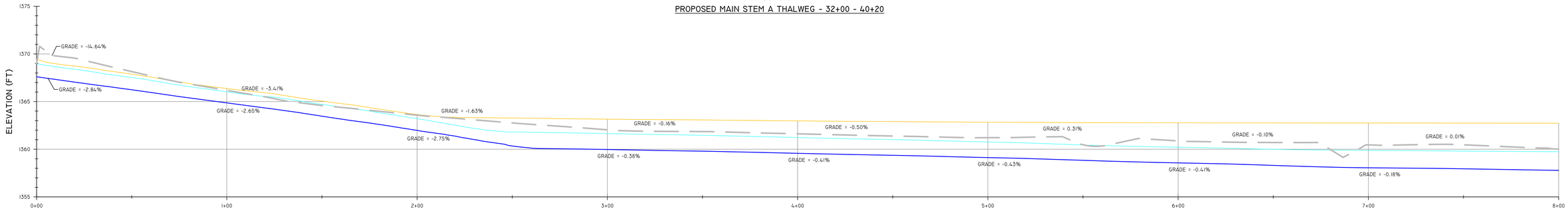
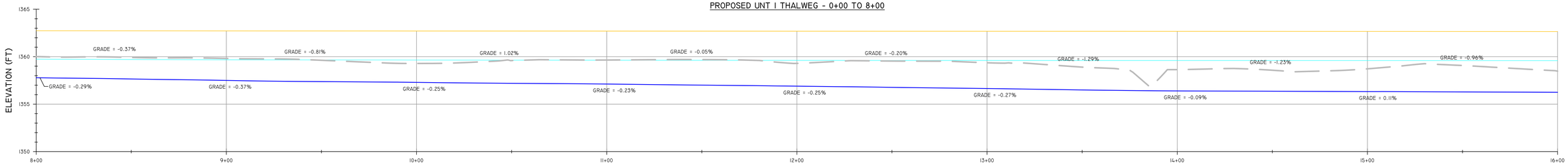


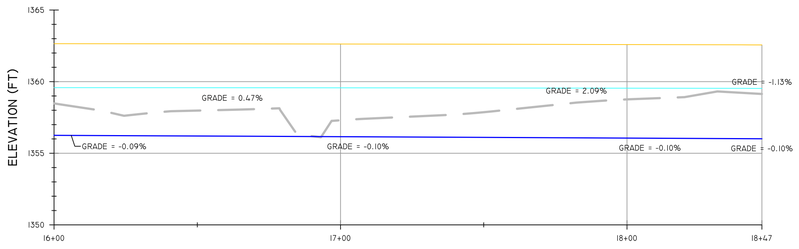

PROPOSED MAIN STEM A THALWEG - 32+00 - 40+20



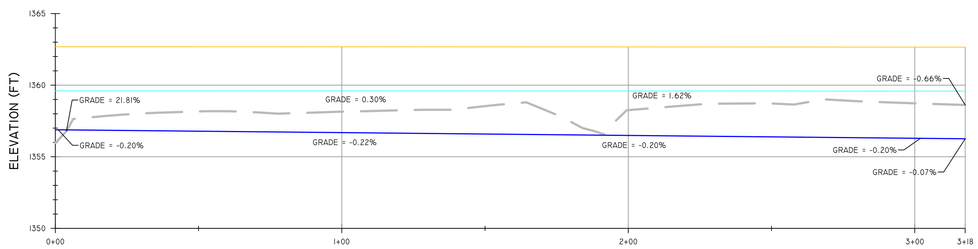

PROPOSED UNT I THALWEG - 0+00 TO 8+00



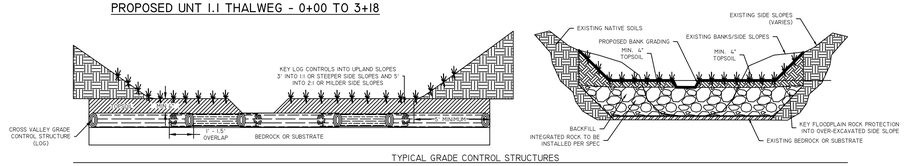

PROPOSED UNT I THALWEG - 8+00 TO 16+00




PROPOSED UNT I THALWEG - 16+00 TO 18+47




PROPOSED UNT 1.1 THALWEG - 0+00 TO 3+18




TYPICAL GRADE CONTROL STRUCTURES

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
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## LEGEND

EXISTING GROUND PROFILE

PROPOSED 2 YR WSE PROFILE

PROPOSED 100 YR WSE PROFILE

PROPOSED RELOCATION THALWEG PROFILE

## NOTES

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2. POOL HABITAT STRUCTURES NOT SHOWN ON PROFILES.
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## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PROPOSED THALWEG PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C610 | FILE NO: 0217-014-060 |
| DATE: | JANUARY 21, 2019 | | |

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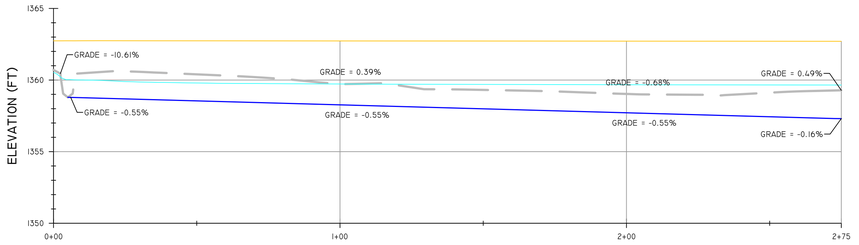
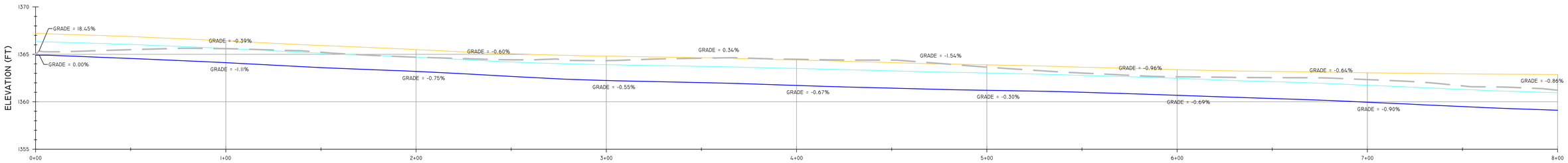


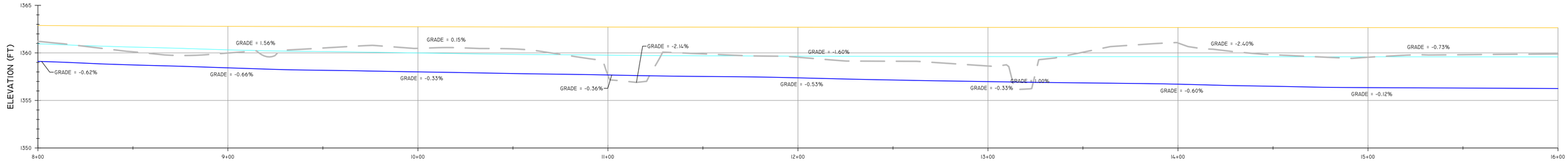

STATION

PROPOSED UNT 1.2 THALWEG - 0+00 TO 2+75



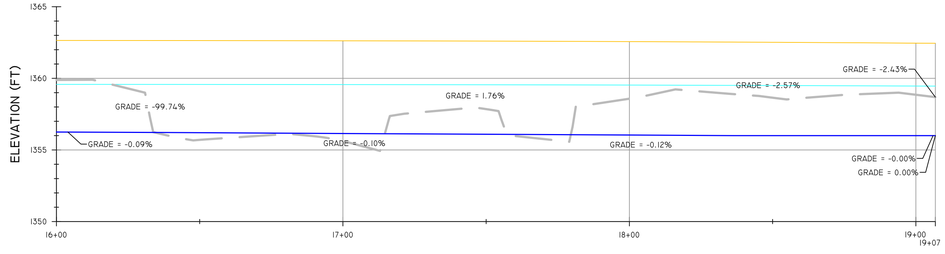

STATION

PROPOSED UNT 2 THALWEG - 0+00 TO 8+00



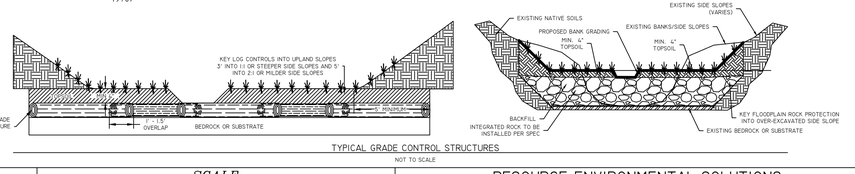

STATION

PROPOSED UNT 2 THALWEG - 8+00 TO 16+00




STATION

PROPOSED UNT 2 THALWEG - 16+00 TO 19+07




TYPICAL GRADE CONTROL STRUCTURES

NOT TO SCALE

## REVISIONS

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## LEGEND

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STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PROPOSED THALWEG PROFILES

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C611 | FILE NO: 0217-014-040 |
| DATE: | JANUARY 21, 2019 | | |

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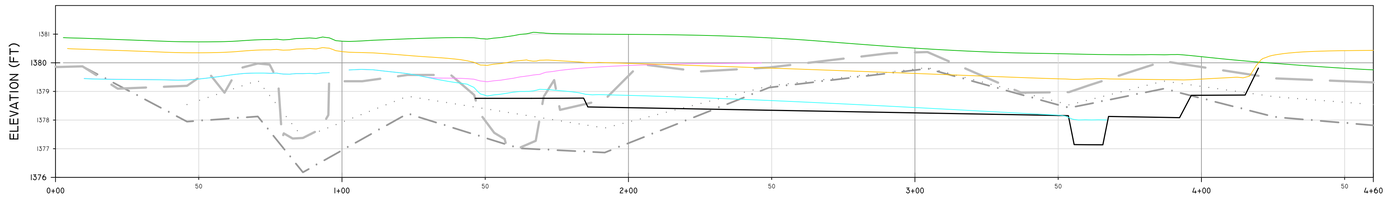
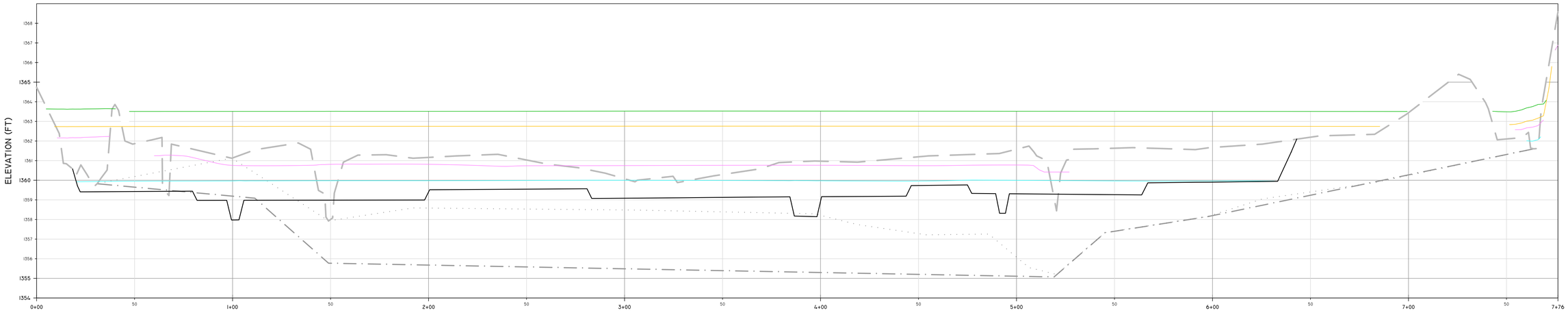



STATION

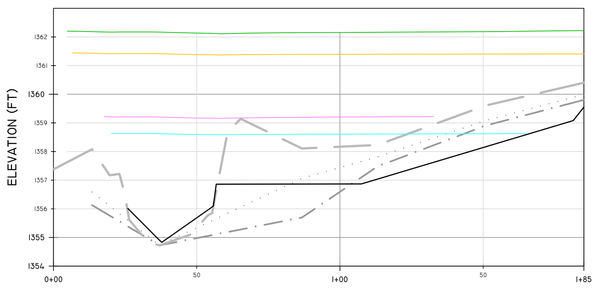
DEGRADATION CROSS SECTION 1




STATION

DEGRADATION CROSS SECTION 2

| 100 YEAR WATER SURFACE ELEVATION SUMMARY | | | | |
|---|---|---|---|---|
| CROSS SECTION | STATIONING | EXISTING 100YR WSE | PROPOSED 100YR WSE | DIFFERENCE |
| DEGRADATION CROSS SECTION 1 | 0+86 | 1380.85 | 1380.49 | -0.36 |
| DEGRADATION CROSS SECTION 2 | 0+29 | 1363.64 | 1362.74 | -0.90 |
| DEGRADATION CROSS SECTION 3 | 0+38 | 1362.16 | 1361.41 | -0.75 |
| CROSS SECTION 1 | 2+29 | 1412.39 | 1412.13 | -0.26 |
| CROSS SECTION 2 | 2+79 | 1398.52 | 1398.38 | -0.14 |
| CROSS SECTION 3 | 1+15 | 1394.32 | 1394.2 | -0.12 |
| CROSS SECTION 4 | 0+45 | 1370.19 | 1369.7 | -0.49 |
| CROSS SECTION 5 | 0+31 | 1363.42 | 1362.67 | -0.75 |
| CROSS SECTION 6 | 0+59 | 1363.15 | 1362.39 | -0.76 |
| CROSS SECTION 7 | 0+41 | 1357.6 | 1357.44 | -0.16 |
| BOUNDARY CROSS SECTION 1 | 0+82 | 1421.31 | 1421.31 | 0 |
| BOUNDARY CROSS SECTION 2 | 0+63 | 1372.23 | 1372.23 | 0 |
| BOUNDARY CROSS SECTION 3 | 1+56 | 1356.82 | 1356.86 | 0.04 |




STATION

DEGRADATION CROSS SECTION 3

*REVISIONS*

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
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*LEGEND*

- EXISTING GROUND PROFILE
- EXISTING GRAVEL PROFILE
- EXISTING COBBLE PROFILE
- EXISTING 2 YR WSE PROFILE
- EXISTING 100YR WSE PROFILE
- PROPOSED GROUND PROFILE
- PROPOSED 2 YR WSE PROFILE
- PROPOSED 100YR WSE PROFILE

*NOTES*

*SEAL*

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

*SCALE*

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US

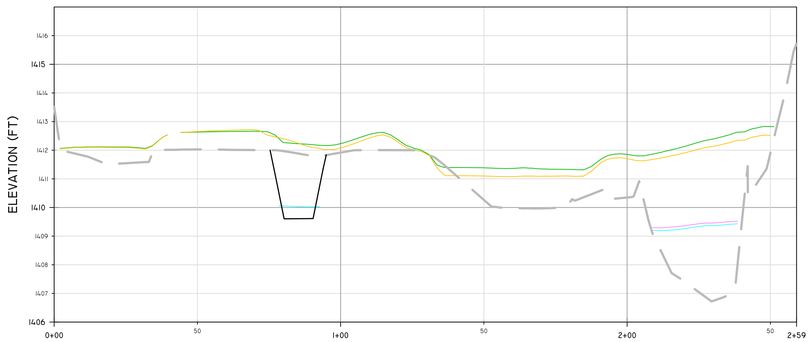
STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

DEGRADATION CROSS SECTIONS

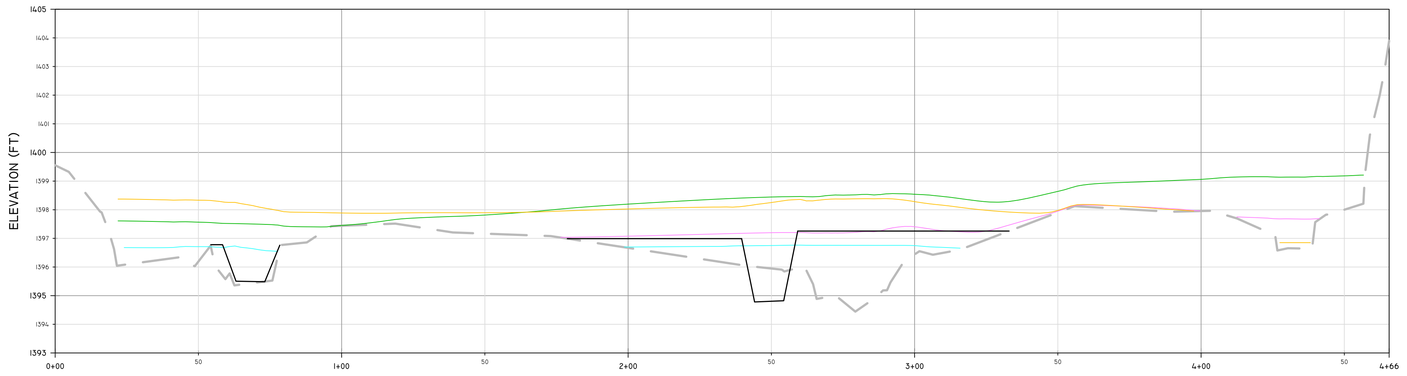
| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C612 | FILE NO: 0214-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

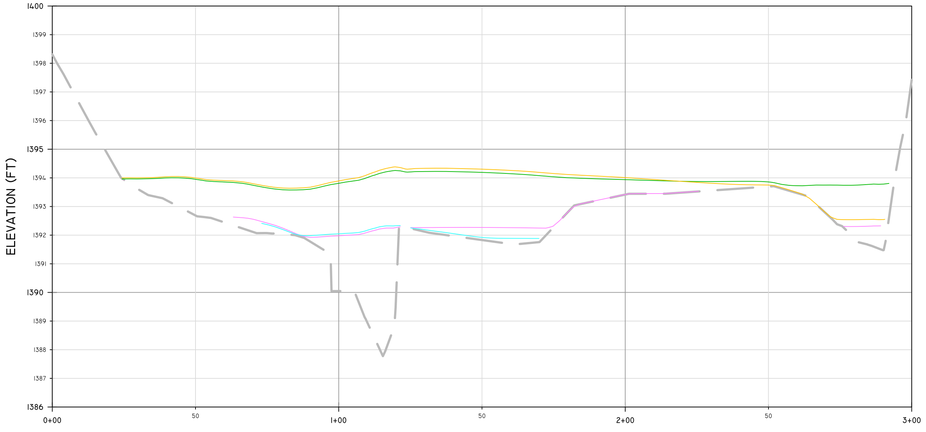
S:\RES CAD\CAD Working\027_STARRUCCA CREEK\Design\DWG\FP-ANSI D(15.5"X 36.00 INCHES) ARCH FULL BLEED D (24.00 X 36.00 INCHES)




STATION
CROSS SECTION 1




STATION
CROSS SECTION 2




STATION
CROSS SECTION 3

| 100 YEAR WATER SURFACE ELEVATION SUMMARY | | | | |
|---|---|---|---|---|
| CROSS SECTION | STATIONING | EXISTING 100YR WSE | PROPOSED 100YR WSE | DIFFERENCE |
| DEGRADATION CROSS SECTION 1 | 0+86 | 1380.85 | 1380.49 | -0.36 |
| DEGRADATION CROSS SECTION 2 | 0+29 | 1363.64 | 1362.74 | -0.90 |
| DEGRADATION CROSS SECTION 3 | 0+38 | 1362.16 | 1361.41 | -0.75 |
| CROSS SECTION 1 | 2+29 | 1412.39 | 1412.13 | -0.26 |
| CROSS SECTION 2 | 2+79 | 1398.52 | 1398.38 | -0.14 |
| CROSS SECTION 3 | 1+15 | 1394.32 | 1394.2 | -0.12 |
| CROSS SECTION 4 | 0+45 | 1370.19 | 1369.7 | -0.49 |
| CROSS SECTION 5 | 0+31 | 1363.42 | 1362.67 | -0.75 |
| CROSS SECTION 6 | 0+59 | 1363.15 | 1362.39 | -0.76 |
| CROSS SECTION 7 | 0+41 | 1357.6 | 1357.44 | -0.16 |
| BOUNDARY CROSS SECTION 1 | 0+82 | 1421.31 | 1421.31 | 0 |
| BOUNDARY CROSS SECTION 2 | 0+63 | 1372.23 | 1372.23 | 0 |
| BOUNDARY CROSS SECTION 3 | 1+56 | 1356.82 | 1356.86 | 0.04 |

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
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## LEGEND

- EXISTING GROUND PROFILE
- EXISTING GRAVEL PROFILE
- EXISTING COBBLE PROFILE
- EXISTING 2 YR WSE PROFILE
- EXISTING 100YR WSE PROFILE
- PROPOSED GROUND PROFILE
- PROPOSED 2 YR WSE PROFILE
- PROPOSED 100YR WSE PROFILE

## NOTES

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C.
PAROLA PROFESSIONAL
ENGINEER

## SCALE

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US

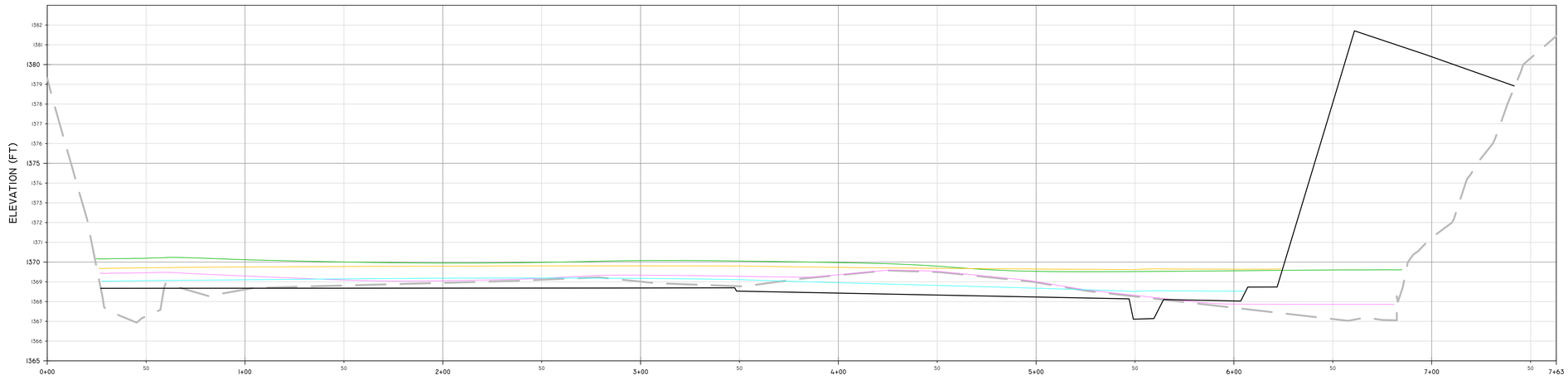
STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

CROSS SECTIONS

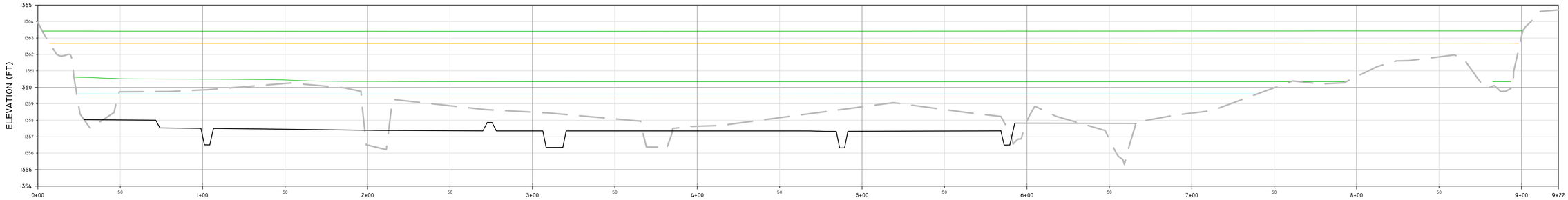
| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C613 | FILE NO: 0214-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

S:\RES CAD\CAD Working\027_STARRUCCA CREEK\Design\DWG\PLANSETS\ 65% ARCH FULL BLEED D (24.00 X 36.00 INCHES)




CROSS SECTION 4




CROSS SECTION 5

| 100 YEAR WATER SURFACE ELEVATION SUMMARY | | | | |
|---|---|---|---|---|
| CROSS SECTION | STATIONING | EXISTING 100YR WSE | PROPOSED 100YR WSE | DIFFERENCE |
| DEGRADATION CROSS SECTION 1 | 0+86 | 1380.85 | 1380.49 | -0.36 |
| DEGRADATION CROSS SECTION 2 | 0+29 | 1363.64 | 1362.74 | -0.90 |
| DEGRADATION CROSS SECTION 3 | 0+38 | 1362.16 | 1361.41 | -0.75 |
| CROSS SECTION 1 | 2+29 | 1412.39 | 1412.13 | -0.26 |
| CROSS SECTION 2 | 2+79 | 1398.52 | 1398.38 | -0.14 |
| CROSS SECTION 3 | 1+15 | 1394.32 | 1394.2 | -0.12 |
| CROSS SECTION 4 | 0+45 | 1370.19 | 1369.7 | -0.49 |
| CROSS SECTION 5 | 0+31 | 1363.42 | 1362.67 | -0.75 |
| CROSS SECTION 6 | 0+59 | 1363.15 | 1362.39 | -0.76 |
| CROSS SECTION 7 | 0+41 | 1357.6 | 1357.44 | -0.16 |
| BOUNDARY CROSS SECTION 1 | 0+82 | 1421.31 | 1421.31 | 0 |
| BOUNDARY CROSS SECTION 2 | 0+63 | 1372.23 | 1372.23 | 0 |
| BOUNDARY CROSS SECTION 3 | 1+56 | 1356.82 | 1356.86 | 0.04 |

*REVISIONS*

| NO. | DESCRIPTION | DATE | BY |
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*LEGEND*

- EXISTING GROUND PROFILE
- EXISTING GRAVEL PROFILE
- EXISTING COBBLE PROFILE
- EXISTING 2 YR WSE PROFILE
- EXISTING 100YR WSE PROFILE
- PROPOSED GROUND PROFILE
- PROPOSED 2 YR WSE PROFILE
- PROPOSED 100YR WSE PROFILE

*NOTES*

*SEAL*

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C.
PAROLA PROFESSIONAL
ENGINEER

*SCALE*

0 30 60 120 Feet

SCALE: 1" = 30'


RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
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TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US


STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

CROSS SECTIONS

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C614 | FILE NO: 0214-014-004 |
| DATE: | JANUARY 21, 2019 | | |

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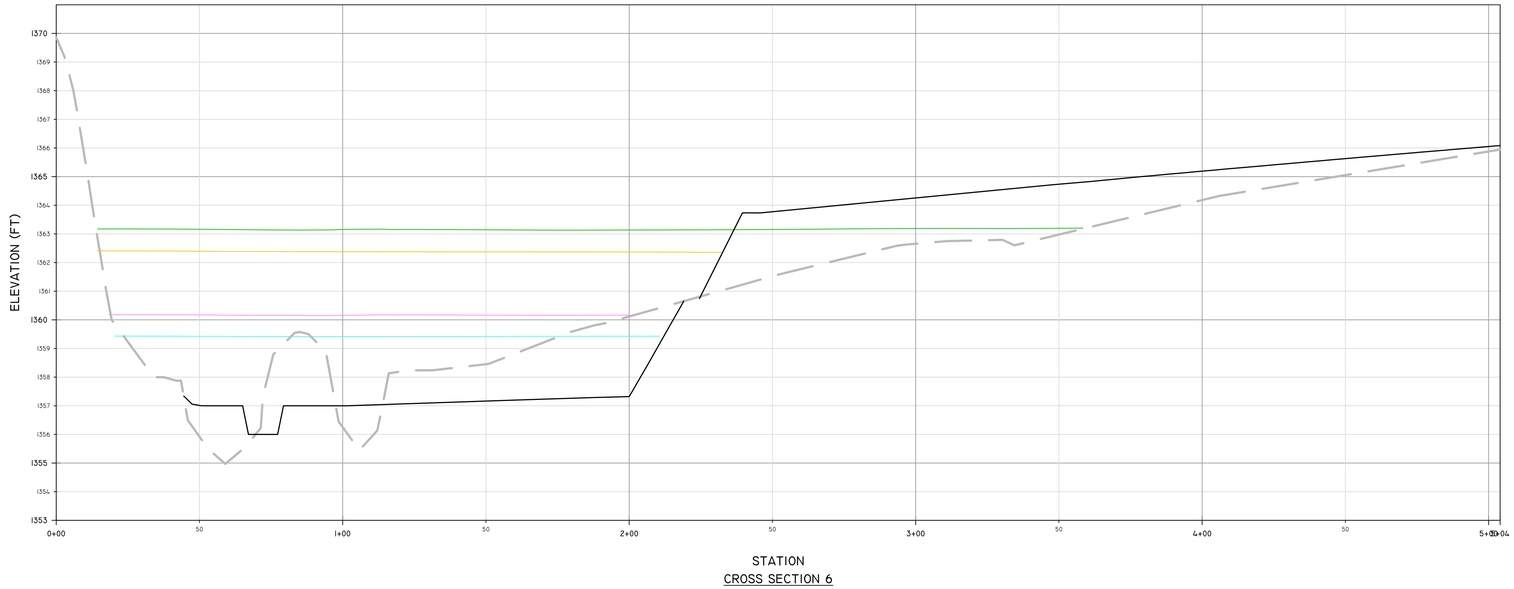
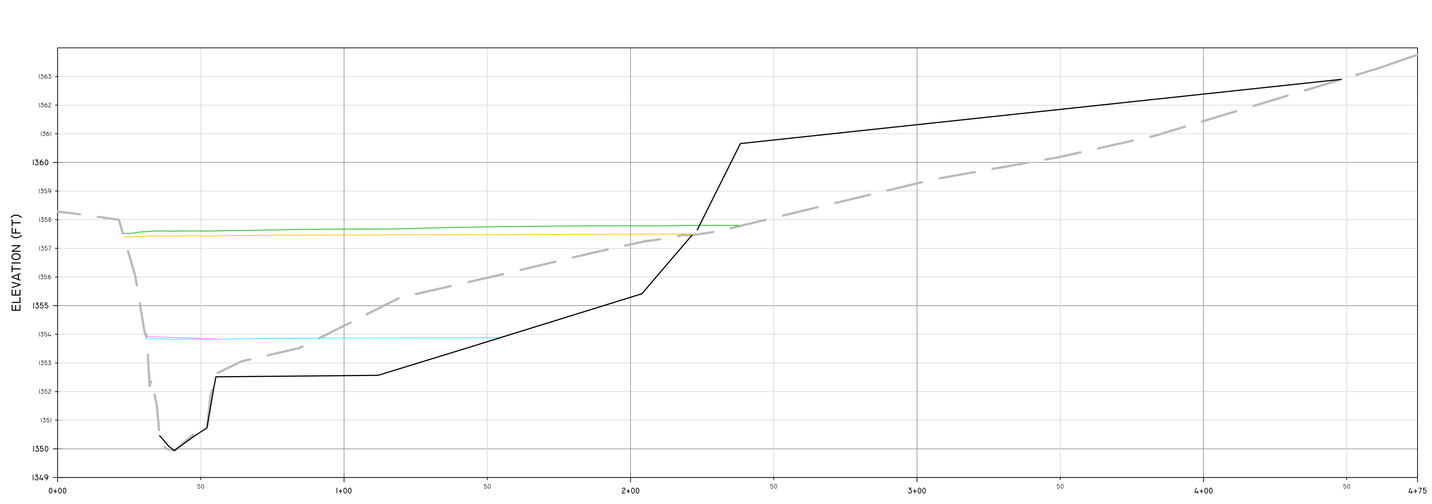



CROSS SECTION 6

| 100 YEAR WATER SURFACE ELEVATION SUMMARY | | | | |
|---|---|---|---|---|
| CROSS SECTION | STATIONING | EXISTING 100YR WSE | PROPOSED 100YR WSE | DIFFERENCE |
| DEGRADATION CROSS SECTION 1 | 0+86 | 1380.85 | 1380.49 | -0.36 |
| DEGRADATION CROSS SECTION 2 | 0+29 | 1363.64 | 1362.74 | -0.90 |
| DEGRADATION CROSS SECTION 3 | 0+38 | 1362.16 | 1361.41 | -0.75 |
| CROSS SECTION 1 | 2+29 | 1412.39 | 1412.13 | -0.26 |
| CROSS SECTION 2 | 2+79 | 1398.52 | 1398.38 | -0.14 |
| CROSS SECTION 3 | 1+15 | 1394.32 | 1394.2 | -0.12 |
| CROSS SECTION 4 | 0+45 | 1370.19 | 1369.7 | -0.49 |
| CROSS SECTION 5 | 0+31 | 1363.42 | 1362.67 | -0.75 |
| CROSS SECTION 6 | 0+59 | 1363.15 | 1362.39 | -0.76 |
| CROSS SECTION 7 | 0+41 | 1357.6 | 1357.44 | -0.16 |
| BOUNDARY CROSS SECTION 1 | 0+82 | 1421.31 | 1421.31 | 0 |
| BOUNDARY CROSS SECTION 2 | 0+63 | 1372.23 | 1372.23 | 0 |
| BOUNDARY CROSS SECTION 3 | 1+56 | 1356.82 | 1356.86 | 0.04 |




CROSS SECTION 7

*REVISIONS*

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
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*LEGEND*

- EXISTING GROUND PROFILE
- EXISTING GRAVEL PROFILE
- EXISTING COBBLE PROFILE
- EXISTING 2 YR WSE PROFILE
- EXISTING 100YR WSE PROFILE
- PROPOSED GROUND PROFILE
- PROPOSED 2 YR WSE PROFILE
- PROPOSED 100YR WSE PROFILE

*NOTES*

*SEAL*

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

*SCALE*

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452
WWW.RES.US
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

CROSS SECTIONS

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C615 | FILE NO: 0214-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

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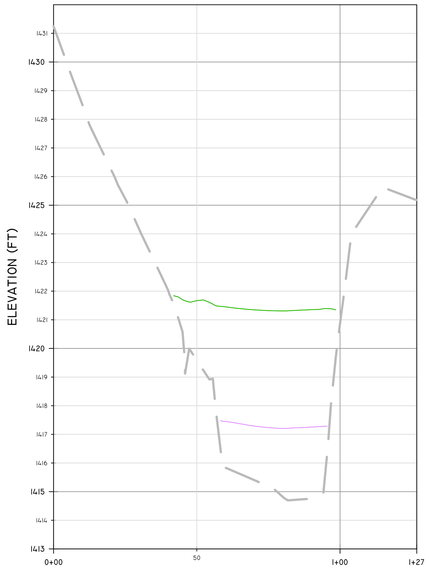
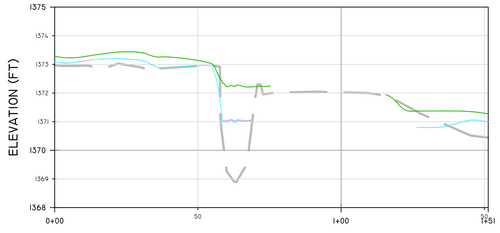


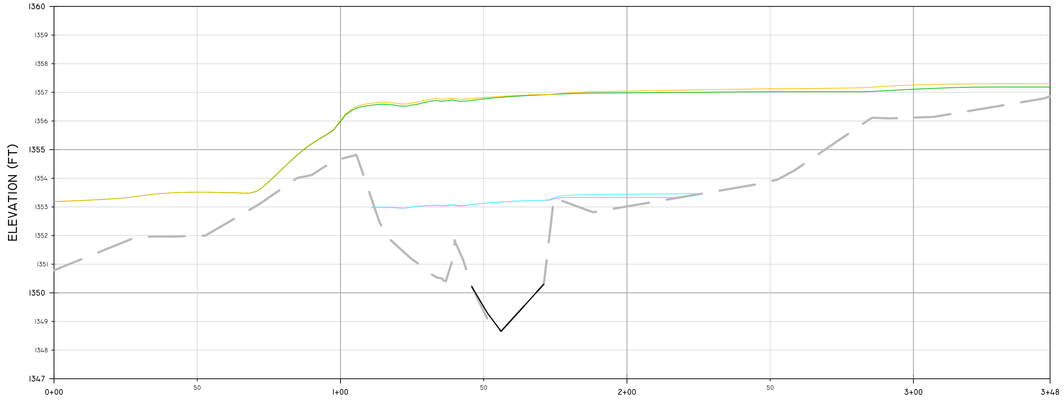

STATION

BOUNDARY CROSS SECTION 1




STATION

BOUNDARY CROSS SECTION 2




STATION

BOUNDARY CROSS SECTION 3

| 100 YEAR WATER SURFACE ELEVATION SUMMARY | | | | |
|---|---|---|---|---|
| CROSS SECTION | STATIONING | EXISTING 100YR WSE | PROPOSED 100YR WSE | DIFFERENCE |
| DEGRADATION CROSS SECTION 1 | 0+86 | 1380.85 | 1380.49 | -0.36 |
| DEGRADATION CROSS SECTION 2 | 0+29 | 1363.64 | 1362.74 | -0.90 |
| DEGRADATION CROSS SECTION 3 | 0+38 | 1362.16 | 1361.41 | -0.75 |
| CROSS SECTION 1 | 2+29 | 1412.39 | 1412.13 | -0.26 |
| CROSS SECTION 2 | 2+79 | 1398.52 | 1398.38 | -0.14 |
| CROSS SECTION 3 | 1+15 | 1394.32 | 1394.2 | -0.12 |
| CROSS SECTION 4 | 0+45 | 1370.19 | 1369.7 | -0.49 |
| CROSS SECTION 5 | 0+31 | 1363.42 | 1362.67 | -0.75 |
| CROSS SECTION 6 | 0+59 | 1363.15 | 1362.39 | -0.76 |
| CROSS SECTION 7 | 0+41 | 1357.6 | 1357.44 | -0.16 |
| BOUNDARY CROSS SECTION 1 | 0+82 | 1421.31 | 1421.31 | 0 |
| BOUNDARY CROSS SECTION 2 | 0+63 | 1372.23 | 1372.23 | 0 |
| BOUNDARY CROSS SECTION 3 | 1+56 | 1356.82 | 1356.86 | 0.04 |

*REVISIONS*

| NO. | DESCRIPTION | DATE | BY |
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*LEGEND*

EXISTING GROUND PROFILE
EXISTING GRAVEL PROFILE
EXISTING COBBLE PROFILE
EXISTING 2 YR WSE PROFILE
EXISTING 100YR WSE PROFILE
PROPOSED GROUND PROFILE
PROPOSED 2 YR WSE PROFILE
PROPOSED 100YR WSE PROFILE

*NOTES*

*SEAL*

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

*SCALE*

0 25 50 100 Feet

SCALE: 1" = 25'

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452
WWW.RES.US
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

BOUNDARY CROSS SECTIONS

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C616 | FILE NO: 0214-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

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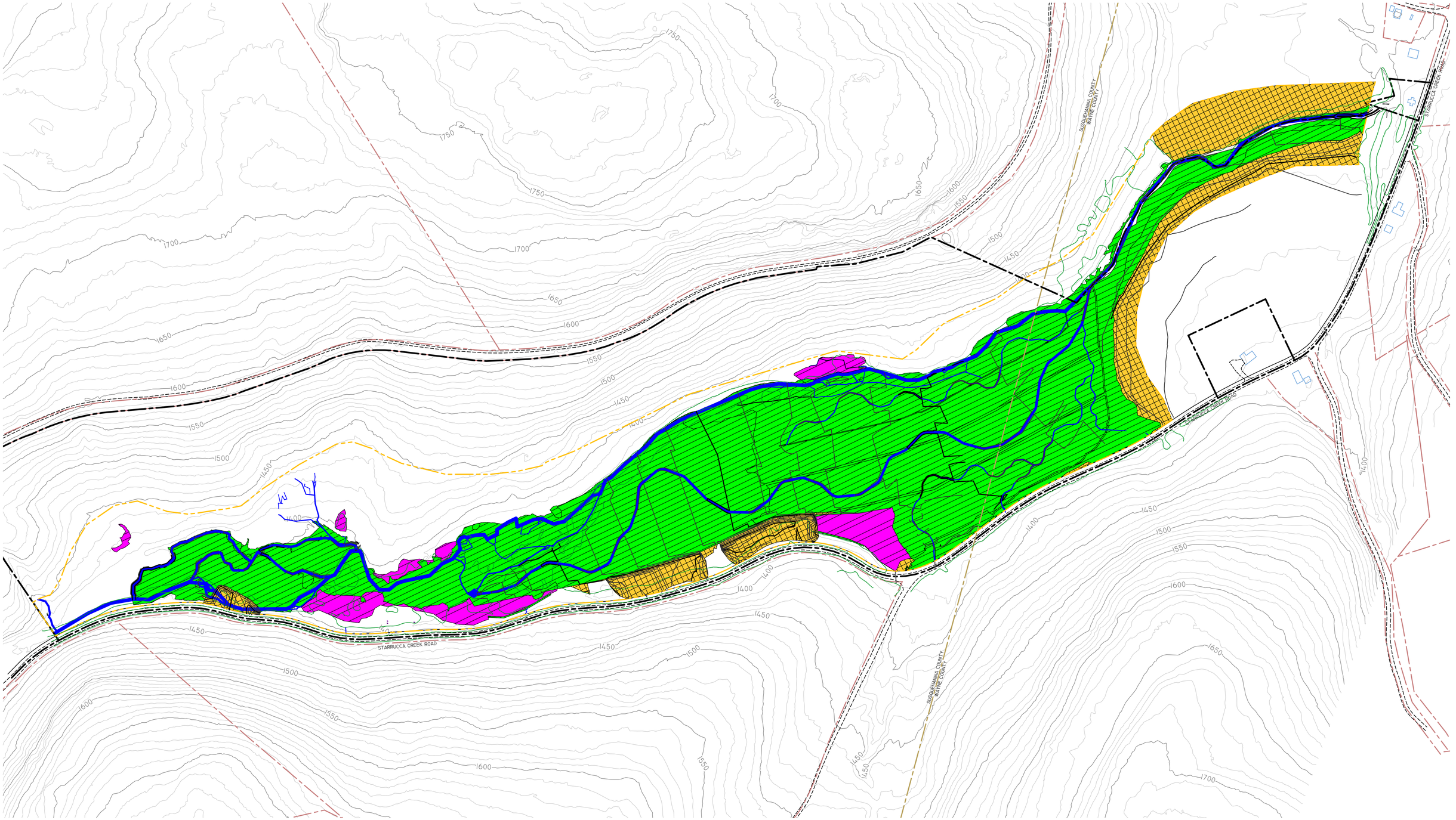


## REVISIONS

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## LEGEND

- PROPERTY BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- PROJECT BOUNDARY
- MUNICIPAL BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- ROAD EDGE
- EXISTING STRUCTURES
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- LIVE STAKES PLANTING
- UPLAND RESTORATION PLANTING
- WETLAND RESTORATION PLANTING
- WETLAND ENHANCEMENT PLANTING
- UPLAND RESTORATION SEEDING
- WETLAND RESTORATION SEEDING
- WETLAND ENHANCEMENT SEEDING

## NOTES

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL RICHARDSON SACHS
ENGINEER
PE079631
1/21/2019

## SCALE

0 200 400 800 Feet

SCALE: 1" = 200'


RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
www.res.us
TELEPHONE: (412) 249-2452
EMAIL: SYEAMANS@RES.US


# STARRUCCA CREEK MITIGATION BANK
## DESIGN PLANS
## PLANTING PLAN

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C700 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

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| ZONE | SPECIES | | MATURE HEIGHT (FT) | PLANT SPACING (FEET O.C.) | PLANTS PER ACRE |
|---|---|---|---|---|---|
| | BOTANICAL NAME | COMMON NAME | | | |
| Upland Restoration Planting (11.37 AC) | *Acer rubrum* | Red Maple | 75-100 | 6-10 | 10 |
| | *Acer saccharinum* | Silver Maple | 50-80 | 6-10 | 10 |
| | *Acer saccharum* | Sugar Maple | 75-100 | 6-10 | 10 |
| | *Betula alleghaniensis* | Yellow Birch | 75-100 | 6-10 | 10 |
| | *Carpinus caroliniana* | American Hornbeam | 35-50 | 6-10 | 10 |
| | *Carya ovata* | Shagbark Hickory | 50-75 | 6-10 | 15 |
| | *Fagus grandiflora* | American Beech | 75-100 | 6-10 | 10 |
| | *Hamamelis virginiana* | Witch hazel | 20-30 | 6-10 | 10 |
| | *Liriodendron tulipifera* | Tulip Poplar | 100-120 | 6-10 | 10 |
| | *Lindera benzoin* | Spicebush | 42533 | 6-10 | 15 |
| | *Prunus serotina* | Black Cherry | 40-80 | 6-10 | 20 |
| | *Pinus strobus* | Eastern White | 50-80 | 6-10 | 25 |
| | *Quercus alba* | White Oak | 50-80 | 6-10 | 25 |
| | *Quercus rubra* | Red Oak | 40-80 | 6-10 | 25 |
| | *Viburnum dentatum* | Southern Arrowwood | 6-15 | 6-10 | 25 |
| | *Viburnum prunifolium* | Blackhaw | 12-15 | 6-10 | 20 |
| TOTAL | | | | | 250 |

| ZONE | SPECIES | | MATURE HEIGHT (FT) | PLANT SPACING (FT) | Plants Per Acre |
|---|---|---|---|---|---|
| | BOTANICAL NAME | COMMON NAME | | | |
| Wetland Restoration Planting (56.47 AC) | *Alnus serrulata* | Smooth alder | 8-12 | 6 TO 10 | 40 |
| | *Carpinus caroliniana* | American Hornbeam | 35-50 | 6 TO 10 | 70 |
| | *Carya laciniosa* | Shellbark Hickory | 100-120 | 6 TO 10 | 75 |
| | *Ilex verticillata* | Winterberry Holly | 6-12 | 6 TO 10 | 40 |
| | *Quercus palustris* | Pin oak | 50-75 | 6 TO 10 | 70 |
| | *Quercus bicolor* | Swamp White Oak | 60-80 | 6 TO 10 | 75 |
| | *Sambucus canadensis* | Elderberry | 6-12 | 6 TO 10 | 40 |
| | *Vaccinium corymbosum* | Highbush blueberry | 6-12 | 6 TO 10 | 40 |
| TOTAL | | | | | 450 |

| ZONE | SPECIES | | MATURE HEIGHT (FT) | PLANT SPACING (FT) | Plants Per Acre |
|---|---|---|---|---|---|
| | BOTANICAL NAME | COMMON NAME | | | |
| Wetland Enhancement Planting (4.18 AC) | *Alnus serrulata* | Smooth alder | 8-12 | 6 TO 10 | 10 |
| | *Carpinus caroliniana* | American Hornbeam | 35-50 | 6 TO 10 | 15 |
| | *Carya laciniosa* | Shellbark Hickory | 100-120 | 6 TO 10 | 15 |
| | *Ilex verticillata* | Winterberry Holly | 6-12 | 6 TO 10 | 10 |
| | *Quercus palustris* | Pin oak | 50-75 | 6 TO 10 | 15 |
| | *Quercus bicolor* | Swamp White Oak | 60-80 | 6 TO 10 | 15 |
| | *Sambucus canadensis* | Elderberry | 6-12 | 6 TO 10 | 10 |
| | *Vaccinium corymbosum* | Highbush blueberry | 6-12 | 6 TO 10 | 10 |
| TOTAL | | | | | 100 |

| ZONE | Botanical Name | Common Name | % Per Acre | LBS/ACRE |
|---|---|---|---|---|
| Upland Restoration Seeding (11.37 AC) | *Elymus virginicus* | Virginia Wildrye | 20% | 4 |
| | *Sorghastrum nutans* | Indiangrass | 19% | 3.8 |
| | *Schizachyrium scoparium* | Little Bluestem | 18% | 3.6 |
| | *Tridens flavus* | Purpletop | 9% | 1.8 |
| | *Andropogon gerardii* | Big Bluestem | 4% | 0.8 |
| | *Chamaecrista fasciculata* | Partridge Pea | 4% | 0.8 |
| | *Penstemon digitalis* | Tall White Beardtongue | 4% | 0.8 |
| | *Eupatorium coelestinum* | Mistflower | 2% | 0.4 |
| | *Monarda fistulosa* | Wild Bergamot | 2% | 0.4 |
| | *Senna hebecarpa* | Wild Senna | 2% | 0.4 |
| | *Symphyotrichum novae-angliae* | New England Aster | 2% | 0.4 |
| | *Symphyotrichum laeve* | Smooth Blue Aster | 2% | 0.4 |
| | *Lespedeza virginica* | Slender Bushclover | 2% | 0.4 |
| | *Liatris spicata* | Marsh (Dense) Blazing Star | 2% | 0.4 |
| | *Eragrostis hirsuta* | Bigtop Lovegrass | 2% | 0.4 |
| | *Verbesina alternifolia* | Wingstem | 1% | 0.2 |
| | *Solidago juncea* | Early Goldenrod | 1% | 0.2 |
| | *Asclepias syriaca* | Common Milkweed | 1% | 0.2 |
| | *Helianthus giganteus* | Giant Sunflower | 1% | 0.2 |
| | *Heliopsis helianthoides* | Oxeye Sunflower | 1% | 0.2 |
| | *Geum canadense* | White Avens | 1% | 0.2 |
| TOTAL | | | 100% | 20 |

| ZONE | Botanical Name | Common Name | % Per Acre | LBS/ACRE |
|---|---|---|---|---|
| Wetland Restoration Seeding (56.47 AC) | *Carex vulpinoidea* | Fox Sedge | 31% | 6.2 |
| | *Elymus virginicus* | Virginia Wildrye | 20% | 4 |
| | *Carex lurida* | Lurid (Shallow) Sedge | 14% | 2.8 |
| | *Scirpus atrovirens* | Green Bulrush | 5% | 1 |
| | *Verbena hastata* | Blue Vervain | 4% | 0.8 |
| | *Cinna arundinacea* | Wood Reedgrass | 3.5% | 0.7 |
| | *Juncus effusus* | Soft Rush | 3% | 0.6 |
| | *Carex scoparia* | Blunt Broom Sedge | 3% | 0.6 |
| | *Carex lupulina* | Hop Sedge | 3% | 0.6 |
| | *Onoclea sensibilis* | Sensitive Fern | 2% | 0.4 |
| | *Heliopsis helianthoides* | Oxeye Sunflower | 2% | 0.4 |
| | *Glyceria canadensis* | Rattlesnake Grass | 1% | 0.2 |
| | *Scirpus cyperinus* | Woolgrass | 1% | 0.2 |
| | *Asclepias incarnata* | Swamp Milkweed | 1% | 0.2 |
| | *Symphyotrichum novae-angliae* | New England Aster | 1% | 0.2 |
| | *Doellngeria umbellata* | Flat Topped White Aster | 1% | 0.2 |
| | *Eupatorium fistulosum* | Joe Pye Weed | 0.50% | 0.1 |
| | *Eupatorium perfoliatum* | Boneset | 0.50% | 0.1 |
| | *Penthorum sedoides* | Ditch Stonecrop | 0.50% | 0.1 |
| | *Sisyrinchium angustifolium* | Narrowleaf Blue Eyed Grass | 0.50% | 0.1 |
| | *Ludwigia alternifolia* | Seedbox | 0.50% | 0.1 |
| | *Lobelia siphilitica* | Great Blue Lobelia | 0.50% | 0.1 |
| | *Alisma subcordatum* | Mud Plantain | 0.50% | 0.1 |
| | *Mimulus ringens* | Square Stemmed Monkeyflower | 0.50% | 0.1 |
| | *Carex intumescens* | Bladder (Star) Sedge | 0.40% | 0.08 |
| | *Pycnanthemum tenuifolium* | Slender Mountainmint | 0.10% | 0.02 |
| TOTAL | | | 100% | 20 |

| ZONE | Botanical Name | Common Name | % Per Acre | LBS/ACRE |
|---|---|---|---|---|
| Wetland Enhancement Seeding | *Carex vulpinoidea* | Fox Sedge | 31% | 3.1 |
| | *Elymus virginicus* | Virginia Wildrye | 20% | 2 |
| | *Carex lurida* | Lurid (Shallow) Sedge | 14% | 1.4 |
| | *Scirpus atrovirens* | Green Bulrush | 5% | 0.5 |
| | *Verbena hastata* | Blue Vervain | 4% | 0.4 |
| | *Cinna arundinacea* | Wood Reedgrass | 3.5% | 0.35 |
| | *Juncus effusus* | Soft Rush | 3% | 0.3 |
| | *Carex scoparia* | Blunt Broom Sedge | 3% | 0.3 |
| | *Carex lupulina* | Hop Sedge | 3% | 0.3 |
| | *Onoclea sensibilis* | Sensitive Fern | 2% | 0.2 |
| | *Heliopsis helianthoides* | Oxeye Sunflower | 2% | 0.2 |
| | *Glyceria canadensis* | Rattlesnake Grass | 1% | 0.1 |
| | *Scirpus cyperinus* | Woolgrass | 1% | 0.1 |
| | *Asclepias incarnata* | Swamp Milkweed | 1% | 0.1 |
| | *Symphyotrichum novae-angliae* | New England Aster | 1% | 0.1 |
| | *Doellngeria umbellata* | Flat Topped White Aster | 1% | 0.1 |
| | *Eupatorium fistulosum* | Joe Pye Weed | 0.50% | 0.05 |
| | *Eupatorium perfoliatum* | Boneset | 0.50% | 0.05 |
| | *Penthorum sedoides* | Ditch Stonecrop | 0.50% | 0.05 |
| | *Sisyrinchium angustifolium* | Narrowleaf Blue Eyed Grass | 0.50% | 0.05 |
| | *Ludwigia alternifolia* | Seedbox | 0.50% | 0.05 |
| | *Lobelia siphilitica* | Great Blue Lobelia | 0.50% | 0.05 |
| | *Alisma subcordatum* | Mud Plantain | 0.50% | 0.05 |
| | *Mimulus ringens* | Square Stemmed Monkeyflower | 0.50% | 0.05 |
| | *Carex intumescens* | Bladder (Star) Sedge | 0.40% | 0.04 |
| | *Pycnanthemum tenuifolium* | Slender Mountainmint | 0.10% | 0.01 |
| TOTAL | | | 100% | 10 |

| ZONE | SPECIES | | MATURE HEIGHT (FT) | PLANT SPACING (FEET O.C.) |
|---|---|---|---|---|
| | BOTANICAL NAME | COMMON NAME | | |
| Live Stakes | *Comus amomum* | Silky Dogwood | 6-12 | 2' |
| | *Comus sericea* | Redosier Dogwood | 5-13 | 2' |
| | *Salix caprea* | Pussy Willow | 15-25 | 2' |
| TOTAL | | | | 2' |

REVISIONS

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LEGEND

NOTES

SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL RICHARDSON SACHS
ENGINEER
PE079631
1/21/2019

SCALE

RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452
WWW.RES.US
EMAIL: SYEAMANS@RES.US

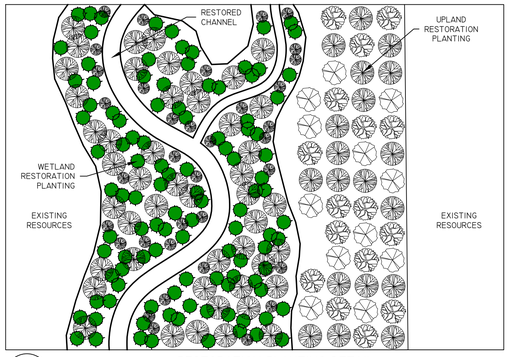
STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PLANTING LIST

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C701 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

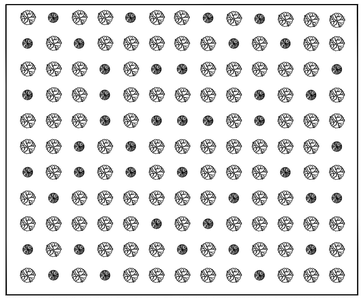
S:\RES CAD\CAD Working\0217-STARRUCCA CREEK\Design\DWG\PLANSETS\459% ARCH FULL BLEED D (24.00 X 36.00 INCHES)



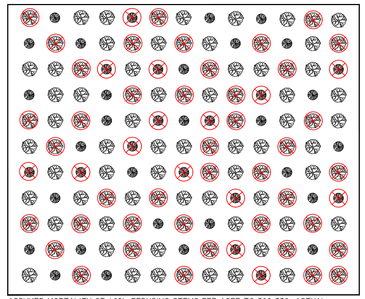

PL-1 C702

## RESTORATION PLANTING DETAIL

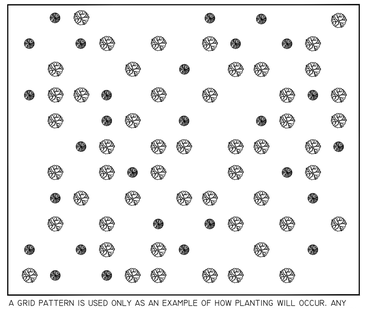
NOT TO SCALE



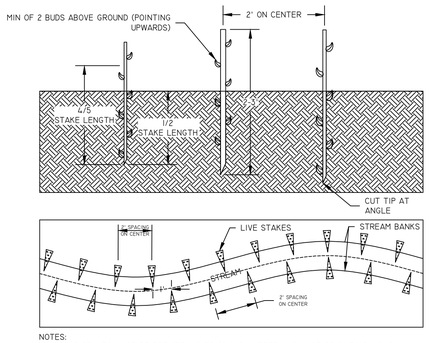
INITIAL PLANTING DENSITY OF 500-550 STEMS PER ACRE; WITH AN APPROXIMATE RATIO OF 70% CANOPY AND 30% SHRUBS SPECIES. PLANTING LOCATIONS ARE APPROXIMATE, THE ACTUAL LOCATION OF PLANTS ON THE PRM SITE WILL BE SUBJECT TO SITE CONDITIONS AT THE TIME OF PLANTING.



ASSUMED MORTALITY OF 40%, REDUCING STEMS PER ACRE TO 300-330. ACTUAL MORTALITY TO BE VERIFIED DURING MONITORING.



A GRID PATTERN IS USED ONLY AS AN EXAMPLE OF HOW PLANTING WILL OCCUR. ANY REPLANTING WILL BE RANDOMIZED REGARDLESS OF WHICH ZONE IT WILL OCCUR WITHIN.




NOTES:

1. LIVE STAKES MUST BE BETWEEN ¾" TO 2" IN DIAMETER AND MUST BE 2' TO 3' LONG.
2. CUT THE STAKES WITH AN ANGLE ON THE BOTTOM AND SQUARE ON THE TOP, WITH THE BUDS POINTING UPWARD.
3. TRIM ALL SIDE BRANCHES CLEANLY SO THE CUTTING IS ONE STEM.
4. STAKES MUST BE STORED IN A COOL AND MOIST PLACE TO KEEP THEM ALIVE AND DORMANT.
5. DRIVE STAKES PERPENDICULAR TO THE GROUND WITH RUBBER HAMMER AT LEAST ⅓ TO ⅔ OF THE TOTAL STAKE LENGTH. KEEP AT LEAST 2 BUDS ABOVE GROUND SURFACE.
6. DO NOT USE SPLIT STAKES.

PL-3 C702

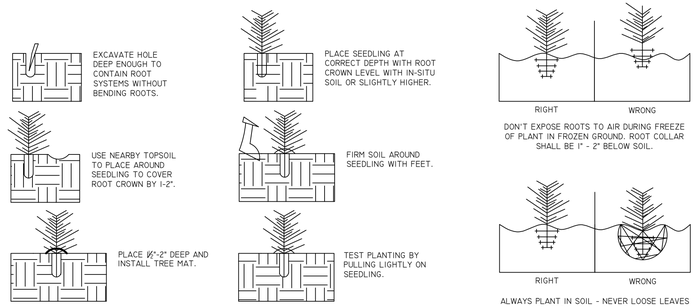
## LIVE STAKES

NOT TO SCALE

PL-2 C702

## MATRIX PLANTING PLAN DETAIL

NOT TO SCALE




PL-4 C702

## TUBELING PLANTING DETAIL

NOT TO SCALE

### CARE OF SEEDLING UNTIL PLANTED

SEEDLINGS SHOULD BE PLANTED IMMEDIATELY. IF IT IS NECESSARY TO STORE MOSS-PACKED SEEDLINGS FOR MORE THAN 2 WEEKS, ONE PINT OF WATER PER PKG. SHOULD BE ADDED. IF CLAY-TREATED, DO NOT ADD WATER TO PKG. PACKAGES MUST BE SEPARATED TO PROVIDE VENTILATION TO PREVENT "HEATING". SEPARATING PACKAGES WITH WOOD STRIPS AND STORE OUT OF THE WIND IN A SHADED, COOL, (NOT FREEZING) LOCATION.

### CARE OF SEEDLING DURING PLANTING

WHEN PLANTING, ROOTS MUST BE KEPT MOIST UNTIL TREES ARE IN THE GROUND. DO NOT CARRY SEEDLINGS IN YOUR HAND EXPOSED TO THE AIR AND SUN. KEEP MOSS-PACKED SEEDLINGS IN A CONTAINER PACKED WITH WET MOSS OR FILLED WITH THICK MUDDY WATER. COVER CLAY-TREATED SEEDLINGS WITH WET BURLAP ONLY.

## PLANTING DETAIL NOTES:

### A. GENERAL:

1. PLANT DETAILS ARE INCORPORATED INTO THIS SPECIFICATION BY REFERENCE.

2. QUALITY ASSURANCE
2.1. SUPPLIER CERTIFICATION: THE SUPPLIER OF ALL SEEDS AND/OR VEGETATION SHALL CERTIFY THAT ORIGIN OF THE SEEDS FROM WHICH THE PLANTS OR SEEDS WERE PRODUCED IS FROM THE EASTERN OR CENTRAL PORTIONS OF THE U.S. PRIOR TO PLANTING.
2.2. INSTALLER QUALIFICATIONS: ENGAGE AN EXPERIENCED INSTALLER, WHO HAS SUCCESSFULLY COMPLETED RESTORATION PLANTING PROJECTS SIMILAR IN SIZE AND COMPLEXITY TO THIS PROJECT.
2.3. INSTALLER'S FIELD SUPERVISION: INSTALLER TO MAINTAIN AN EXPERIENCED FULL-TIME SUPERVISOR ON THE PROJECT SITE WHEN PLANTING IS IN PROGRESS.

3. PLANT MATERIALS
3.1. PROVIDE PLANT MATERIALS OF QUANTITY, SIZE, GENUS AND SPECIES INDICATED ON THE CONSTRUCTION DRAWINGS.

4. ALL PLANT MATERIALS AND WORK SHALL COMPLY WITH RECOMMENDATIONS AND REQUIREMENTS OF ANSI Z60.1 2004 AMERICAN STANDARD FOR NURSERY STOCK. ALL SEEDS MUST MEET APPLICABLE STATE AND FEDERAL REGULATIONS AND MUST INCLUDE LABELING INDICATING SUPPLIER, FORMULATION, GERMINATION RATES AND SEED DATE. LABELS FROM ALL SEED INSTALLED ARE TO BE KEPT AND SUPPLIED TO OWNER AT COMPLETION OF PROJECT.

DO NOT MAKE SUBSTITUTIONS UNLESS APPROVED BY THE PROJECT MANAGER. REQUESTS FOR SUBSTITUTIONS MUST BE MADE IN WRITING TO THE PROJECT MANAGER AND APPROVED TO INSTALLATION. INCLUDE REASONS WHY THE SUBSTITUTIONS ATE BEING REQUESTED.

6. PROJECT ENGINEER MAY INSPECT PLANT MATERIALS EITHER AT PLACE OF GROWTH OR ON SITE DURING PLANTING ACTIVITIES, FOR COMPLIANCE WITH REQUIREMENTS FOR GENUS, SPECIES, VARIETY, SIZE, AND QUALITY. MATERIAL FOUND TO BE UNACCEPTABLE WILL BE REJECTED AND THE CONTRACTOR WILL BE REQUIRED TO SUPPLY REPLACEMENT MATERIAL WITHIN TIME FRAME (I.E., 1 WEEK). REJECTED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM PROJECT SITE. UNACCEPTABLE MATERIAL IS DEFINED AS THE FOLLOWING:
6.1. PLANTS WITH BENT TRUNKS OR MULTIPLE LEADERS, UNLESS CHARACTERISTIC FOR THE SPECIES;
6.2. PLANTS WITH DISEASED TRUNKS, STEMS, OR LEAVES;
6.3. PLANTS WITH PEST-INFESTED TRUNKS, STEMS, OR LEAVES;
6.4. PLANTS OF INSUFFICIENT SIZE;
6.5. PLANTS WITH WRONG SPECIES/SUB-SPECIES; AND
6.6. PLANTS HAVING ROOT GIRDLING IN THE CONTAINER.

7. DELIVERY, STORAGE, AND HANDLING
7.1. PROTECT BARK, BRANCHES, AND ROOT SYSTEMS FROM SUN SCALD, DRYING, SWEATING, WHIPPING, AND OTHER HANDLING AND TYING DAMAGE. DO NOT BEND OR BIND-TIE TREES OR SHRUBS IN SUCH A MANNER AS TO DESTROY THEIR NATURAL SHAPE. PROVIDE PROTECTIVE COVERING OF PLANTS DURING DELIVERY. DO NOT DROP PLANTS DURING DELIVERY.
7.2. DELIVER PLANT MATERIALS AFTER PREPARATIONS FOR PLANTING HAVE BEEN COMPLETED AND PLANT IMMEDIATELY. IF PLANTING IS DELAYED MORE THAN 6 HOURS AFTER DELIVERY, FOLLOW STORAGE INSTRUCTIONS AS SHOWN IN TUBELING TREE PLANTING DETAIL.
7.3. DO NOT REMOVE CONTAINER-GROWN STOCK FROM CONTAINERS UNTIL PLANTING TIME.
7.4. SEED: SEED SHOULD BE CLEAN AND DRY. DO NOT USE SEED THAT HAS BECOME MOIST DURING DELIVERY OR STORAGE. IF SEED NEEDS TO BE TEMPORALLY STORED IT SHOULD BE STORED IN A COOL, DRY PLACE.

8. PROJECT CONDITIONS
8.1. EXAMINE THE SUB-GRADE AND TOPSOIL, AND VERIFY THE ELEVATIONS PRIOR TO INSTALLING PLANT ON SEED MATERIAL. ALL SOIL AMENDMENTS AND CONDITIONING SHALL BE COMPLETED PRIOR TO SEEDING AND PLANT MATERIAL INSTALLATION. DO NOT PROCEED WITH THE WORK UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED IN A MANNER ACCEPTABLE TO THE INSTALLER.
8.2. CALL PENNSYLVANIA ONE CALL SYSTEM AT 1-800-242-1776, 72 HOURS PRIOR TO ANY EXCAVATION. DETERMINE LOCATION OF UNDERGROUND UTILITIES AND PERFORM WORK IN A MANNER WHICH WILL AVOID POSSIBLE DAMAGE. HAND EXCAVATE AS REQUIRED.

9. PLANTING AND SEEDING RESTRICTIONS
9.1. PLANTS SHALL BE PLANTED DURING UNFROZEN SOIL CONDITIONS SEPTEMBER 15TH - MAY 15TH. PLANT INSTALLATION OUTSIDE OF THIS TIME PERIOD SHALL NOT OCCUR UNLESS APPROVED BY THE PROJECT CONSTRUCTION MANAGER AND MAY REQUIRE ADDITIONS TO THE SCOPE OF WORK, SUCH AS WATERING REGIMES, AND ADDITIONAL PLANT QUANTITIES.
9.2. SEEDING SHALL BE COMPLETED DURING SEPTEMBER 15-MAY 15 TO THE GREATEST EXTENT POSSIBLE. DORMANT WINTER SEEDING SHALL NOT BE CONDUCTED WITH MORE THAN 2" OF SNOW ON THE GROUND AT THE TIME OF SEEDING. DUE TO THE SCHEDULE OF THE PROJECT, SOME PERMANENT SEEDING OUTSIDE THIS TIME PERIOD WILL BE NECESSARY. THE CONTRACTOR WILL BE RESPONSIBLE FOR REMEDIAL SEEDING IN UNDER-PERFORMING AREAS DUE TO SEEDING OUTSIDE OF THIS TIME PERIOD. A COVER CROP SHALL BE SOWN AT THE TIME OF PERMANENT SEEDING TO PROVIDE QUICKER GERMINATION AND STABILIZATION PER THE PLAN SHEETS.
9.3. THESE LIMITS MAY NOT BE MODIFIED UNLESS APPROVED BY THE PROJECT ENGINEER IN ADVANCE, WITH THE RISK OF SURVIVAL BORNE SOLELY BY THE CONTRACTOR.

10. WARRANTY
10.1. WARRANTY PERIOD IS FOR ONE (1) YEAR AFTER DATE OF FINAL ACCEPTANCE AND COVERS DEFECTS INCLUDING DEATH AND UNSATISFACTORY GROWTH, EXCEPT FOR DEFECTS RESULTING FROM NEGLECT BY OWNER, ABUSE OR DAMAGE BY OTHERS, OR UNUSUAL PHENOMENA OR INCIDENTS WHICH ARE BEYOND CONTRACTOR'S CONTROL.
10.2. CONTRACTOR SHALL GUARANTEE A MINIMUM SURVIVAL RATE FOR THE WARRANTY PERIOD OF 85% FOR BALLED AND BURLAPPED, CONTAINER GROWN, AND TUBELINGS, AND 75% FOR BARE ROOT AND LIVE STAKES.
10.3. IF SURVIVAL RATES ARE LESS THAN THE ABOVE WARRANTY RATES, THE CONTRACTOR SHALL REPLACE THE QUANTITY OF DEFECTIVE OR DEAD PLANTS UP TO THE ORIGINAL CONSTRUCTION DRAWING SPECIFIED PLANT QUANTITY. WARRANTY PLANTINGS SHALL OCCUR WITHIN THE NEXT PLANTING WINDOW (SEPTEMBER 15TH -JUNE 15TH, EXCLUDING FROZEN SOIL CONDITIONS) FOLLOWING THE END OF THE APPLICABLE WARRANTY PERIOD.
10.4. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY DURING THE WARRANTY PERIOD TO PROVIDE WRITTEN NOTICE OF ANY MAINTENANCE PRACTICE TO THE OWNER, WHICH IN THEIR OPINION WILL AFFECT THE GUARANTEE IF NOT REMEDIED PROMPTLY. THE PROJECT ENGINEER WILL RENDER AN OPINION OF ANY CONFLICT IF NECESSARY.

11. MAINTENANCE
11.1. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ALL PLANT MATERIAL THROUGH FINAL ACCEPTANCE AND WARRANTY PERIOD.

### B. EXECUTION:

INSTALL PLANT MATERIALS IN ACCORDANCE WITH THE SPECIFICATIONS AND DETAILS OF THE CONSTRUCTION DRAWINGS FOLLOWING THE ADDITION OF SOIL AMENDMENTS, SEEDING, AND INSTALLATION OF APPLICABLE EROSION CONTROL FABRIC.

1. CONTAINER GROWTH MATERIAL
1.1. PLANTING OF CONTAINER GROWN MATERIAL SHALL OCCUR IN ACCORDANCE WITH LOCATIONS AND/OR PATTERNS SPECIFIC TO THE CONSTRUCTION DRAWINGS.
1.2. PLANTING HOLES SHALL BE AT LEAST TWICE THE DIAMETER AND DUG TO THE SAME DEPTH AS THE CONTAINER IN WHICH THEY ARE GROWN. DO NOT REMOVE PLANT MATERIAL FROM CONTAINER UNTIL IMMEDIATELY BEFORE INSTALLATION. EXAMINE THE ROOTS TO SEE IF THEY ARE POT BOUND. CAREFULLY SEPARATE ANY POT BOUND OR CRAMPED ROOTS AND SPREAD THEM OUT WHEN PLACING THE PLANT WITHIN THE HOLE SO THAT THE ROOTS CAN GROW WITHOUT FURTHER CONSTRICTION OF THE ROOT BALL.
1.3. SET PLANT MATERIALS PLUMB AND CENTERED WITHIN HOLE, ENSURING THAT THE TOP OF THE ROOT BALL IS SLIGHTLY ELEVATED ABOVE THE SURROUNDING SOIL ELEVATIONS. BACKFILL AROUND ROOT BALL WITH SUITABLE NATIVE SOIL, MAINTAINING PLUMB, AND GENTLY TAMPING BACKFILL LAYERS TO ELIMINATE VOIDS. WATER IS BACKFILL LAYERS TO THE POINT OF SOIL SATURATION.
1.4. FOLLOWING THE BACKFILLING, ADD EXISTING SOIL TO BRING THE FINAL GRADE IN THE PLANTING HOLE TO THE SURROUNDING SOIL SURFACE. RAKE THE UNUSED EXISTING SOIL OUTSIDE THE PLANTING HOUSE, TAKING CARE NOT TO MOUND THE SOIL OR TO SIGNIFICANTLY ALTER THE EXISTING GRADES.

2. BAREROOT AND TUBELING MATERIAL
2.1. IT SHOULD BE ANTICIPATED THAT THE SOIL MAY BE COMPACTED MORE THAN OPTIMAL FOR PLANTING AND IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO RIP SOIL TO ASSURE OPTIMAL PLANTING CONDITION. SOIL SHALL BE RIPPED TO A DEPTH OF 9-12".
2.2. BAREROOT MATERIAL SHALL BE TREATED WITH ROOT DIP ACCORDING TO THE MANUFACTURERS RECOMMENDATION PRIOR TO PLANTING. MATERIALS SHALL BE PLANTED IMMEDIATELY OR OTHERWISE STORED PER THE MANUFACTURER'S RECOMMENDATIONS.

3. LIVE STAKE MATERIAL
3.1. LIVE STAKE MATERIAL SHALL BE KEPT MOIST ACCORDING TO MANUFACTURES RECOMMENDATIONS. DO NOT ALLOW THE LIVE STAKES TO DRY OUT PRIOR TO INSTALLATION.
3.2. MATERIAL SHALL BE PLANTED ACCORDING TO THE DETAIL PROVIDED. THE USE OF A PUNCH/PLANTING BAR, AUGER, REBAR, OR WATER-JET MAY BE USED TO PRE-DRILL HOLE IF NECESSARY.TAMP SOIL AROUND STAKE FOLLOWING INSTALL.

4. SEEDING
4.1. SEEDING SHALL OCCUR AS SHOWN ON THE PLANTING PLAN. IN ACCORDANCE WITH THE CURRENT VERSION OF THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION EROSION AND SEDIMENT POLLUTION CONTROL PROGRAM MANUAL SEED SHALL BE APPLIED PRIOR TO INSTALLATION OF ANY EROSION CONTROL FABRIC. AREAS APPLIED WITH HERBICIDE MAY BE SEEDED 7 DAYS AFTER APPLICATION.
4.2. SOW SEED WITH A SPREADER OR A HYDROSEED MACHINE WITH MANUFACTURER RECOMMENDED BINDING AGENT. IN AREAS WITH DENSE EXISTING VEGETATION, INSTALL SEED WITH A NATIVE NO-TILL DRILL SEEDER. DO NOT BROADCAST DROP SEED WHEN WIND VELOCITY EXCEEDS 5 MPH. EVENLY DISTRIBUTE SEED BY SOWING EQUAL QUANTITIES IN TWO DIRECTIONS AT RIGHT ANGLES TO EACH OTHER.
4.3. DO NOT USE WET SEED OR SEED THAT IS MOLDY OR OTHERWISE DAMAGED IN TRANSIT OR STORAGE.
4.4. SOW SEED PRIOR TO INSTALLATION OF EROSION CONTROL FABRIC WHERE APPLICABLE.
4.5. IF BROADCAST, ROLL SEEDED AREAS LIGHTLY, AND WATER WITH A FINE SPRAY.
4.6. PROTECT SEEDED AREAS AGAINST EROSION BY SPREADING STRAW MULCH IMMEDIATELY FOLLOWING COMPLETION OF SEEING OPERATIONS IF OTHER EROSION CONTROL MEASURES ARE NOT OTHERWISE SPECIFIED. SPREAD UNIFORMLY AT A RATE OF 2 TONS PER ACRE (90 LB. PER1,000 S.F.) TO FORM A CONTINUOUS BLANKET OVER SEEDED AREAS. SPREAD BY HAND, BLOWER, OR OTHER SUITABLE EQUIPMENT. ANCHOR STRAW MULCH BY CRIMPING INTO TOPSOIL BY SUITABLE MECHANICAL EQUIPMENT.
4.7 STRAW EROSION CONTROL BLANKET IS A SUITABLE ALTERNATIVE TO BE USED INSTEAD OF BLOWN OR CRIMPED STRAW.

5. LOCATION
5.1. ALL PLANT MATERIAL IS TO BE INSTALLED AS SHOWN ON THE PLANTING PLANS FOR THE PROTOTYPE.
5.2. UPLAND TREE PLANTINGS ARE TO BE INSTALLED IN A 9X9 GRID PATTERN.
5.3. FLOODPLAIN PLANTINGS ARE TO BE INSTALLED IN A CLUMPED FASHION WITH A MINIMUM OF 3' SPACING BETWEEN PLANTS. PLANTS ARE TO BE INSTALLED BASED UPON THE HYDROLOGIC TOLERANCES AND SITE CONDITIONS AFTER CONSTRUCTION IS COMPLETED.
5.4. ALL LIVE STAKES ARE TO BE INSTALLED ALONG STREAM BANKS, POOLS, AND FLOODPLAIN POOLS BASED UPON SPACING INDICATED IN THE PLANTING PLAN SPECIES LIST.

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### LEGEND

TUBELING
SHRUB
REPLANTED TUBELING
REPLANTED SHRUB

### NOTES

### SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
MICHAEL RICHARDSON SACHS
ENGINEER
PE079631

1/21/2019

### SCALE

RESOURCE ENVIRONMENTAL SOLUTIONS
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PITTSBURGH PA 15219
TELEPHONE: (412) 249-2452
WWW.RES.US
EMAIL: SYEAMANS@RES.US

STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

PLANTING DETAILS

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C702 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

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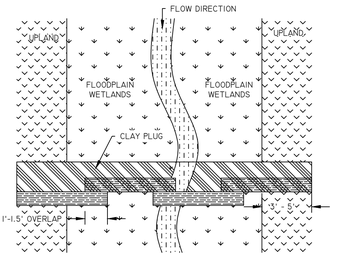
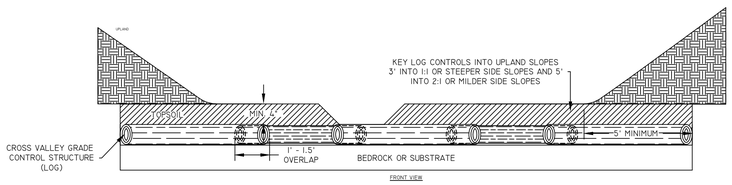
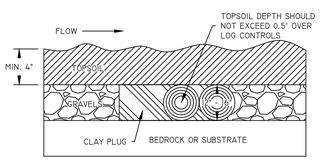
ARCH FULL BLEED D (24.00 X 36.00 INCHES)



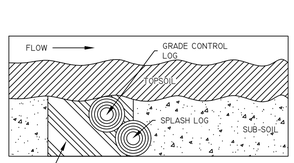

TOP VIEW




FRONT VIEW




SIDE VIEW




SIDE VIEW

1. NOTES:
2. STRUCTURES MAY BE CONSTRUCTED OUT OF WOOD OR STONE MATERIAL; ALL MATERIAL IS TO BE APPROVED BY THE DESIGN ENGINEER OR CONSTRUCTION MANAGER PRIOR TO INSTALLATION ON-SITE
3. WOODY MATERIAL IS TO BE BETWEEN 12"-16" AND RELATIVELY STRAIGHT; HIGHLY VARIABLE OR CURVED TRUNKS ARE NOT TO BE USED
4. STONE MATERIAL IS TO BE A MINIMUM OF 12 INCHES MEDIAN DIAMETER, AND MUST BE INSTALLED IN A COLUMN FASHION WHICH IS 2 FEET WIDE, 2 FEET DEEP, AND THE SPECIFIED WIDTH OF THE STRUCTURE AS SHOWN ON THE PLANS
5. ALL STRUCTURES ARE TO BE PLACED ON BEDROCK OR SIMILAR NON-EROSIVE BASE SUCH AS A DENSE CLAY. IF BEDROCK OR A NON-EROSIVE FOUNDATION IS NOT AVAILABLE A SPLASH LOG MUST BE INSTALLED DOWNSTREAM OF THE GRADE CONTROL LOGS AS SHOWN ON THE DESIGN PLANS
6. LOGS WITHIN THE FLOODPLAIN ARE TO BE OVERLAPPED BY A MINIMUM OF 1.5 '; WHERE THE LOGS ARE TOED INTO THE VALLEY SIDE SLOPES, ARE TO BE TOED IN A MINIMUM OF 3 5'. IF INSUFFICIENT MATERIAL IS AVAILABLE TO TOE IN THE WOODY MATERIAL IT IS TO BE ANCHORED IN PLACE USING MINING LAG BOLTS DRILLED INTO THE BEDROCK OR LOGS WILL BE KEYED INTO THE BEDROCK A MINIMUM OF 3 INCHES.
7. MATERIAL WITH A HEAVY CLAY OR CLAYEY SILT CONTENT SHALL BE USED TO CONSTRUCT A CLAY PLUG ON THE UPSTREAM SIDE OF THE LOG SILL. THE CLAY PLUG SHALL BE TIED INTO BEDROCK OR OTHER NON-PERMEABLE MATERIAL AT THE BASE OF THE STRUCTURE AND SHALL EXTEND UPWARDS TO WITHIN 2 INCHES OF THE TOP OF THE STRUCTURE. THE CLAY PLUG SHALL HAVE A WIDTH OF 3 FEET UPSTREAM OF THE LOG SILL AND EXTEND ACROSS THE ENTIRE VALLEY BOTTOM IN ORDER TO PREVENT WATER-PIPING THROUGH THE STRUCTURE. MATERIAL EXCAVATED FOR THE LOG SILLS MAY BE USED AT THE DISCRETION OF THE ENGINEER OR CONSTRUCTION MANAGER TO CONSTRUCT THE CLAY PLUG.
8. FINAL STRUCTURE ALIGNMENT AND LOCATION MAY BE ADJUSTED BY DESIGN ENGINEER OR CONSTRUCTION MANAGER IN THE FIELD AS NEEDED

C-1 / C800

## CROSS VALLEY GRADE CONTROL LOGS

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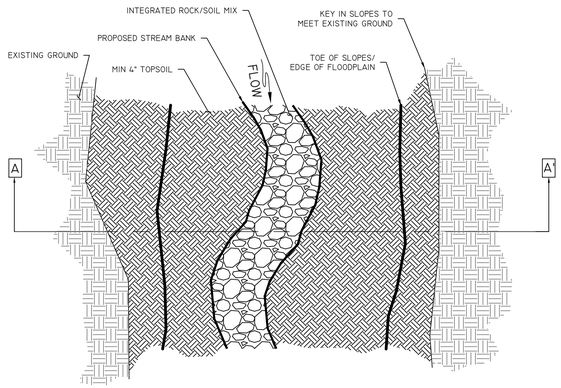
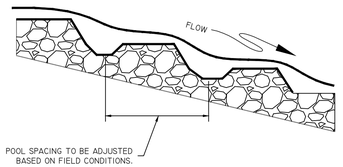
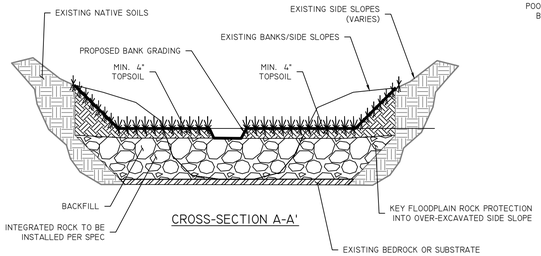



PLAN VIEW




PROFILE VIEW




CROSS-SECTION A-A'

| STREAM FEATURE DIMENSION TABLE | | |
|---|---|---|
| FEATURE | WIDTH (FT) | DEPTH (FT) |
| CHANNEL | VARIES (SEE PLAN) | 2 |
| POOL | VARIES (SEE PLAN) | 2 - 4 |

### INTEGRATED ROCK SPECIFICATION:

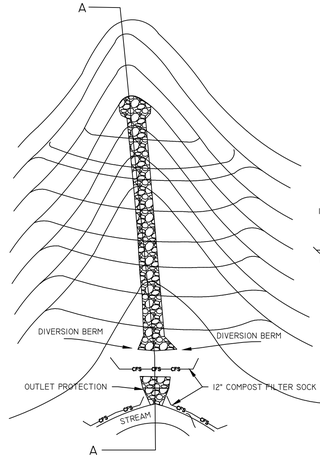
1. NATIVE BACKFILL MATERIAL AND FILL TO BE COMBINED WITH RIPRAP FOR THE INTEGRATED ROCK COMPACTED LAYER SHALL BE FREE OF ROOTS, STUMPS, WOOD, RUBBISH, STONES GREATER THAN 6 , FROZEN OR OTHER OBJECTIONABLE MATERIALS. FILL MATERIAL MUST BE APPROVED BY THE CONSTRUCTION MANAGER PRIOR TO PLACEMENT AND SHALL CONFORM TO UNIFIED SOIL CLASSIFICATION GC, SC, CH, OR CL AND MUST HAVE AT LEAST 30% PASSING THE #200 SIEVE.

2. COMPACTION - THE MOVEMENT OF THE HAULING AND SPREADING EQUIPMENT OVER THE FILL SHALL BE CONTROLLED SO THAT THE ENTIRE SURFACE OF EACH LIFT SHALL BE TRAVERSED BY NOT LESS THAN ONE TREAD TRACK OF HEAVY EQUIPMENT OR COMPACTION SHALL BE ACHIEVED BY A MINIMUM OF FOUR COMPLETE PASSES OF A SHEEPSFOOT ROLLER, RUBBER TIRED ROLLER, VIBRATORY ROLLER, OR EARTHMOVING EQUIPMENT CAPABLE OF APPLYING SUFFICIENT GROUND PRESSURE. FILL MATERIAL SHALL CONTAIN SUFFICIENT MOISTURE SUCH THAT THE REQUIRED DEGREE OF COMPACTION WILL BE OBTAINED WITH THE EQUIPMENT USED. THE FILL MATERIAL SHALL CONTAIN SUFFICIENT MOISTURE SO THAT IF FORMED INTO A BALL IT WILL NOT CRUMBLE, YET NOT BE SO WET THAT WATER CAN BE SQUEEZED OUT. WHEN REQUIRED BY THE REVIEWING AGENCY THE MINIMUM REQUIRED DENSITY SHALL NOT BE LESS THAN 95% OF MAXIMUM DRY DENSITY WITH A MOISTURE CONTENT WITHIN +/-2% OF THE OPTIMUM. EACH LAYER OF FILL SHALL BE COMPACTED AS NECESSARY TO OBTAIN THAT DENSITY, AND IS TO BE CERTIFIED BY THE CONSTRUCTION MANAGER AT THE TIME OF CONSTRUCTION. ALL COMPACTION IS TO BE DETERMINED BY AASHTO METHOD T-99 (STANDARD PROCTOR).

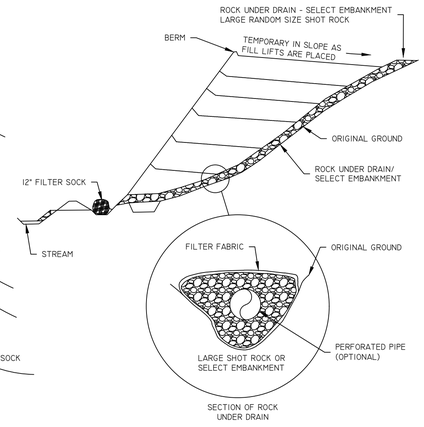
C-2 / C800

## INTEGRATED ROCK DETAIL

NOT TO SCALE




PLAN VIEW




SECTION OF ROCK UNDER DRAIN

SECTION A-A

1. INSTALL TO COLLECT AND CONVEY SURFACE WATER SO THAT EROSION IS MINIMIZED AND SEDIMENT LADEN RUNOFF FROM DISTURBED AREAS.
2. SIGNIFICANT SOURCES OF CLEAN UP SLOPE SURFACE WATER THAT DRAIN ONTO DISTURBED AREAS SHALL BE INTERCEPTED AND CONVEYED TO A STABILIZED DISCHARGE POINT WHERE THE WATER WILL NOT DRAIN BACK ONTO THE DISTURBED AREA.
3. UP SLOPE DIVERSIONS MUST DISCHARGE WHERE THERE CAN BE NO DAMAGE TO ADJACENT LAND.
4. SURFACE WATER CONTROLS SHALL BE INSTALLED CONCURRENTLY WITH ROUGH GRADING.
5. THE ROCK UNDER DRAIN MUST BE STARTED PRIOR TO INITIAL FILL PLACEMENT.
6. POSITIVE DRAINAGE AND/OR DIVERSIONS MUST BE MAINTAINED AT ALL TIMES TO
7. DIRECT RUNOFF TOWARDS THE ROCK UNDER DRAIN CHANNEL.
8. THE ROCK UNDER DRAIN IS CONSTRUCTED LIKE A HUGE FRENCH DRAIN.
9. ROCK FOR THE UNDER DRAIN OR WICK SHALL CONSIST OF DURABLE SHOT ROCK, SELECT EMBANKMENT OR LARGE RIPRAP WITH LITTLE OR NO FINE MATERIAL.
10. THE ROCK CORE MUST BE WRAPPED IN A SUITABLE FILTER FABRIC GEOTEXTILE TO PREVENT SOIL FINES FROM CLOGGING THE VOIDS.
11. MAINTENANCE FOR THIS PRACTICE IS THAT IT IS TO BE INSPECTED ONCE A WEEK OR IMMEDIATELY AFTER EACH 0.5-INCH OR GREATER RAIN EVENT.
12. POSITIVE DRAINAGE TOWARDS THE CONVEYANCE(S) MUST BE MAINTAINED AT ALL TIMES.
13. NOTE THE USE OF THE FILL WITH ROCK UNDER DRAIN MAY NOT BE APPROPRIATE IN ALL CASES AND SHOULD BE REVIEWED BY A GEOTECHNICAL ENGINEER.

C-3 / C800

## FILL WITH ROCK UNDER DRAIN

NOT TO SCALE

### REVISIONS

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### LEGEND

### NOTES

### SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

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STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

CONSTRUCTION DETAILS

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| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: C800 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

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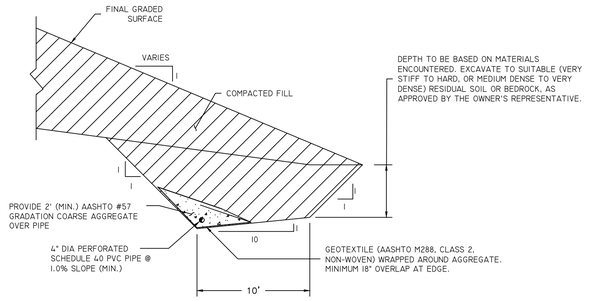
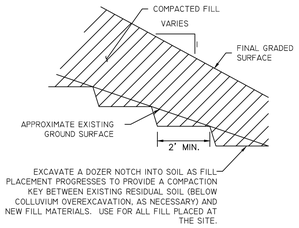


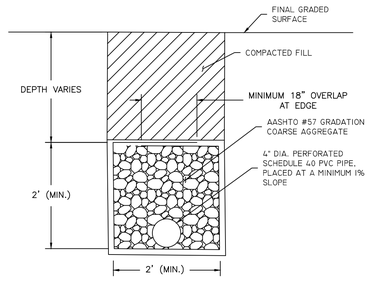

NOTES:

1. OUTLET FILL FOUNDATION KEY DRAIN BEYOND THE LIMITS OF NEW FILL USING SUBSURFACE DRAIN INSTALLED AT LOCATIONS SHOWN ON PLAN.
2. DEEPER FILL KEYS (IF REQUIRED) SHOULD TRANSITION GRADUALLY INTO SHALLOWER FILL KEYS.
3. KEY DRAINS SHOULD OUTLET BEYOND THE LIMITS OF THE NEW FILL AND TO A STABLE AREA.

## DETAIL 1
## TYPICAL FILL FOUNDATION KEY

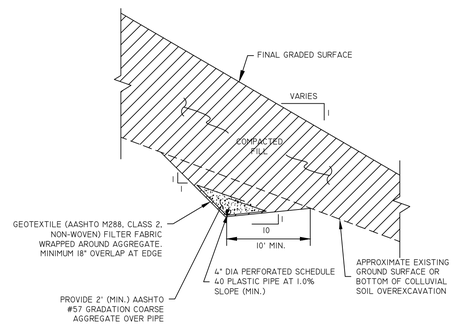



## DETAIL 2
## TYPICAL COMPACTION KEY




NOTE:
INSTALL SUBSURFACE DRAINS AT LOCATIONS SHOWN ON PLAN (TO OUTLET FILL FOUNDATION KEY DRAINS) AND AT SEEPAGE AREAS ENCOUNTERED DURING CONSTRUCTION. OUTLET DRAINS BEYOND LIMITS OF NEW FILL OR CONNECT TO FILL KEY DRAINS.

## DETAIL 3
## TYPICAL SUBSURFACE DRAIN



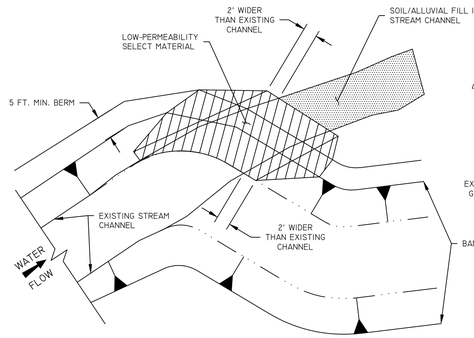

## DETAIL 4
## TYPICAL INTERMEDIATE KEY

### EARTHWORK NOTES

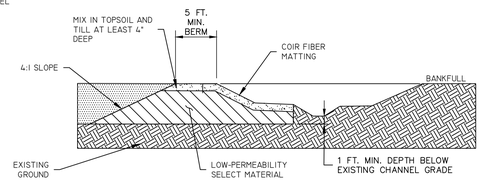
1. CONSTRUCT FILL FOUNDATION AND INTERMEDIATE KEYS AS NEEDED FOR SIGNIFICANT FILLS AND IN ACCORDANCE WITH DETAIL 1 & 4. OUTLET FILL FOUNDATION AND INTERMEDIATE KEY DRAIN USING THE SUBSURFACE DRAIN INSTALLED AT LOCATIONS SHOWN ON PLAN AND IN ACCORDANCE WITH DETAIL 3. INSTALL ADDITIONAL SUBSURFACE DRAINS, AS NECESSARY, IN ACCORDANCE WITH DETAIL 3. FINAL KEY AND DRAIN LOCATIONS MAY BE MODIFIED BY THE OWNER'S REPRESENTATIVE BASED ON CONDITIONS ENCOUNTERED.
2. REFER TO EROSION AND SEDIMENTATION CONTROL PLAN CONSTRUCTION SEQUENCE FOR REMOVAL OF TOPSOIL PRIOR TO FILL PLACEMENT.
3. NEW FILL SHALL BE FREE OF TOPSOIL, ROOTS, ROOT BALLS, BRUSH, GRASS, AND OTHER DELETERIOUS MATERIALS.
4. SOIL FILL MATERIALS FOR BULK EARTHWORK STOCKPILES AND FILL FOUNDATION KEY CONSTRUCTION AT LOCATIONS SHOWN SHOULD CLASSIFY AS GW, GP, GM, GC, SW, SP, SM, SC, ML, OR CL ACCORDING TO THE UNITED SOILS CLASSIFICATION SYSTEM (USCS). USCS CLASSIFICATION CH (FAT CLAY) SOIL SHALL BE BLENDED WITH ROCK OR AMENDED WITH LIME PRIOR TO PLACING AS NEW FILL. PLACE SOIL FILL IN MAXIMUM 8 INCH LOOSE LIFTS, AND COMPACTED TO VISIBLE NON-MOVEMENT USING A HEAVY SEGMENTED PAD COMPACTION EQUIPMENT. THE FILL THE FILL SHOULD BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY UNIT WEIGHT AND WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT ACCORDING TO THE MODIFIED PROCTOR TEST (ASTM 1557). BLEND SOIL WITH LIME AS NECESSARY TO REDUCE THE MOISTURE CONTENT.
5. FIELD MODIFY FINAL GRADES BASED ON FIELD CONDITIONS TO ACHIEVE A BALANCED SITE AS DIRECTED BY OWNER'S FIELD REPRESENTATIVE.

C-4
C801

GEOTECHNICAL DETAILS
NOT TO SCALE




## PLAN




## SECTION

NOTES:

1. LOW PERMEABILITY PLUG TO BE PLACED WHERE THERE IS A SIGNIFICANT POTENTIAL FOR SUBSURFACE PIPING OR GROUNDWATER FLOW AWAY FROM THE PROPOSED STREAM CHANNEL (E.G., OPEN OR BACKFILLED EXISTING CHANNELS ADJACENT TO PROPOSED CHANNELS)
2. BEFORE WRAPPING PLUG WITH COIR FIBER MATTING, MIX IN TOPSOIL AND TILL INTO AT LEAST THE UPPER 4" TO HELP VEGETATION TO ESTABLISH.
3. RAKE SOIL LEVEL AND ADD TEMPORARY AND PERMANENT SEED AND MULCH BEFORE INSTALLING COIR FIBER MATTING.

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LOW PERMEABILITY PLUG
NOT TO SCALE

| REVISIONS | | | |
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LEGEND

NOTES

SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C. PAROLA PROFESSIONAL ENGINEER

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STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

CONSTRUCTION DETAILS

| | |
|---|---|
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| APPROVED BY: | SY |
| DATE: | JANUARY 21, 2019 |

PENNSYLVANIA
SUSQUEHANNA COUNTY WAYNE COUNTY

SHEET: C801
FILE NO: 0217-014-004

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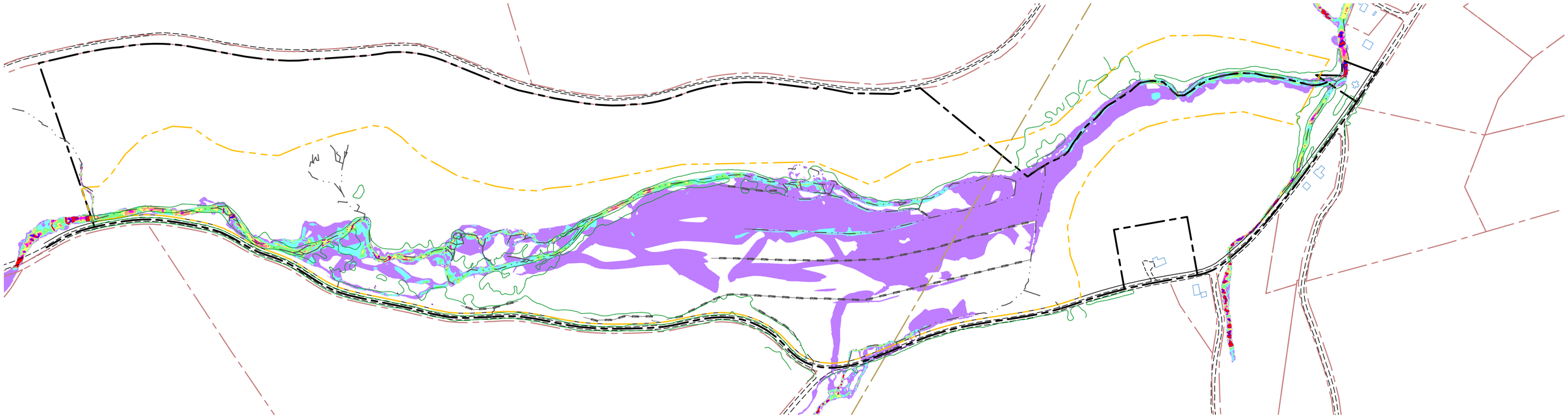
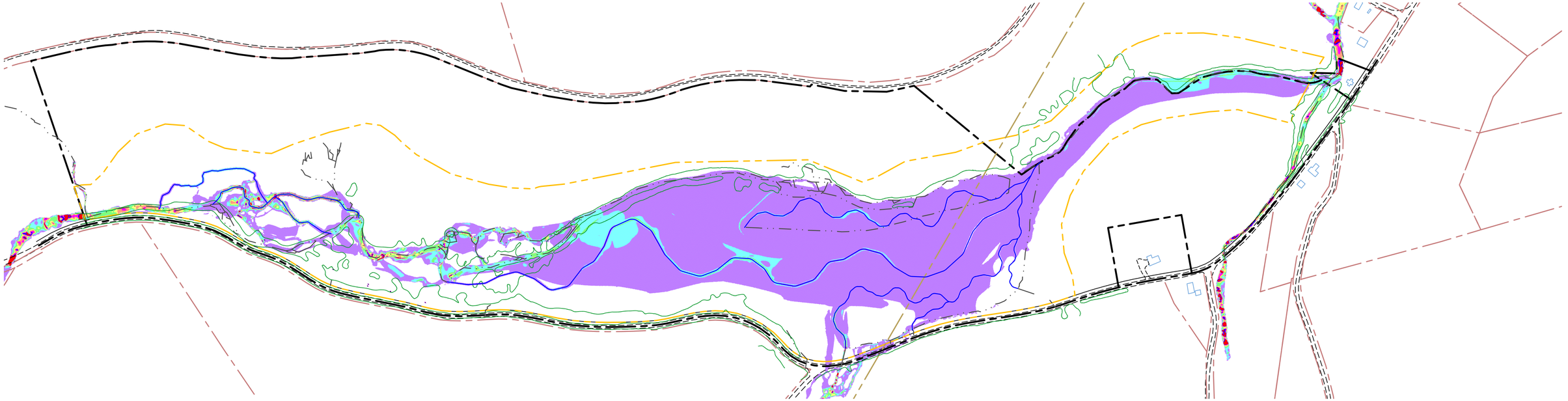


Q2YR EXISTING CONDITIONS
SHEAR STRESS MODEL



Q2YR PROPOSED CONDITIONS
SHEAR STRESS MODEL

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## LEGEND

SHEAR STRESS TABLE

| NUMBER | MINIMUM STRESS | MAXIMUM STRESS | COLOR |
|---|---|---|---|
| 1 | 0.000 | 0.500 | |
| 2 | 0.500 | 1.000 | |
| 3 | 1.000 | 1.500 | |
| 4 | 1.500 | 2.000 | |
| 5 | 2.000 | 2.500 | |
| 6 | 2.500 | 3.000 | |
| 7 | 3.000 | 3.500 | |
| 8 | 3.500 | >3.500 | |

## NOTES

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PE 082572 ARTHUR C.
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ENGINEER

## SCALE

0 400 800 1600 Feet

SCALE: 1" = 250'


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STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

Q2YR SHEAR STRESS MODELS

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
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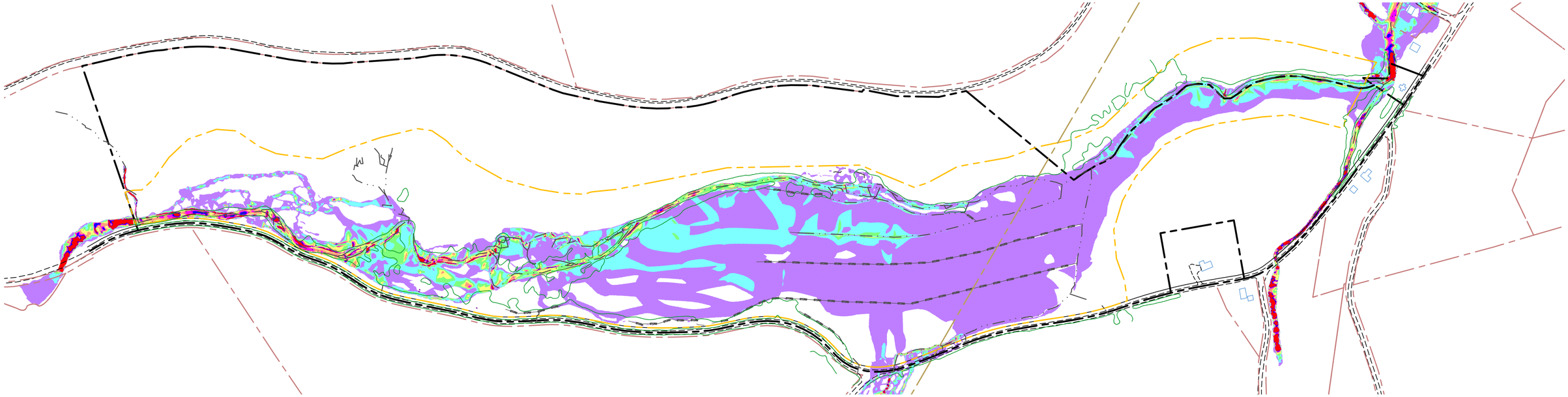
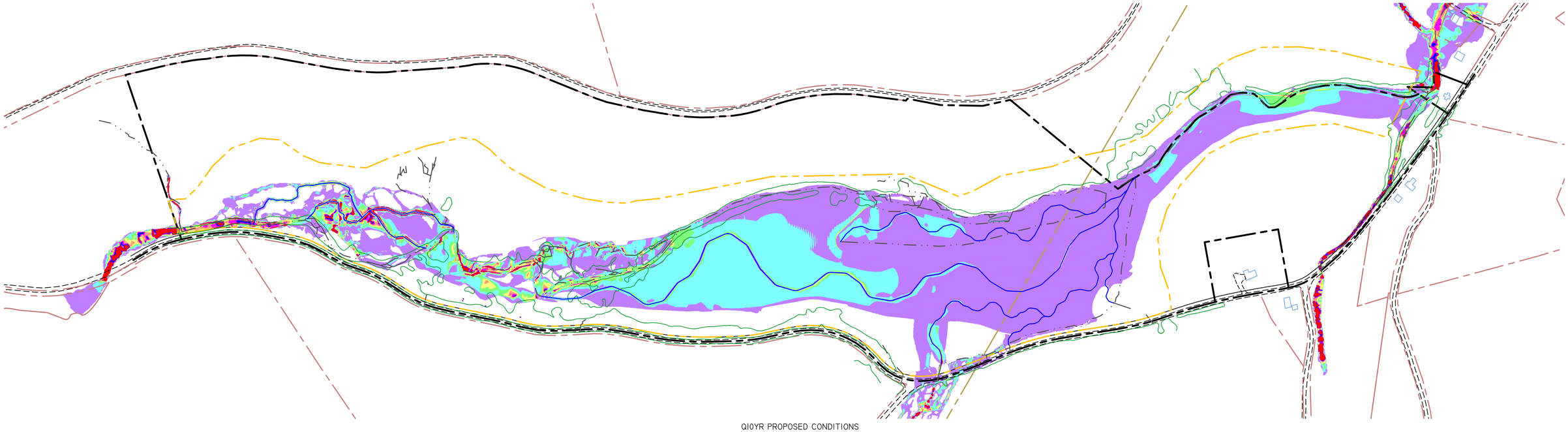


Q10YR EXISTING CONDITIONS
SHEAR STRESS MODEL



Q10YR PROPOSED CONDITIONS
SHEAR STRESS MODEL

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|---|---|---|---|
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| 4 | 1.500 | 2.000 | |
| 5 | 2.000 | 2.500 | |
| 6 | 2.500 | 3.000 | |
| 7 | 3.000 | 3.500 | |
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SCALE: 1" = 250'


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Q10YR SHEAR STRESS MODELS

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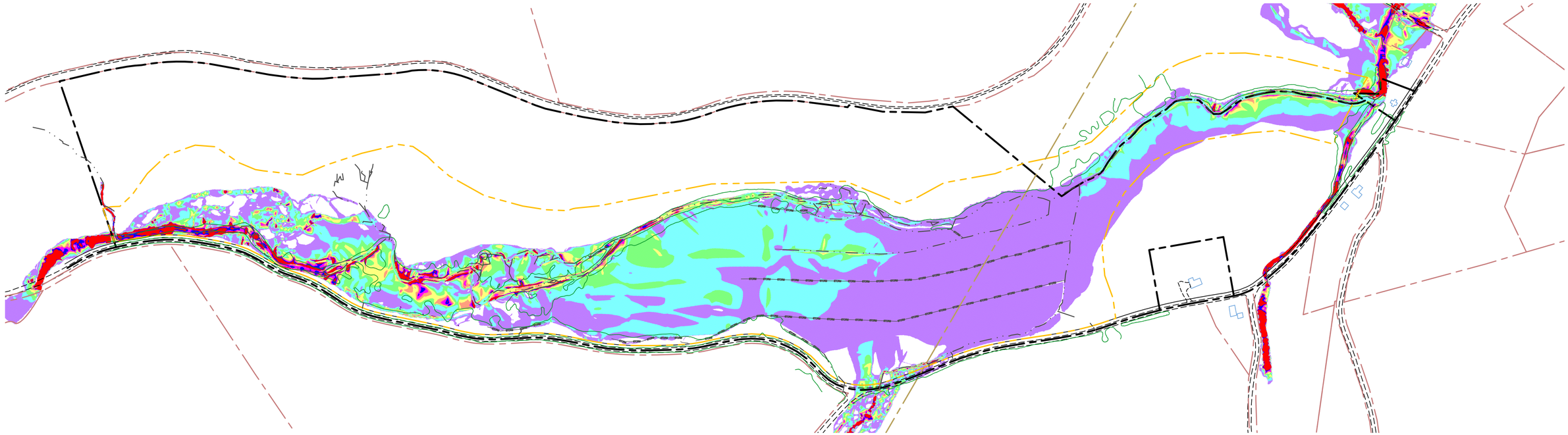
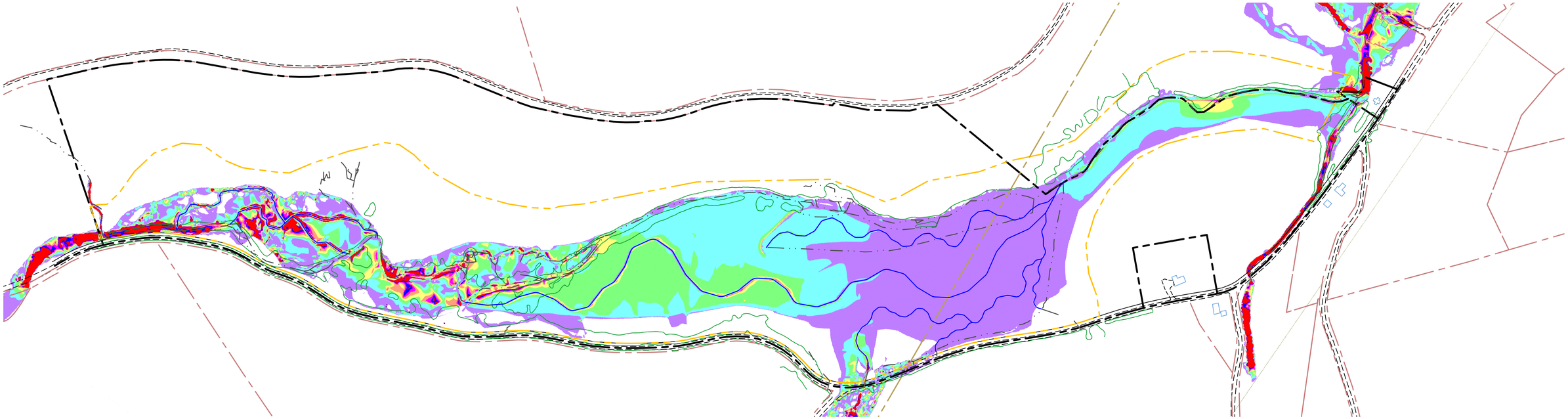


Q100YR EXISTING CONDITIONS
SHEAR STRESS MODEL



Q100YR PROPOSED CONDITIONS
SHEAR STRESS MODEL

## REVISIONS

| NO. | DESCRIPTION | DATE | BY |
|---|---|---|---|
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## LEGEND

SHEAR STRESS TABLE

| NUMBER | MINIMUM STRESS | MAXIMUM STRESS | COLOR |
|---|---|---|---|
| 1 | 0.000 | 0.500 | |
| 2 | 0.500 | 1.000 | |
| 3 | 1.000 | 1.500 | |
| 4 | 1.500 | 2.000 | |
| 5 | 2.000 | 2.500 | |
| 6 | 2.500 | 3.000 | |
| 7 | 3.000 | 3.500 | |
| 8 | 3.500 | >3.500 | |

## NOTES

## SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ARTHUR C. PAROLA
ENGINEER
No. PE 082572

PE 082572 ARTHUR C.
PAROLA PROFESSIONAL
ENGINEER

## SCALE

0 250 500 1000 Feet

SCALE: 1" = 250'


RESOURCE ENVIRONMENTAL SOLUTIONS
33 TERMINAL WAY, SUITE W445A
PITTSBURGH PA 15219
WWW.RES.US
TELEPHONE: (412) 249-2452 EMAIL: SYEAMANS@RES.US


STARRUCCA CREEK MITIGATION BANK
DESIGN PLANS

Q100YR SHEAR STRESS MODELS

| | | | |
|---|---|---|---|
| DRAWN BY: | RD | PENNSYLVANIA | |
| CHECKED BY: | MS | SUSQUEHANNA COUNTY | WAYNE COUNTY |
| APPROVED BY: | SY | SHEET: S102 | FILE NO: 0217-014-004 |
| DATE: | JANUARY 21, 2019 | | |

RiverineSolutions

S:\RES CAD\CAD Workings\0217-STARRUCCA CREEK\Design\DWG\PLANSETS\65%
ARCH FULL BLEED D (24.00 X 36.00 INCHES)

# APPENDIX J
# FINANCIAL ASSURANCES

# NATIONAL FISH AND WILDLIFE FOUNDATION

# AND

# [BANK SPONSOR NAME] - BANK SPONSOR

# [BANK NAME] LONG-TERM FUNDING AGREEMENT

This [Bank Name] Long-Term Funding Agreement ("Agreement") is entered by and between the National Fish and Wildlife Foundation, a Congressionally chartered foundation and District of Columbia non-profit corporation ("Foundation"), and [Banker's Name] ("Bank Sponsor" or "Recipient"), (together, the "Parties," and individually, a "Party"), as of the date of the signature of the last Party to sign (such date, the "Effective Date").

WHEREAS, the Mitigation Bank Instrument ("MBI") for the [Bank Name] ("Bank") sponsored by Bank Sponsor, that was submitted for approval to the United States Army Corps of Engineers [enter name of district office] District ("USACE") requires Bank Sponsor to establish a long-term financing or funding mechanism to provide ongoing payment for specified land management, maintenance, and monitoring of the real property comprising the Bank ("Bank Property") in accordance with the MBI and associated long-term management plan that identifies the specific land management activities that are required to be performed on the Bank Property to improve, conserve, and/or protect the aquatic resources, habitat and other ecological values of the Bank Property ("Long-Term Management Plan"). The Bank Property, comprised of approximately [insert acreage] acres, including [insert type of aquatic resources/habitat/species] will be managed in accordance with the MBI and associated Long-Term Management Plan.

WHEREAS, Bank Sponsor is also the Recipient under this Agreement and is responsible to protect and manage for conservation purposes the Bank Property in accordance with the MBI.

WHEREAS, the Foundation is a charitable non-profit corporation established by the United States Congress in 1984 by the National Fish and Wildlife Foundation Establishment Act, 16 U.S.C. Section 3701 et seq., as amended ("Establishment Act"), and is a tax exempt organization under Section 501(c)(3) of the Internal Revenue Code, and is authorized under the Establishment Act and other laws, to hold and administer funds for the long-term management and maintenance of mitigation lands and mitigation and conservation bank properties.

WHEREAS, the MBI provides for the establishment of a fund to pay the costs of the long-term management and maintenance of the Bank Property ("LTMM Fund") to be held and managed by the Foundation in trust as a neutral fiduciary.

WHEREAS, the MBI incorporates by reference and attaches this Agreement and the USACE's approval of the MBI constitutes its approval of this Agreement as the document governing the intent, uses, benefits, purposes, and duration of the LTMM Fund, and the terms and conditions under which it will be established, held, and administered by the Foundation.

NOW, THEREFORE, in consideration of the mutual promises made herein, and for other and further consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

## I. PURPOSES

A. The purposes of this Agreement are to establish an LTMM Fund for the Bank to be held by the Foundation in trust for the benefit of the Bank Property, and to set forth the Parties' respective responsibilities with respect to the funds to be held in and administered from the LTMM Fund.

B. If and to the extent the funds are subject to the Uniform Prudent Management of Institutional Funds Act ("UPMIFA"), this Agreement is the record under which the funds are transferred to, and held by, the Foundation, and as such shall be considered the "gift instrument" for purposes of UPMIFA. As reflected by its incorporation into the MBI, this Agreement shall be deemed in all respects to set forth the USACE's approval as to the intent, uses, benefits, purposes, and duration of the LTMM Fund.

## II. ACCOUNT ESTABLISHMENT, INVESTMENT, AND ADMINISTRATION

A. This Agreement, through its approval under the MBI, authorizes the Foundation to hold the LTMM Fund as requested by and received from the Bank Sponsor, in the amount of [insert amount] ($00.00) in [2019 or applicable year] dollars, to be deposited in installments, as described in Section [insert number] of the MBI, until full funding of the amount, to be held in trust for the long-term, perpetual management, maintenance, and monitoring of the Bank Property, in accordance with the MBI, including this Agreement, the Long-Term Management Plan, and the associated "Property Analysis Record" of the costs of perpetual long-Term management, maintenance, and monitoring of the Bank Property ("Endowment Assessment"), dated [insert date], all of which have been approved by the USACE as part of the MBI.

B. The Foundation shall deduct a single, one-time payment of Three Thousand Four Hundred dollars ($3,400) at the time of deposit from the deposit amount itself (if not paid otherwise by the Bank Sponsor) for the establishment of a uniquely identifiable financial account constituting the LTMM Fund. The Parties agree, as soon as practicable after the Foundation's receipt of funds for deposit into the LTMM Fund, to invest the funds in accordance with the Foundation's prevailing Investment Policy Statement for Long-Term and "Quasi-Endowment" Land Management, Maintenance and Monitoring Funds Accounts Held by the National Fish and Wildlife Foundation, the current version of which is attached hereto as Attachment A and as the same may be modified from time to time in accordance with its terms. The Recipient shall have no right or responsibility with respect to the investment or financial management of the LTMM Fund under this Agreement or otherwise.

C. The LTMM Fund shall be subject to an annual fee of one percent (1%) ("Annual Fee") of the LTMM Fund's balance for the Foundation's annual administration, operation, reporting, and accounting of the LTMM Fund. The Foundation shall assess and collect the Annual Fee either quarterly or annually, in either case at the Foundation's election, during each year in which the account is in existence. The Foundation shall collect the Annual Fee by deducting it from the balance of the LTMM Fund.

D. The Foundation shall submit to the Recipient and to the USACE an activity report for the LTMM Fund by March 15 of each calendar year the LTMM Fund is in existence. In each activity report, the Foundation shall report on the balance of the LTMM Fund at the beginning of the calendar year; deposits; disbursements; fees; earnings, gains, losses and other investment activity accruing to the LTMM Fund during the previous calendar year; administrative expenses; the balance of the LTMM Fund at the end of the calendar year; and the specific asset allocation percentages of the portfolio in which the LTMM Fund funds is invested. If requested, the Foundation shall also provide to the USACE a copy of its most recent financial statement as prepared by an independent auditor.

E. Disbursements from the LTMM Fund shall be made in accordance with Section IV of this Agreement, entitled Recipient Land Management. If the MBI authorizes the USACE to (1) direct or approve in writing a different form or mechanism for disbursements from the LTMM Fund; (2) specify an increase or decrease in the amount to be disbursed from the LTMM Fund to the Recipient; and/or (3) direct the Foundation to administer the LTMM Fund in a manner that differs from the terms and conditions of this Agreement, and the USACE provides written notice to Bank Sponsor directing the foregoing, Bank Sponsor agrees to promptly provide a written copy of such notice to the Foundation. The Bank Sponsor and the Foundation further agree and acknowledge that the Foundation shall be obligated to follow such written direction or approval of the USACE and shall, upon receipt of any such written notice from Bank Sponsor, make disbursements in accordance with the USACE's specifications.

## III. FOUNDATION'S FIDUCIARY OBLIGATIONS AND LIMITATIONS ON LIABILITY

A. The Foundation shall have a duty of loyalty to the Bank Property with respect to the LTMM Fund, and shall not use or borrow against funds in the LTMM Fund for its own benefit, except for assessment and collection of the fees due to the Foundation or its financial institutions, or as otherwise approved, permitted or directed by the USACE pursuant to this Agreement.

B. The Foundation shall not be liable to the USACE, the Bank Sponsor, the Recipient, or any other entities or persons for losses arising from investment of funds in the LTMM Fund that is consistent with this Agreement.

## IV. RECIPIENT LAND MANAGEMENT

A. Performance of Land Management Activities. The Recipient has agreed to perform the specific land management activities set forth in the Long-Term Management Plan that are required to be performed on the Bank Property to improve, conserve, and/or protect the habitat and other

ecological values of the Bank Property ("Land Management Activities") on the Bank Property as part of its obligations under the MBI. Funding to pay the costs of the Land Management Activities shall be provided in accordance with the terms and conditions set forth below. If, at any time, the Long-Term Management Plan, the Land Management Activities, the Endowment Assessment, or Endowment Payment Schedule (as such term is defined below) is amended or otherwise modified as permitted by the MBI, then:

1. The Recipient shall immediately notify the Foundation in writing of such amendment or modification;

2. The Recipient shall transmit to the Foundation as soon as practicable the amended Long-Term Management Plan, Land Management Activities, Endowment Assessment, or Endowment Payment Schedule, as applicable, along with the corresponding written approval by the USACE of each such amended document; and

3. Any amended Long-Term Management Plan, Land Management Activities (and associated costs), Endowment Assessment, and Endowment Payment Schedule, as approved by the USACE, shall upon receipt by the Foundation supersede and replace their original counterparts, and shall thereafter govern as the "Long-Term Management Plan," "Land Management Activities," "Endowment Assessment," and "Endowment Payment Schedule" under this Agreement.

B. Funding for Land Management Activities. The Foundation hereby agrees to disburse funds from the LTMM Fund to the Recipient to pay the costs of Recipient's performance of the Land Management Activities on the Bank Property, upon the terms and conditions set forth below.

C. Scope of Services to be Performed. The Recipient will perform the Land Management Activities as set forth in the Long-Term Management Plan and the Endowment Assessment. The Recipient will pay for the costs of such Land Management Activities using the funds disbursed to it under this Agreement. The Parties agree and acknowledge that the Long-Term Management Plan and the Endowment Assessment were created by or on behalf of the Bank Sponsor and approved by the USACE. The Foundation is expressly entitled to rely on the validity of the USACE approval and the accuracy and validity of the Long-Term Management Plan and the Endowment Assessment without independent verification. The Foundation shall not be liable in any respect to the USACE, the Recipient, or to any other entities or persons, for errors, omissions, inaccuracies, or other elements of the Long-Term Management Plan or the Endowment Assessment, whether contained therein or omitted therefrom, including but not limited to the sufficiency or adequacy of the LTMM Fund calculated pursuant to the Endowment Assessment. The Parties agree and acknowledge that the Recipient is required to perform Land Management Activities on the Bank Property under the MBI only to the extent funds are made available to the Recipient under this Agreement to pay for performance of such Land Management Activities. In addition, in the event an amendment is made to the Long-Term Management Plan that changes the Land Management Activities identified in the Endowment Assessment or Endowment Payment Schedule, thereby requiring an amendment to the Endowment Assessment, the Foundation shall not be liable to USACE, the Recipient, or to any other entities or persons for any decision by USACE to approve the amendment to the Endowment

Assessment or the Endowment Payment Schedule in any way that impairs the viability of the LTMM Fund as a source of perpetual funding for the Land Management Activities on the Bank Property.

D. Payment.

1. *Payment in the Ordinary Course*.

a. Unless approved otherwise by the USACE in writing, the Foundation shall not make any disbursement of funds from the LTMM Fund unless and until it receives from the Bank Sponsor a copy of the USACE's written confirmation that performance standards have been attained and the LTMM Fund has been fully funded for a period of at least three (3) years. The Foundation's receipt of USACE's written confirmation (or other written approval) in this respect is an express condition precedent to the Foundation's initial disbursement of funds from the LTMM Fund.

b. In consideration of the Land Management Activities to be performed by the Recipient, the Foundation shall disburse to the Recipient from the LTMM Fund annual, advance payments (each such payment, an "Endowment Payment") which the Recipient shall use to pay the costs of Land Management Activities to be performed by the Recipient throughout the forthcoming calendar year. Unless the USACE directs or approves otherwise in a written instrument delivered to the Foundation, each Endowment Payment will be made for the amount requested by the Recipient in a written payment request (hereinafter, a "Payment Request") submitted to the Foundation pursuant to this Section D (as adjusted by a measure of inflation as described below in this subsection). Each Payment Request is subject to a maximum annual dollar limit calculated as the total dollar value of Land Management Activities, exclusive of any contingency amount or any incremental amount for non-annual work items (the funds for such non-annual work items to be paid in full in the calendar year immediately preceding the calendar year in which the applicable work item is to be performed), for the applicable calendar year as set forth in the Endowment Assessment. An Endowment Payment Schedule (as hereinafter defined) created and/or approved by the Recipient and approved by the USACE reflecting the foregoing, i.e., the total dollar value of Land Management Activities for each calendar year, including annual and applicable non-annual occurrence expenses, exclusive of any contingency amount, set forth in the Endowment Assessment ("Endowment Payment Schedule"), is attached to this Agreement as Attachment B, and incorporated herein by reference. Payment Requests shall be made in accordance with the Endowment Payment Schedule except as otherwise provided in this Agreement. Each Endowment Payment shall be adjusted by a measure of inflation over the period of time since the Endowment Assessment was completed. The measure of inflation shall be calculated using the United States Department of Labor's Bureau of Labor Statistics' Consumer Price Index – [insert applicable region CPI], or the successor of such index over the same period of time.

c. The Recipient must submit to the Foundation the written confirmation specified in Section IV.D.1.a. (or the Foundation must have received another applicable written approval from the USACE) on or before the date of its first Payment Request. The Recipient must submit to the Foundation a Payment Request between July 1 and November 15 of a calendar year in order to receive an Endowment Payment to fund Land Management Activities in the immediately following calendar year. Absent the express written approval of the USACE, the Recipient will not be eligible to receive an Endowment Payment for the immediately forthcoming calendar year if the Recipient has failed to submit to the Foundation a Payment Request between July 1 and November 15 of the then-current calendar year. The Foundation will disburse Endowment Payments in December for Payment Requests properly submitted to the Foundation in the period from the immediately prior July 1 through November 15.

d. The Recipient shall submit all Payment Requests via email, fax, or mail to the Foundation. In the event an alternate method of requesting payment becomes available in the future, such as an online payment request system, the Foundation will notify the Recipient and provide appropriate instructions. All Payment Requests must include a written statement by the Recipient that (1) the Endowment Payment will be used exclusively for payment of expenses of Recipient for Land Management Activities and (2) the Recipient reasonably expects the Land Management Activities specified in the Endowment Assessment for the applicable calendar year to be actually necessary in that year.

2. *USACE Suspension or Reduction of Payments for Performance Reasons*. In accordance with the terms of the MBI, the USACE may conduct periodic site visits and/or other evaluations of the Bank Property in order to monitor the progress and effectiveness of Land Management Activities performed by the Recipient. If at any time the USACE determines that the Land Management Activities are not being performed in a satisfactory manner (including, without limitation, that the Land Management Activities are not being performed in accordance with the Long-Term Management Plan or applicable laws or regulations), the USACE may issue a written stop-payment notice (hereinafter a "Stop Payment Notice") to the Foundation. A Stop Payment Notice will instruct the Foundation either to suspend or reduce Endowment Payments to the Recipient until the Foundation is otherwise notified in writing by the USACE. The Foundation shall be entitled to rely on any Stop Payment Notice received from the USACE and shall be obligated to follow the instructions contained therein. The Foundation shall not be liable in any manner to the Recipient or to any other entities or persons by virtue of following the instruction of the USACE contained in any Stop Payment Notice. Upon issuing a Stop Payment Notice, the USACE may appoint a replacement Recipient ("Replacement Recipient") in accordance with Section IV.D.6. below.

3. *USACE Suspension or Reduction of Payments for Financial Reasons.* From time to time the Foundation's financial advisors may advise that the LTMM Fund has decreased to levels that may threaten its continued existence as a source of perpetual funding for Land Management Activities, whether due to unexpected investment performance or otherwise.

The Foundation shall notify the USACE and Recipient of any such appraisal and upon receipt of such notice, the Recipient shall propose appropriate modifications to continued Endowment Payments and associated Land Management Activities, if any, in order to protect the long-term viability of the LTMM Fund. The USACE will approve or disapprove such proposal and shall so notify the Recipient and Foundation in writing. The Foundation will be obligated to follow the written response of the USACE with respect to any such modifications. Neither the Foundation nor the Recipient shall be liable in any manner to the USACE or any other entities or persons by virtue of following the approval of the USACE contained in any notice issued under this Subsection 3.

4. *One-time Payments.* Whether upon request by the Recipient or otherwise, the USACE may give approval to the Foundation in writing to disburse a specific amount of funding from the LTMM Fund not contemplated by the Long-Term Management Plan or Endowment Assessment to the Recipient so that the Recipient may perform an activity, or activities, which the USACE determines to be consistent with the management of the Bank Property. The Foundation will disburse any such one-time payment within thirty (30) business days of receipt of the USACE's approval. A one-time payment may fund, but is not necessarily restricted to, activities in response to a catastrophic event (e.g., recovery after a fire), and/or a specific amount of funding from the contingency amount in the LTMM Fund. Upon receipt of such one-time payment, the Recipient shall, as soon as practicable, perform whatever activity, or activities, the one-time payment is intended to fund as directed or approved by the USACE. The Recipient and the Foundation hereby acknowledge that any approval by the USACE under this Subsection 4 for the Foundation to disburse a one-time payment not contemplated by the Long-Term Management Plan or Endowment Assessment may impair or preclude the viability of the LTMM Fund as a source of perpetual funding for the Land Management Activities on the Bank Property. Neither the Foundation nor the Recipient shall be liable to the USACE or to any other entities or persons for any decision by the USACE to direct a one-time payment under this Subsection 4 that impairs the viability of the LTMM Fund as a source of perpetual funding for the Land Management Activities on the Bank Property.

5. *Overages in Payments.* Any portion of an Endowment Payment that remains unspent and unobligated by the Recipient as of the end of the calendar year for which such amount was paid shall be deemed an "overage" for purposes of this subsection. Any overage shall be (a) retained and accounted for by the Recipient; (b) used by the Recipient exclusively for payment of costs of the immediately following year's Land Management Activities; (c) reflected as a deduction from the amount of the Payment Request submitted by the Recipient for the immediately following year; and (d) deducted from the amount of the Endowment Payment made by the Foundation for such following year.

6. *USACE Assignment of Replacement Recipient.* The USACE may (a), pursuant to Section IV.D.2. above, issue a Stop Payment Notice that requires the appointment of a Replacement Recipient, which Replacement Recipient shall be identified by USACE in consultation with Permittee; or (b) at the request of Bank Sponsor or Recipient, as applicable, approve the appointment of a Replacement Recipient proposed by Bank Sponsor or Recipient in the

absence of the issuance of a Stop Payment Notice. Any Replacement Recipient duly appointed through action of USACE and Bank Sponsor or Recipient, as applicable, shall assume the rights and responsibilities of the "Recipient" hereunder, including but not limited to the right to receive Endowment Payments and other payments under this Agreement and the obligation to perform the Land Management Activities. In the event the USACE appoints or approves the appointment of a Replacement Recipient, written notification of the Replacement Recipient will be provided by the USACE to the Foundation, the Bank Sponsor, Recipient, the Replacement Recipient, and the Conservation Easement Grantee, if any. The Foundation shall have no obligation to make disbursements from the LTMM Fund to the Replacement Recipient unless and until: 1) Replacement Recipient executes an assignment and assumption agreement with the Recipient that is acceptable to the Foundation whereby: a) the Recipient assigns and otherwise transfers in all respects to Replacement Recipient all rights, obligations, title and interest held by the Recipient in this Agreement; and b) the Replacement Recipient agrees to accept such Assignment and assume all rights, obligations, title, and interest of the Recipient Replacement; or 2) this Recipient Agreement is terminated and Replacement Recipient enters into a substitute Recipient Agreement with the Foundation.

E. Review and Reporting Requirements. The Recipient shall submit to the Foundation and the USACE an annual funding report ("Annual Funding Report") for each calendar year this Agreement is in effect. Each Annual Funding Report shall be submitted by the Recipient between January 1 and January 31, or at least thirty (30) days prior to the effective date of termination of this Agreement. The Annual Funding Report shall (1) describe in reasonable detail the Land Management Activities performed by the Recipient during the immediately preceding calendar year or in the event of termination the then-current calendar year (in either case, the "Reporting Period"); (2) detail all expenses incurred by or on behalf of the Recipient for Land Management Activities performed during the Reporting Period; (3) describe any discrepancy between the Land Management Activities expected to be performed during the Reporting Period in accordance with the Long-Term Management Plan and the Endowment Assessment and the Land Management Activities actually performed during the Reporting Period; and (4) describe any discrepancy between the costs of Land Management Activities as modeled in the Endowment Assessment and the costs of Land Management Activities actually performed during the Reporting Period.

The Parties expressly agree and acknowledge that the Foundation is entitled to rely on the accuracy and validity of the Annual Funding Reports submitted by the Recipient and shall have no duty to independently verify the information set forth therein. The Parties further agree and acknowledge that, except as otherwise expressly permitted or required by this Agreement, the Foundation shall have neither the right nor the obligation to reduce, suspend, or otherwise modify Endowment Payments based on the contents of any Annual Funding Report, and that any remedial action under this Agreement or otherwise with respect to Endowment Payments based on the contents of any Annual Funding Report shall be the exclusive right and/or obligation of the USACE.

F. Compliance with Laws; Indemnification.

1. In conducting the Land Management Activities and performing its obligations under this Agreement, the Recipient agrees to conduct all such activities in compliance with all applicable Federal, State, and local laws, regulations, and ordinances; and to secure all appropriate and necessary public or private permits, approvals, and consents.

2. The Foundation and Recipient shall indemnify and hold harmless each other, and their respective officers, directors, agents, representatives, and employees in respect of any and all claims, injuries, losses, diminution in value, damages, liabilities, whether or not currently due, and related expenses (including without limitation, settlement costs and any legal or other expenses for investigating or defending any actions or threatened actions) arising from or in connection with any breach by the indemnifying Party of its obligations under this Agreement (including, in the case of the Recipient, of its obligation to perform the Land Management Activities).

3. The terms of this Section IV will survive termination of this Agreement.

## V. TERM, TERMINATION, AND TRANSFER

A. This Agreement shall continue in full force and effect unless and until terminated by either Party, which termination shall be effective on the date specified by either party in a written notice delivered to the other party not less than one hundred eighty (180) days prior to the intended date of termination. Notwithstanding the immediately preceding sentence, regardless of the date that notice of termination is provided and the passage of the intervening minimum one hundred eighty (180) day notice period, termination is not effective unless and until the Foundation has transferred in an orderly fashion the custody, control or other power necessary for the investment, management, and administration of all the funds in the LTMM Fund (other than funds in an amount equal to any fees due and owing to the Foundation or its financial institutions) to an entity identified or approved in writing by the USACE.

B. Prior to the effective date of termination of this Agreement, the Foundation shall transfer all funds remaining in the LTMM Fund, other than fees due and owing to the Foundation or its financial institutions, to an entity designated by the USACE to serve as a successor.

C. Within ninety (90) days following final disbursement of the funds in the LTMM Fund to any successor, the Foundation shall provide to the Recipient and the USACE a final financial activity report on the Account.

## VI. CONTACT INFORMATION AND COMMUNICATIONS

A. All approvals, notices, reports, and other communications required or permitted under this agreement shall be in writing and delivered by first-class mail, overnight mail, receipt-confirmed facsimile, electronic mail, or electronic PDF format. Each Party agrees to notify the other promptly after any change in name representative, address, telephone, or other contact information.

B. If any notice or communication is required or permitted to be delivered to the USACE hereunder, such notice or communication shall be delivered to the USACE lead contact identified in Section VI.C. below.

C. The individuals named below shall be the representatives of the Bank Sponsor and the Foundation for purposes of this Agreement:

| | |
|---|---|
| Foundation Primary: | Anne Butterfield<br>Senior Manager, Impact-Directed Environmental Accounts<br>National Fish and Wildlife Foundation<br>90 New Montgomery Street, Suite 1010<br>San Francisco, CA 94105<br>Phone: (415) 243-3106<br>Facsimile: (415) 778-0998<br>Email: anne.butterfield@nfwf.org |
| Foundation Alternate: | Jana Doi<br>Manager, Impact-Directed Environmental Accounts<br>National Fish and Wildlife Foundation<br>90 New Montgomery Street, Suite 1010<br>San Francisco, CA 94105<br>Phone: (415) 243-3102<br>Facsimile: (415) 778-0998<br>Email: jana.doi@nfwf.org |
| Bank Sponsor/ Recipient: | Name<br>Title, Organization<br>Address<br>City, State, Zipcode<br>Phone:<br>Facsimile:<br>Email: |
| USACE Lead: | Name<br>Title, Organization<br>Address<br>City, State, Zipcode<br>Phone:<br>Facsimile:<br>Email: |

D. The Parties agree and acknowledge that any change to their respective Representatives as set forth in Section VI.C. above shall not constitute an amendment to this Agreement and may be effected through written notice to the other Party.

## VII. MISCELLANEOUS PROVISIONS

A. If any provision of this Agreement is held to be unlawful or invalid by any court of law with duly established jurisdiction over this Agreement, the Parties intend that the remainder of this Agreement shall remain in full force and effect notwithstanding the severance of the unlawful or invalid provision(s).

B. Except as otherwise provided in this Agreement, this Agreement may be amended only by a written amendment, signed by the Parties, and approved by the USACE. Counterpart originals, facsimile copies, and/or portable document format (pdf) versions of signed amendments are acceptable and will be treated as binding originals, but this Agreement may not be amended via electronic mail.

C. Each of the Parties is acting in its independent capacity in entering into and carrying out this Agreement and not as an agent, employee, or representative of the other Party.

D. The Parties will cooperate in good faith to achieve the objectives of this Agreement and to avoid disputes. The Parties will use good faith efforts to resolve disputes at the lowest organizational level and, if a dispute cannot be so resolved, the Parties will then elevate the dispute to the appropriate officials within their respective organizations.

E. Nothing contained in this Agreement is intended to unlawfully delegate the USACE's duties or to limit the authority of the USACE to fulfill its statutory or regulatory responsibilities.

F. This Agreement shall not be the basis of any claims, rights, causes of action, challenges, or appeals by any person not a Party to this Agreement, except that the Parties acknowledge that the USACE shall have the rights expressly assigned to it hereunder and, for such purposes, shall be an intended third party beneficiary of this Agreement.

G. This Agreement shall be governed by and interpreted in accordance with the laws of the State of [insert name of state], disregarding principles of conflicts of law. Venue for any action arising out of this Agreement shall be in the [name of applicable court] County of [insert name of county], [insert name of state].

H. Any waiver by either Party of any term or provision of this Agreement shall be given in writing. No waiver shall be construed as a waiver of any other provision of this Agreement, nor shall such waiver be construed as a waiver of such provision respecting any other event or circumstance.

I. The headings used in this Agreement are for convenience only and shall not determine or limit the interpretation, construction or meaning of this Agreement.

J. This Agreement may be executed in one or more counterparts, each of which shall be considered an original, but all of which together shall constitute one and the same instrument.

K. This Agreement represents the entire agreement of the Parties with respect to the subject matter hereof and may not be amended, except in writing signed by each Party hereto.

L. Each Party to this Agreement warrants to the other that its respective signatory has full right and authority to enter into and consummate this Agreement and the transactions contemplated hereby.

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their respective authorized representatives, intending to be bound legally.

NATIONAL FISH AND WILDLIFE FOUNDATION

By: _____ Date: _____

Timothy J. DiCintio, Senior Vice President
Impact-Directed Environmental Accounts

BANK SPONSOR/RECIPIENT

Entity/Company Name

By: _____ Date: _____

[Name], [Title]

ACKNOWLEDGED AND APPROVED AS TO FORM:

UNITED STATES ARMY CORPS OF ENGINEERS

By: _____ Date: _____

[Title], [Name of District] District

ATTACHMENT A

Investment Policy Statement for Long-Term and "Quasi-Endowment" Land Management, Maintenance and Monitoring Funds Accounts Held by the National Fish and Wildlife Foundation

ATTACHMENT B

Endowment Payment Schedule

# Mitigation Bank Performance Bond

**Bond No.** _____ **Penal Sum:** $ **XXX,XXX.XX**

**Know All Men By These Presents,**

That we, **First Pennsylvania Resource, LLC of 33 Terminal Way Blvd., Suite 431A Pittsburgh, PA 152197** (hereinafter called the Principal), as Principal, and **RLI Insurance Company** with an office at **8 Greenway Plaza**, **Suite 400 Houston**, **TX 77046**, a corporation duly organized under the laws of the State of Illinois (hereinafter called the "Surety"), as Surety, are held and firmly bound unto either, as evidenced by the signature below, the **Pennsylvania Department of Environmental Protection (PADEP) of 400 Market Street Harrisburg, PA 17101** or the **US Army Corps of Engineers (USACE) of 1000 Liberty Avenue Pittsburgh, PA 15222-4186** (herineafter called the "Obligee"), as Obligee, up to the maximum penal sum of five hundred and ninety thousand one hundred and sixty and 00/100 Dollars ($XXX,XXX.XX) (hereinafter called the "Maximum Penal Sum"), for the payment of which we, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into the PSUMBI with the Obligee, dated the ____ day of ____, 2018, which includes the Mitigation Site Plan for the Codorus Creek Mitigation Bank (the "Mitigation Bank Site") to ensure that aquatic resources will be restored or established on the Mitigation Bank Site, which PSUMBI and Mitigation Site Plan are hereby referred to and made a part hereof as if fully set forth herein.

WHEREAS, the Principal has applied for Permits for such activities from the U.S. Army Corps of Engineers (USACE) and/or the Pennsylvania Department of Environmental Protection (PADEP) to insure full compliance with all the terms and conditions of US Department of Army Permit _____ and/or PADEP Permit _____ (Permits).

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that this bond will not be released in whole or in part until the Principal receives written verification from the IRT that the conditions for release in PSUMBI and Mitigation Site Plan and Permits have been met. If the above bounden Principal shall complete construction of the Mitigation Bank Site and meet the final Performance Standards as defined in PSUMBI and Mitigation Site Plan, including any amendments, and received acknowledgment of such from the IRT, then this obligation shall be null and void; otherwise shall remain in full force and effect, subject, however, to the following conditions:

1) Upon successful completion of construction and approval of an as-built report, the Penal Sum shall be reduced by thirty percent (30%).

2) Obligee will issue a full and final release of this Bond when i) the final Performance Standards, as defined in PSUMBI, are met, or ii) other security, in the amount of and

covering the same obligations stated herein, is posted with the Obligee. This bond will not be released in whole or in part until the Principal receives written verification from the IRT that the conditions for release in the Instrument and Mitigation Site Plan and Permits have been met.

3) The Surety's obligation under this bond shall arise after the Obligee has notified the Principal in their failure to abide by the terms and conditions of PSUMBI. Upon notice of the Principal's Default under PSUMBI, the Surety may take one of the following actions:

    a) Remedy the Default of the Principal to the full satisfaction of the Obligee by a date certain determined by the Obligee, or

    b) Immediately tender to a party or parties identified by the Obligee the portion of the penal sum that the Obligee determines is due and owing and necessary to remedy the Default. In no circumstances shall such a sum be tendered to the Obligee. Any new party or parties identified by the Obligee under this section shall immediately become a Surety or Sureties to this bond. If the Obligee determines that it is unable to identify such a party or parties, the Surety(ies) shall remedy the Default of the Principal under a) of this section.

    c) In the event that the Surety(ies) fail(s) to respond within thirty (30) business days to the Obligee's notice of Default, or to honor commitments to the full satisfaction of the Obligee under a) or b) above of this section, the remaining portion of the full penal sum may, at the election of the Obligee, immediately become due and owing and paid to a party or parties identified by the Obligee. In no circumstances shall such a sum be tendered to the Obligee. Any new party or parties identified by the Obligee under this paragraph shall immediately become a Surety or Sureties to this bond.

4) Surety shall have no obligation to the Principal, the Obligee or any other person or entity for any loss suffered by the Principal, the Obligee or any other person or entity by reason of acts or omission which are or could be covered by the Principal's general liability insurance, products liability insurance, completed operations insurance or any other insurance.

NOTWITHSTANDING ANYTHING CONTAINED IN THE AGREEMENT TO THE CONTRARY, THE LIABILITY OF THE PRINCIPAL AND SURETY UNDER THIS BOND IS LIMITED TO THE TERM BEGINNING THE _____ DAY OF _____, 20__, AND ENDING THE _____ DAY OF _____, 20__, AND ANY EXTENSIONS OR RENEWALS OF THE REFERENCED AGREEMENT SHALL BE COVERED UNDER THIS BOND ONLY WHEN CONSENTED TO IN WRITING BY THE SURETY. IT IS FURTHER AGREED THAT REFUSAL BY THE SURETY TO EXTEND THE TERM OF THIS BOND SHALL NOT CONSTITUTE A DEFAULT BY THE PRINCIPAL, AND SHALL NOT GIVE RISE TO A CLAIM OR DEMAND AGAINST THE SURETY UNDER THIS BOND

In accordance with regulations at 33 C.F.R. § 332.3(n)(5), the Surety shall provide the Obligee notification at least 120 days in advance of termination, revocation, or modification of this bond.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Obligee named herein, or their heirs, executors, administrators or successors.

Sealed with our seals and dated this _____ **day of** _____**, 2013.**

**Principal: First Pennsylvania Resource, LLC**

By:_____
Name/Title

**Surety: RLI Insurance Company**

By:_____
Greg E. Chilson, Attorney-in-Fact

**Obligee: US Army Corps of Engineers**

By:_____
Name/Title