Compensatory Mitigation Plan

Wilmington Harbor – Edgemoor Expansion | Wilmington, Delaware

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1. Introduction

The Diamond State Port Corporation, a body corporate and politic established under Chapter 87, Title 29 of the Delaware Code within the Delaware Department of State (the "DSPC" or the "Applicant"), has applied to the United States Army Corps of Engineers (USACE) for a Clean Water Act Section 404 permit, and a Rivers and Harbors Act Section 10 permit (Application CENAP-OR-R-2019-278) for construction and dredging related to the construction of a primary harbor access channel and ship berth development (the "Project") at the applicant's Edgemoor property (the "Edgemoor Site"). The Project supports the redevelopment of the Edgemoor Site into a multi-user containerized cargo port.

For the benefit of the regional economy, the Purpose of this project is to maintain and strengthen the State of Delaware's international waterborne trade capabilities by meeting the rising and evolving demand for modern containerized ports, while electrifying ports operations in accordance with the State of Delaware Coastal Management Program Policy and Procedures. International waterborne trade is considered an essential part of the State of Delaware's economy. According to the DSPC Strategic Master Plan, the Port of Wilmington supports over 4,000 jobs annually, generates nearly $340 million in business revenue, over $300 million in personal revenue, and $31 million in regional, state and local taxes. The State of Delaware's position along the Delaware River places it within a competitive international trade market with the Port of Philadelphia, just 25 miles upriver of the Port of Wilmington.

The need for this Project is driven by the increase in vessel size and draft depth. With the completion of the Panama Canal Lock Expansion, Asia/U.S. trade shipping to the eastern seaboard is forecasted to increase. The increase is expected to come through the use of new ships that are larger than those currently in service, due to the inherent efficiency of shipping goods in the largest vessel possible. These larger vessels are known as New Panamax ships, several of which are now already in service. As these New Panamax ships increasingly seek to enter east coast ports, they will inevitably displace the smaller vessels that currently dominate the fleet. Currently, there is not an existing port in the State of Delaware capable of accepting New Panamax vessels. The current Port of Wilmington berths capable of handling containerized cargos are maintained to a depth of 38 ft MLLW. Therefore, container vessels such as New Panamax ships bound for the Port of Wilmington in the State of Delaware would need to be light-loaded (loaded at a reduced capacity) or lightened prior to arrival at the Port. Both options decrease the efficiency and efficacy of operations, putting the Port of Wilmington at a competitive disadvantage.

If Delaware is to meet the increasing demands of international waterborne trade and to continue DSPC's mission to contribute to the economic vitality of Delaware and the region, Delaware needs to modernize its ports facilities and the ship berths need additional depth to accommodate the larger ships in the fleet.

The Project is located adjacent to and north of the Federal navigation channel, in the southern portion of Reach B of the Delaware River, at the intersection of the Cherry Island and Bellevue Ranges and is offshore of the applicant's property located along Hay Road, in Edgemoor, Delaware as shown in Figure 1. The Applicant proposes to deepen portions of the Delaware River adjacent to the Federal Navigation Channel to create primary harbor access that will serve the proposed berth construction at the Edgemoor Site.

The primary harbor access channel will provide access to an approximately 2,600 foot long wharf structure. Proposed construction of the berth and access channel calls for excavation to a 45-foot mean lower low water (MLLW) project depth. The 45-foot MLLW Project depth matches the maintained depth of the Federal navigation channel of the Delaware River. The area to be dredged is approximately 4000 feet in length and a width extending from the boundary of the federal navigation channel to approximately 300 feet offshore of the site at MLLW. The harbor layout and berth grading are shown in project permit drawings titled "Port of Wilmington – Edgemoor Expansion, Permit Plans" prepared by Duffield Associates, LLC (Duffield) dated October, 2019, Revised June 2021. The permit applications include a report titled, Wilmington Harbor, Edgemoor Expansion, and Environmental Assessment Technical Document (EATD)." The EATD included a series of site assessments which document the conditions at the site and evaluate the impacts of the project.

On April 20, 2021, the Applicant received a letter from the USACE stating that based on the review of the Project and supporting documents, comments received during the public comment period, as well as consultation with the resource agencies, a compensatory mitigation is required for the direct loss of approximately 5.5 acres of water associated with the proposed bulkhead filling and 7.5 acres associated with the shading resulting from the wharf construction at a ratio of 1:1 for functions lost to functions compensated. In response thereto, this Compensatory Mitigation Plan has been prepared in accordance with 33 CFR 332 and the posted USACE Philadelphia District Regulatory Programs "Mitigation and Monitoring Guidelines", as well as additional input from a number of compensatory mitigation discussions with USACE and the resource agencies. Therefore, this Compensatory Mitigation Plan includes three main components:

- A discussion on Design Element to minimize the habitat loss;
- A discussion on Mitigation Project Selection; and
- A discussion on the proposed compensatory mitigation projects.

The USACE Philadelphia District Regulatory Compensatory Mitigation Plan Checklist has been included as Appendix A.

In summary, the Applicant proposes a compensatory mitigation with elements that provide for (1) the preservation of existing estuarine habitat near the project site; (2) the restoration of habit that is currently inaccessible to anadromous fish; and (3) the support of population and restoration studies to be performed by resource agencies in the watershed near the project site.

2. Project Impact Avoidance and Minimization

2.1 Adverse Impacts Avoided Through Initial Project Planning

The initial phase of this Project included the development of a strategic master plan for the Port of Wilmington. This planning evaluated the condition of the current facilities, the economic projections and solicited input from a variety of stakeholders, including port operators, environmental non-governmental organizations, state and local government agencies, community groups and the general public. Several alternatives to modernize the facilities were assessed for the value they offered for expansion and for the environmental impacts that might result from the selection of those alternatives. The document that was prepared as part of this initial phase is included as Appendix 2 of the referenced EATD, and the discussion of alternatives for port expansion in Chapter 5 of that appendix. The alternative sites included:

- Improvements to Existing Port of Wilmington (Alternative 1 and 1A);
- Expansion of the Port along the Delaware River adjacent to the current the existing Autoberth (Alternatives 2B and 2C);
- Development of a new containerized cargo port downstream of the Delaware Memorial Bridge at Riveredge Industrial Park (Alternative 3), in New Castle; and
- Development of a new containerized cargo port at the former Chemours Edge Moor Plant, located in Edgemoor, Delaware (Alternative 4).

In-water work to support Alternative 1 required repair of the existing seven Christina River fixed wharves, demolition of existing buildings interfering with crane movements along the wharves, extending crane rails to berths 6 and 7, reconfiguring areas within the Port to enhance cargo and movements. Some of these improvements have been implemented but are not expected to support the predicted expansion of cargo shipping as they cannot facilitate berthing of the expected new Panamax ships because the available draft of the Christina River (35 to 38 feet at MLLW) remains unchanged and the technical constraints of the Wilmington Harbor limit the viability of channel deepening without significant environmental impacts.

Alternative 1A was illustrated as Figure 5-3 in the EATD Appendix 2 and was used to assess an expansion of the usable inland areas of the Port to accommodate the throughput of additional cargo. For this alternative to work, approximately 51 acres of former Pigeon Point Landfill would have had to be acquired and utilized to store roll-on/roll-off cargo to make room within the existing port for an expanded container yard. The repurposing of Pigeon Point landfill would have necessitated regrading of the top of the landfill and construction of a road around Wilmington Harbor South Confined Dredge Facility (WHS CDF), which would have triggered extensive impacts to the tidal and non-tidal wetlands that extend between Pigeon Point landfill and WHS CDF. These impacts would have far exceeded those contemplated by the Project.

Alternatives 2B and 2C were illustrated as Figures 5-4 and 5-5 in the EATD Appendix 2. Both Alternatives 2B and 2C would have necessitated ceasing the use of WHS CDF for dredge material storage, which in turn would have required construction of another CDF at some other location. Alternative 2B assessed expansion of berthing capacity along the Delaware River with

new berths developed in deep water in line with the existing Autoberth. The environmental impacts associated with this alternative would have included decking over or filling most of the shallow subtidal area, and intertidal area located between the Delaware River navigation channel and the existing WHS CDF. The intertidal area along Wilmington Harbor South, approximately 6 acres, was developed as an intertidal wetlands mitigation project by USACE to compensate for the destruction of similar wetlands during the construction of Wilmington Harbor South. The area of shading impact by a pile supported deck would have been approximately 61 acres, far exceeding the impacts contemplated by the Project.

Alternative 2C assessed construction of a marginal wharf along the current shoreline of WHS CDF. Alternative 2C would have required structural modifications to the dike support system of WHS CDF, likely a deep foundation bulkhead along the low tide line to replace the support currently provided by geotextiles that extend beneath the dikes and well out under the Delaware River. The area between the bulkhead and the top of the WHS CDF would be filled. That area would have included approximately 6 acres of the USACE intertidal wetland constructed as mitigation for the construction of WHS CDF. If the bulkhead was moved further inland, the same wetland area would have been removed by dredging. In either case, dredging would have removed the shallow, subtidal and intertidal river bottom to provide ship access to the wharf from the navigation channel. The impacts related to this Alternative 2C far exceed those contemplated by the Project and were likely otherwise not implementable given USACE's already existing mitigation obligations.

The Riveredge Industrial Park site, Alternative 3, was illustrated as Figure 5-6 in the EATD Appendix 2. Alternative 3 would have required excavation (dredging of an access channel, berth area and turning basin) to allow ships to move across the approximately 4,100 feet of shallow water between the navigation channel and the margin wharves along the Delaware River shoreline. The initial estimated area of dredging for the project ranged from 110 to 130 acres, with corresponding volume estimates of 7.5 to 8 million cubic yards. Estimates of annual maintenance dredging ranged from 1 to 2 million cubic yards. Construction of the marginal wharf and container yard along the Delaware River shoreline would have resulted in shading approximately 38 acres of shallow subtidal and intertidal habitats, plus shading or filling approximately 23 acres of tidal wetlands. Construction of truck and railroad access to the wharf would have required the filling or bridging of tidal wetlands. Impacts to tidal wetlands was estimated to be approximately 23 acres. Those wetlands are believed to help support the heronry located on Pea Patch Island, near Delaware City, Delaware. The impacts related to Alternative 3 far exceed those contemplated by the Project.

The Edgemoor Site, Alternative 4, was illustrated as Figure 5-7 in the EATD Appendix 2. Alternative 4 required excavation (dredging of an access channel, berth area and turning basin) to allow ships to move across the approximately 800 feet of water between the navigation channel and the wharves along the Delaware River shoreline. The current estimated area of dredging for the project is on the order of 86 acres, with corresponding volume estimates of 3.3 million cubic yards. Estimates of annual maintenance dredging ranged from 0.2 to 0.3 million cubic yards. Construction of a high deck wharf and bulkhead and container yard along the Delaware River shoreline will resulted in shading approximately 7.5 acres of shallow subtidal and intertidal habitats, plus filling approximately 5.5 tidal lands. Through the strategic planning process, Alternative 4 was identified as the Project.

2.2 Selected Project – Edgemoor Development

2.2.1 Adverse Impacts Avoided Through Project Design

The selection of the Edgemoor Site for the Project avoided tidal wetland impacts. The site shoreline currently has been modified with bulkheads, retaining walls and rip-rap armor that fix the extent of high tide penetration of the property. An unvegetated, high energy, intertidal beach is present in most areas between the high tide and low tide lines. The shallow subtidal areas are also void of vegetation likely due to a combination of the highly turbid water which limits light penetration and the exposed, high energy conditions that exist at this location.

The Applicant understood the resource value of Cherry Island Flats as a spawning location for striped bass and selected a design that avoided construction impacts to that area. The Project requires that ships be able to turn (reverse direction) within the project area. As conceived, the radius describing the outer arc of the ship would pass through during a turn was set to coincide with the outer boundary of the navigation channel so that there would be no dredging of Cherry Island Flats.

Optimization of the channel design shifted the wharf structure upriver to reduce the impacts to the substrate on the down river end (where the project is further from the channel) and reduced the model sedimentation rates. The channel design also considered alternatives which shifted the bulkhead toward the river; however, these alternatives would have required widening of the navigation channel to accommodate the turning basin and would have resulted in impacts to the Cherry Island Flats. Alternatives which shifted the bulkhead further inland (reducing the shading of the existing river) were also considered, but would have resulted in additional impacts to the legacy environmental impacts that have been remediated on the site (as discussed further in Section 2.2.2) and were not selected.

2.2.2 Minimization of Unavoidable Adverse Environmental Impacts

The shoreward location of the proposed bulkhead and landward side of the proposed wharf were constrained by existing environmental conditions within the upland portion of the property. The property is regulated under the Resource Conservation and Recovery Act (RCRA). There are four closed and capped waste lagoons located within the upriver portion of the site. The dikes and caps for two of those former lagoons extend to locations close to the high tide line on the property. In the downriver portion of the site, a closed solid waste disposal area is present behind the existing and failing bulkhead. To avoid disturbing and exposing the wastes stored in the former lagoons and landfill while also minimizing impacts to the aquatic environment, the Project bulkhead location is set at the low tide line near the closed facility. The bulkhead is designed to be linear in order to reduce the abnormal flow and sedimentation that could result from variable flow conditions in a bulkhead, which matches the existing shoreline that result from proposed grade differential of approximately 30 feet. This location minimized the amount of fill that would be placed in the aquatic environment to the unvegetated intertidal beach. The fill improves the long-term safety of the site by providing structural support of the dikes and caps, provides additional buffer between the wastes and the Delaware River, as well as providing resilience against the inevitable sea level rise that is occurring.

The wharf structure is pile-supported to maintain water circulation beneath it. The size of the wharf is minimized to support berthing of two post-Panamax (also called new Panamax)

container ships and operation of six cargo gantry cranes that will be used to offload and load the ships. The deck of the wharf was set at an elevation (18 feet North American Vertical Datum) that not only places it above the forecast height of the 100-year flood, it exceeds the height of the storm waves expected during such a storm and the expected rise of sea level during the life of the wharf. This height results in approximately 10 feet of separation between the lower surface of the wharf and the surface of the water at high tide (approximately 15 feet of separation at low tide). This feature, along with the minimization of the size of the wharf, serve to minimize the impact of the shading generated by construction of the wharf.

A portion of the stratum B (sandy) sediments that will be dredged are planned for reuse for the fill to be placed behind the proposed bulkhead. The environmental quality of those sediments is suitable for use within the proposed port. This reuse minimizes the amount of dredged material that requires long-term storage in a dredged material disposal area, which in turn, prolongs the useful life of the dredged material disposal area. It helps to avoid or minimize environmental impacts associated with the construction of a replacement disposal areas.

2.2.3 Summary of the Affected Environment

The proposed project is planned to include a discharge of dredged materials to approximately a 5.5-acre area of intertidal environment located along the right descending bank of the Delaware River. The fill will be placed behind a bulkhead installed as part of the Project. The proposed bulkhead will be installed roughly along the existing mean low water location. The jurisdictional fill will extend from the bulkhead landward to the mean high water line. Figure 2 includes photographs providing views of the intertidal area of the site where filling in waters of the United States of America (U.S.) will occur. The fill placed into waters of the U.S. will be granular soil material obtained from an upland source. Project planning anticipates that in-water work, such as pile driving and dredging, will not occur during the anadromous fish spawning migration, including the extended period associated with Atlantic sturgeon spawning.

Per 40 CFR 230 Subpart E-*Potential Impacts on Special Aquatic Sites*, the Edgemoor Site for the Project is not a designated sanctuary or refuge. Further, the area to be filled does not meet the definition of a special aquatic site. No wetlands are present in the area that will be filled, based on a wetlands report prepared in October 2019 and provided as Appendix 9 of the EATD. The area to be filled is not a mudflat. The intertidal beach is composed of sand, gravel, cobbles and detritus. The area to be filled is not vegetated, is not a coral reef, and is not a riffle and pool complex.

Table 1: Summary of Project Impacts

	As Constructed	Area Filled/ Covered	Area Excavated/ Unshaded	Net Change
Intertidal Area	0 acres	5.15 acres	0 Acres	-5.15 Acres
Subtidal Area	86.9 Acres	0.35 Acres	0.1 Acres	-0.25 Acres
Shaded Area	7.5 Acres	7.13 Acres	0.43 Acres	- 6.7 Acres
			Net Impact	-12.1 Acres

The intertidal area waterward of the shoreline retaining structures is a high energy environment typified by an exposed beach that consists of sandy and gravelly materials. No living vegetation has been observed in the intertidal area (or subtidal area) proposed for filling. The beach is subject routinely to wake from passing ships and storm waves. Storm winds in the project vicinity commonly blow from a northerly direction. The fetches to the northeast of the project site extend 2 to 3 miles. No significant historical or cultural resources were identified at the Project site.

The construction will include filling of existing intertidal and subtidal areas, excavation of areas to create subtidal areas as well as the construction of high deck shading and the removal of several areas of shading from historic dock structures that are to be removed. Figure 3 includes detail related to the modifications of site conditions and Table 1 summarizes the project impacts.

3. Mitigation Site Selection

The Applicant conducted an evaluation of potential mitigation project using a combination of aerial photography and knowledge of restoration initiatives and concepts involving other agencies and organizations. In addition, a mitigation team was assembled to provide guidance and feedback on mitigation concepts. Led by USACE, the mitigation team also included representatives from the National Oceanic and Atmospheric Administration Fisheries ("NOAA Fisheries"), the U.S. Fish and Wildlife Service ("USFWS"), the Delaware River and Basin Commission ("DRBC"), the U.S. Environmental Protection Agency ("EPA"), the National Park Service ("NPS") and the Delaware Department of Natural Resources and Environmental Control ("DNREC").

In evaluating potential mitigation projects, the applicant considered on-site and off-site mitigation, the use of mitigation banking credits, whether projects were in-kind or out-of-kind, their feasibility and likelihood of success and feedback from representatives of the state and federal agencies on the mitigation team. As per 33 CFR Section 322, the following factors were taken into consideration by the Applicant while reviewing potential mitigation projects:

- Hydrologic conditions;
- Habitat connectivity;
- Adjacent land uses; and
- Likelihood of success.

Five potential alternatives were initially identified and discussed with the Applicant and then presented to state and federal agencies. Four additional potential projects were then identified during discussions with the resource agencies; shallow water habitat preservation, West Bay Pier Removal, Mussel Restoration in New Castle County Delaware and Brandywine Creek Dam 2 Fish Passage. The sites and projects are discussed briefly below and are indicated in Figure 4.

3.1 Onsite Mitigation

Opportunities for on-site mitigation at the Edgemoor Site are precluded for practical considerations. Much of the shoreline will be occupied by infrastructure supporting the proposed port. The Edgemoor Site has historically been utilized for industrial activity for more than 100 years. Areas of shoreline that will not be developed as supporting infrastructure are located near solid waste operable units that were closed under corrective action and are not suitable for on-site mitigation.

3.2 Offsite In-Kind Mitigation

3.2.1 Pigeon Point Living Shoreline and Habitat Restoration

This project was identified as its location is immediately adjacent to the Delaware River in proximity to the Edgemoor site. The location downriver of the WHS CDF and has been identified as a depositional area where habitat loss has occurred following shoreline modifications. This project would include the removal of recent sediments to restore the former shoreline with

hydrology and ecological design element of a living shoreline. A staggered breakwater near the limit of the shallow water habitat would provide protection to the constructed intertidal and shallow water habitat. The potential area of construction was identified as 15 acres.

Evaluation of this alternative identified risk factors, including the portion of the project with established habitat that would be impacted as well as a multiple land ownership of the target area including federal, state, city and private interests. The Applicant concluded the various ownership issues with the parcels involved would present significant challenges to securing the required approvals to conduct timely on-site construction and significantly hinder the likelihood of success.

3.2.2 Bay West (New Castle) Pier Removal

Three piers owned by Riverview Industrial Park located on the Delaware River, south of the City of New Castle, were identified as possible mitigation projects if one or more of the piers could be removed. Two of the three piers are constructed on fill with one built on wooden piles. The mitigation project would include removal of the pier structures and re-establishment of the natural physical characteristics of the site. The future site protection would include a restrictive convent preventing future reconstruction of the piers. DSPC estimated the areas of the piers and found the acreage occupied by the piers was approximately ¾ acre.

As part of the assessment, DSPC's representatives contacted Paul Cirillo, a principal/owner of the Riverview Industrial Park, to discuss the possibility of DSPC acquiring and removing one or more of the piers. Mr. Cirillo indicated that all three piers are currently functional, permitted and regularly used by his business and clients. Mr. Cirillo also indicated he was planning improvements to at least one of the structures and was hesitant to consider any proposal that would result in his business losing access to any of the three piers given the lack of any commercially accessible piers in this area of Delaware.

Considerations -- Estimated areas of the piers showed that the acreage occupied by the piers was .059, .327 and .378 acres, respectively. Given that USACE has indicated that a mitigation ratio of 1:1 will be required to compensate for the impacts from fill and shading totaling more than 12 acres and the owner of the piers in question expressly indicated he was not interested in such a transaction, DSPC concluded that the potential mitigation credit based on acreage of the three piers was too small to warrant actively pursuing the project that has a low likelihood of success.

3.2.3 Preservation of Christina River Subaqueous Lands

The preservation of in-kind habitat (intertidal and shallow water habitat) in the vicinity of the project site was identified as a potential mitigation through discussions with the resource agencies. The Delaware shoreline of the Delaware and Christina Rivers in the vicinity of the project site have experienced similar industrial development generally consisting of an intertidal area along a constructed shoreline dating to the mid-20th century, when the dredge disposal at the Cherry Island facility commenced, as described in the project Cultural Resources Survey included as Appendix 21 of the EATD. The Applicant identified a potential preservation area along the northern bank of the Christina River.

The Christina River flows into the Delaware River southeast of the City of Wilmington with the mouth of the river bounded by the Port of Wilmington to the South and the Cherry Island facility to the north. Tributaries of the Christina River include the White Clay, Red Clay and Brandywine Creek. Anadromous fish that utilize the tributaries for foraging, spawning and nursery areas must pass through the Christina River and the Port of Wilmington to and from the Delaware River.

The Applicant has identified subaqueous lands on the northern bank of the Christina that contain intertidal and shallow subtidal habitation that could be subject to permanent protection through the establishment of a conservation easement or restrictive covenant to be placed on the property.

Considerations -- Legal title to the subaqueous lands is controlled by the Applicant. The Applicant is not aware of any third-party easement right on the land in questions but will conduct a full title search prior to the Submission of a Final Compensatory Mitigation Plan.

The preservation mitigation project would protect similar migration and foraging habitat of anadromous fish and sturgeon identified by the resource agencies as the project impacts. Additionally, the preservation mitigation project would prevent the additional placement of permanent fill, or the placement of structures which may reduce the function of the habitat in the future. The preservation mitigation project on the Christina River preserves one bank of the Christina River to fish migration unimpeded by the dock structures and shading which exist currently on the southern bank of the river as well as the associated intermittent shipping traffic in the navigation channel.

3.2.4 Fox Point State Park Wetland Rehabilitation

This proposed mitigation project was identified through discussion with the State of Delaware as a potential mitigation to support DNREC subaqueous permitting. The Fox Point State Park is contiguous to the project site, upriver from the project site. The Park was created through filling activities performed along the Delaware River shoreline[1]. Historical aerial photos for the Site dating back to 1954 document the filling activities as well as the condition of the site prior to filling. This generally consisted of aquatic river habitat, and the placed fill material acted in the creation of the upland area that is the park today. The fill reportedly includes a variety of materials, principally dredged material from the Delaware River underlain by steel-making slag, bricks, timber, waste ingots, and ash furnace dust, in addition to miscellaneous trash and debris[1].

Along the upriver end of the park, a low-lying area that is separated from the Delaware River by a constructed revetement has been overgrown with phragmites. The area has been identified as a potential for fill removal to rehabilitate the historic use of the site as intertidal land with habitat.

Considerations – The shoreline along Fox Point State Park is substantially similar to the substrate impacted by the project and would provide the opportunity to restore habitat proximate to the

[1] Integral Consulting, Inc. (2019). "Remedial Investigation Report for Fox Point State Park Phase II Operable Unit (DE-1011)".

project site similar to the Edgemoor project, with the additional benefit of providing wetland plantings to enhance the potential nursery and forage habitat.

3.3 Offsite Out-of-Kind Mitigation

3.3.1 Fox Point State Park Shoreline Stabilization

This proposed mitigation project was identified to provide stabilization of the shoreline near Fox Point State Park north of the Edgemoor Site where impacts would be occurring. The stabilization would require measures to sustain strong currents and high energy environments that could stabilize slopes and sustain minor damage without affecting structural integrity of the project elements.

Considerations -- Federal agencies raised concerns about this site as it would likely require disturbance of existing intertidal habitat and filling of subaqueous lands, which is not a preferred approach for compensatory mitigation projects. Delaware DNREC expressed an interest in potential enhancements to the Fox Point State Park, which is very much utilized and valued by the local community near the Edgemoor Site. As a result, Delaware DNREC has approved, as part of the State Subaqueous permit, a mitigation plan that includes for wetland and upland enhancements to the Fox Point State Park to fulfill the state mitigation requirements. The upland and recreational improvements proposed in this plan are not being submitted as part of the Compensatory Mitigation Plan. Elements related to wetland improvements have been summarized in Section 3.2.4.

3.3.2 Christina River Wetlands Restoration

This proposed mitigation project was identified due to its location within the Delaware River watershed and the previous restoration and mitigation projects associated with DNREC's Northern Delaware Wetlands Rehabilitation Initiative that included the Old Wilmington Marsh known today as the Peterson Wildlife Refuge. The area is located at the southern portion of the Riverfront area of Wilmington near the DuPont Nature Center. The evaluation identified a 15-acre parcel within the bank where restoration could potentially occur.

Considerations -- Discussions with the resource agencies indicated that while this project would be considered for the benefits provided to water quality, the construction of wetland would provide limited offset to the intertidal and shallow water habitat impacts to anadromous fish. In addition, discussions with DNREC indicated that restoration of many of the sites had already occurred and there was additional funding dedicated to future restoration at the Wilmington site, limiting the need for further restoration efforts.

3.3.3 Pea Patch Island Shoreline Stabilization and Habitat Restoration

Pea Patch Island is located in the Delaware River near Delaware City and is home to Fort Delaware State Park and a rookery for numerous species of wading birds. A seawall constructed by USACE on the easterly side of the island has provided significant protections from the wake created by shipping traffic utilizing the nearby navigation channel. However, erosion still threatens intertidal shoreline and tidal wetlands along the southern shore of the island near the dock area that serves the ferry for park visitors and supplies. This potential mitigation project identified the need for shoreline stabilization and creation for shallow water habitat.

Considerations -- Concerns for this proposed mitigation project were identified by the resource agencies because it would likely require filling of subaqueous lands, which is not a preferred approach for compensatory mitigation projects.

3.3.4 White Clay Creek Dam #3 Removal

The removal of White Clay Creek Dam 3 was identified as a proposed mitigation project due to the positive impact that could result for anadromous species such as American shad, hickory shad and river herring, which are species of concern for the federal agencies. Removal of the dam would allow access for migratory fish to spawning and nursery habitat on the White Clay Creek, above Dam 2. Dam 1 was removed in December 2014 along the White Clay Creek, which has been designated as a Wild and Scenic River under the National Park Service.

Considerations -- Previous fishery surveys indicated a significant population of shad below Dam 1 prior to its removal. Limited, subsequent sampling has not consistently confirmed the presence of significant numbers of shad above Dam 1 raising questions about the shad populations in the Creek and efficacy of fish passage of the Dam 1 location due to shallow depths and sediment, especially during low tides. Additionally, the timing associated with the proposed Dam No. 2 and Dam No. 4 removal projects, which are currently in design, was identified as a risk factor. Therefore, the mitigation project has not been identified as a project that would have strong likelihood of success.

3.3.5 Mussel Restoration Delaware River Watershed

The Partnership for the Delaware Estuary (PDE) was contacted to assist in identifying any potential mitigation projects that could be suitable for mitigation. PDE has partnered with numerous organizations to implement shoreline and habitat restoration and enhancement projects within the Delaware watershed. Dr. Danielle Kreeger, Science Director for PDE, provided a summary proposal titled "The Mussels for Clean Water Initiative – Concept Proposal for New Castle County, Delaware". The proposal, which could be scalable based on the number of sites, animals, species of mussels and monitoring, focused on restoration of mussels in Red Clay Creek, White Clay Creek and/or the Christina River. These systems are currently devoid of mussel populations, although pilot studies have indicated that conditions are suitable to sustain mussel populations if reintroduced but only in areas protected from storm water. The project would involve growing mussels in hatchery for 1-2 years, restocking in years 2-3 and multi-species augmentation in years 3-4. Project performance measures are based on water quality enhancements due to the mussels' filtering of water and removal of total suspended solids, nitrogen and phosphorous.

Considerations -- This project appears better developed for mitigation for water quality impacts than loss of habitat. In addition, the uncertainty concerning survivability of the mussels and time frame associated with full implementation suggests that the project would not be suitable as compensatory mitigation.

3.3.6 Brandywine Creek Dam 2 Fish Passage

Brandywine Creek Dam 2 was identified as a potential mitigation project through discussions with the resource agencies as it currently prohibits fish passage for both resident and migratory species including American shad, hickory shad and river herring. Dam 1 was removed by the

City of Wilmington in 2019. A non-profit agency (Brandywine Shad 2020) commissioned a feasibility report 1F[2] to support passage or removal of a series of dams on the Brandywine Creek. The Applicant also discussed the operational requirements for Dam No. 2 with the City of Wilmington. Based on these discussions it is understood that removal of Dam 2 is not practical at this time as it provides the mechanism for the City of Wilmington to obtain supply for its potable water needs. However, fish passage can be created through the construction of a rock weir, nature-like fishway on the face of the dam. The resource agencies expressed significant interest in this proposed mitigation project and the Applicant conducted a Feasibility Assessment.

Three Alternatives were identified to provide fish passage at Dam No. 2 in the Feasibility Assessment. They included a denil technical fishway, natural bypass channel and a full-width rock weir, nature- like fishway. The nature-like fishway is considered to have a higher effectiveness to fish passage and is considered the best available technology for this impendent at this time. Design alternatives which do not include a full -width downstream entrance are considered to have reduced effectiveness due to attraction limitations. [1]

Considerations -- Brandywine Shad 2020 is a non-profit and consortia of organizations, including the University of Delaware Water Resources Center, whose goal is to restore fish passage to the Brandywine Creek. It has obtained funding from the National Fish and Wildlife Foundation and other sources to support its goal and, among other activities, has submitted applications to the USACE and DNREC seeking approvals for removal of Dam 4. Dam 3 is partially breached and a 2020 feasibility study concludes that the breach is sufficient to allow fish passage. Young of the year shad were found below Dam 2 in 2020 sampling. The creation of the rock weir, nature-like fishway represents an off-site, out of kind project that would restore access to habitat that is suitable for compensatory mitigation.

It should be further noted that the City of Wilmington residents who utilize the park and depend on the water infrastructure also constitute the citizens that would be impacted by the Edgemoor Expansion. The community will also provide the work force that will benefit from the economic impact of the project. A letter from the Mayor of the City of Wilmington that supports this project for consideration as mitigation for the Edgemoor project and verifies the commitment of the City of Wilmington to partner with the Applicant to implement and maintain this project has been enclosed as Appendix B.

3.3.6 Establishment of a State of Delaware Environmental DNA Program

The Applicant is proposing to fund monitoring and research activities to be performed by Delaware DNREC in the immediate and regional areas through the use of Environmental DNA (eDNA) sampling and analysis. Monitoring activities will help evaluate and understand potential impacts of the dredging project on resident and transient fish species that use this portion of the Delaware River. It is well documented that the DSPC expansion project area is considered essential habitat for recreationally and commercially valuable species. As such, the Applicant will provide the funding for the purchase of the necessary sampling and analytical equipment to

[1] Brandywine River Dams 2-6, Engineering Feasibility Assessment and Fish Passage Alternatives Analysis, Kleinschmidt, March 31, 2021

allow for an expansion of the DNREC Environmental Laboratory Section's (ELS) existing eDNA monitoring capabilities. In addition, the Applicant proposes to fund expanded eDNA sampling activities in the Delaware River to monitor state and federal public trust species. The sampling activities will be conducted by DNREC's Division of Fish and Wildlife (DFW) Fisheries Section and/or by DNREC's Division of Water (DW) Environmental Laboratory Section (ELS) for the three years (cycles) of dredging that are anticipated for the Port of Wilmington Expansion Project. In addition, sampling activities will be conducted in other areas of the state, not related to Port construction, to assist in ongoing research activities and to assist in the identification of potential future habitat restoration and enhancement projects. The Applicant will fund up to $750,000 towards the activities described above.

Considerations – This mitigation project has the benefit of expanding the knowledge of the regulatory and technical communities on the condition of the Delaware River fisheries with technologies that have not currently been widely utilized in the State. Additionally, the project provides capital investments in equipment to support continued monitoring by the State of Delaware at a reduced funding level. This project also informs these communities on the cumulative impacts of the Delaware River development as well as provides data on the endangered species which are present in the vicinity of the project site but may not utilize the potential intertidal habitat or other mitigation projects.

3.4 Fee-In Lieu or Mitigation Bank

The Applicant is not aware of an approved mitigation bank or an approved in-lieu fee program within service area of the proposed project. A review of the Regulatory In lieu fee and Bank Information Tracking System (RIBITS) for the USACE Philadelphia District did not yield any suitable potential projects. The Applicant is not proposing to establish either an in lieu fee program or mitigation bank.

4. Selection of Mitigation Project

The Applicant considered the type and location of the appropriate compensatory mitigation under 33 CFR Part 332.3 (b) and reviewed the potential projects with the resource agencies as described in Sections 3.1 – 3.4, and evaluated the risk associated with the implementation and the likelihood of successes. This review includes input from USACE and the resource agencies through the evaluation phase. The selected projects represent a permittee-responsible mitigation both in-kind mitigation and out-of-kind with a watershed approach under the American Shad Habitat Plan for the Delaware River, as well as support of resource agencies efforts to monitor the fisheries on the Brandywine Creek.

The American Shad Habitat Plan for the Delaware River was approved May 5, 2021 in response to the Atlantic States Marine Fisheries Commission's (ASMFC) Amendment 3 to the American Shad and River Herring Fishery Management Plan. The Plan was prepared by the Nature Conservancy for the Delaware River Basin Fish and Wildlife Management Cooperative comprised of the Delaware Division of Fish and Wildlife, New Jersey Division of Fish and Wildlife, Pennsylvania Boat Commission, New York State Division of Fish, Wildlife and Marine Resources, USFWS and NOAA Fisheries. In addition to the plan, ASMFC has also published Life History and Habitat Needs documents for American Shad, Hickory Shad and Atlantic Sturgeon, which were identified as species of concern though the consultation with USACE and the resource agencies along with River Herring and Striped Bass.

4.1 Fox Point State Park Wetland Rehabilitation

Fox Point State Park is located adjacent to the proposed project location along the Delaware River and provides an opportunity to develop environmental improvements in the immediate area where impacts will occur from construction of the Port of Wilmington expansion. The design will create intertidal habitat and wetland area including features to provide productive foraging habitat for native fish species as well as habitat for other aquatic species.

The design calls for the removal and treatment of the invasive plant phragmites from a one-acre site that will be excavated down to appropriate elevations to provide intertidal interaction and hydrology creating a range of habitat communities from deep to shallow and emergent intertidal wetlands. Portions of an existing revetment will be removed to facilitate intertidal flow to the wetland area and provide access to the wetland habitat for aquatic species. The location of the project is in an area of the Delaware identified as essential fish habitat for recreationally and commercially valuable species and critical habitat for endangered species.

The rehabilitation of an intertidal wetland serves as an in-kind, offsite mitigation project to compensate for the filling of intertidal area as part of the construction of the proposed container port at Edgemoor. The project is also being proposed to satisfy State of Delaware mitigation requirements.

4.2 Brandywine Creek Dam 2 Fish Passage

The ASMFC identifies dams and other obstructions as a threat to the habitat of the species of concern identified by the resource agencies. The American Shad Plan for the Delaware River specifically defines Brandywine Creek Dam 2 as a relevant barrier. While practical constraints

(the City of Wilmington Water Intake) prevent the removal of the dam at this time; a rock weir, nature- like fishway constructed downstream of the dam would restore access to the upstream habitat for anadromous fish. This action is suitable as an off-site, out-of-kind mitigation and has increased consideration through the watershed approach. A figure indicating the habitat area has been included as Figure 8.

The project is appropriate mitigation as it is located within the Delaware River watershed. It suitably replaces the lost functions and services caused by the impact of the loss of habitat as a result of filling the intertidal and subtidal land within the Delaware River to backfill for the proposed bulkhead and for shading of habitat from the high deck. The mitigation project offers a favorable impact to habitat that is used as a nursery and foraging area for a variety of species, several which are in decline due to habitat loss; specifically river herring, striped bass, and American shad. The mitigation project will restore fish passage and access to approximately 12 acres of shallow and deeper water spawning and nursery habitats on the Brandywine Creek that, for nearly 200 years, have been inaccessible to anadromous fish. These points are further explored in Section 5.

The American Shad Habitat Plan states the Brandywine Creek historically supported very large shad runs. Young of year shad were found below Broom Street Dam (No. 2) in 2020 sampling. It notes that dam removals and fishways are planned for the remaining 10 dams. Finally, the American Shad Habitat Plan acknowledges the assessment and planning work of Brandywine Shad 2020. [3]

The Applicant has included as Appendix B a letter from Wilmington Mayor Michael Purzycki expressing his support for the Port of Wilmington expansion at Edgemoor and his commitment to work with DSPC to include development of the appropriate agreements for implementation, maintenance and protection of the nature like fishway project while assuring that the City water supply infrastructure associated with Dam 2 is maintained.

4.3 Brandywine Creek Fisheries Sampling Support

The Applicant is proposing to supplement fish population survey data through support of DNREC Fisheries Section and the University of Delaware for sampling beyond monitoring associated with performance measures to assess effectiveness of fish passage. Supplemental sampling is expected to be conducted for up to 10 years in order to collect data on both anadromous and resident species. Data collected will inform future updates to and implementation of the American Shad Habitat Plan.

Sampling beyond the monitoring associated with the verification of fish passage at Dam 2 may include:

- Utilization of recreational anglers to collect adult shad located below Dam 2 and above Dam 4 (once removed) for tagging with Passive Integrated Transponders (PIT tags);
- Electrofishing up to two days/week to supplement recreational angler success to provide sufficient tagged fish for an effective data set;

[3] The American Shad Habitat Plan Approved May 5, 2021

- The construction of additional monitoring points down river of Dam 2 and upriver of Dam 4 to monitor migration patterns; and
- Juvenile sampling conducted by haul sein at various locations on the river to monitor effectiveness of regional efforts.

With this mitigation proposal, the Applicant will provide funding support to DNREC, the University of Delaware or identified Non-Profit groups for labor and equipment. DNREC and the agencies will perform data analysis and publicly report annually independent of the monitoring reports prepared for agency submission.

4.4 Establishment of the State of Delaware eDNA Monitoring and Research Program

The applicant is proposing to provide financial support for an environmental DNA monitoring and research program that will be implemented by DNREC. Monitoring activities will help evaluate and understand potential impacts of the proposed project on resident and transient species that utilize the area around Edgemoor. The support will also fill a number of immediate needs identified by DNREC associated with challenges of collecting fisheries data from around the state using traditional sampling techniques and equipment.

The data collected during this three-year project will be vital for state and federal fisheries managers to mitigate impacts from dredging, water withdrawals, shoreline stabilization projects, development of breakwater structures and other possible future perturbations within the Delaware River. The results of this study will also be used to guide the DNREC-DFW time-of year restrictions that reduce anthropogenic impacts on sturgeons (and other species). The eDNA monitoring for river-resident juvenile Atlantic sturgeon and migratory adult Atlantic sturgeon in the Delaware River will provide a better understanding of habitat use within the Delaware River Estuary and provide guidance for traditional sampling efforts to evaluate changes in the location of nursery habitat.

5. Determination of Credits

The Applicant proposes to fill approximately 5.5 acres of an intertidal area at the Edgemoor Site for the purposes of backfilling a proposed bulkhead as part of the Project. As a result, USACE is requiring compensatory mitigation to offset a loss of 5 acres of shallow water habitat. In addition, USACE is requiring compensatory mitigation for construction and shading from the proposed wharf for impacts to approximately 7.5 acres of shallow habitat used as nursery and foraging area for a variety of species, several of which are in decline due to habitat loss; specifically river herring, striped bass and American shad. USACE has determined that mitigation is being required on a 1:1 basis.

Project construction will include the removal of several existing historic dock structures that have caused areas of shading. The area that will be uncovered as a result of removal of these structures is approximately .43 acres. Applying this .43 acres to the required 7.5 acres to be offset results in a net area of 7.13 acres. The total net area to be mitigated is 12.1 acres.

5.1 Credits for Fox Point State Park Wetland Rehabilitation

The Fox Point State Park intertidal habitat rehabilitation is proposed to create 1.33 acres of intertidal land. A mitigation ratio of 1:1 was used to compute credit for the creation of intertidal lands, wetlands, and mudflats. Intertidal habitat will be planted to sustain a mixture of vegetated wetland and mudflat. Summing the components of intertidal acreages, the proposed mitigation credit for the Fox Point habitat project is 1.33 acres.

5.2 Credits for Dam 2 Fish Passage

The proposed mitigation includes the construction of a full width weir, nature-like fishway to facilitate fish passage of Dam 2 on Brandywine Creek. Dam 3 is located approximately .5 miles above Dam 2. Dam 3 has been partially breached and surveys have indicated that fish passage could occur under current conditions. Dam 4 is located approximately .3 miles above Dam 3.

USACE Regulatory Guidance Letter (RGL) No. 18-01: Determination of Compensatory Mitigation Credits for the Removal of Obsolete Dams and Other Structures from Rivers and Streams addresses the applicability of projects "to restore river and stream structure, functions and dynamics." The construction of a rock weir, nature-like fishway provides fish passage functionality and restores the functional use of the stream habitat in the area between the existing Dam 2 and the next impediment, Dam 4.

The restoration of fish passage also supports federal and state goals for the recovery of diadromous fish. Given the close proximity of the habitat area between Dam 2 to Dam 4, the likely spawning and nursery habitat and the presence of American shad below Dam 2 since removal of Dam 1, full value on an acre for acre basis should be applied to the restored function of the stream habitat.

The habitat area of the creek between Dam 2 and Dam 4 is approximately 12.55 acres and includes a combination of pool/run area habitat and riffle area habitat, which are available as spawning and nursery areas. The area of quiescent pool and run water is estimated at 9.38 acres and the area of turbulent flow/riffle water is estimated at 2.49 acres. There is also a

stagnant water area upstream of Dam 3 with 0.68 acres of pool water with minimal flushing at normal flow. Additionally, the rock pools with all of the protected pore spaces created as part of the rock weir, nature-like fishway should provide enhanced benthic habitat compared to the boulder and bedrock habitat currently found at the area immediately below Dam 2.

Using USACE's 1:1 ratio for mitigation, the restoration of fish passage at Dam 2 with the associated access to both pool/run and riffle habitat areas on Brandywine Creek located between Dams 2 and Dam 4, the Applicant should receive full credit on a per acre basis for the 12.57 acres of habitat.

5.3 Credits for Support of Fish Studies

The applicant proposes to provide funding for DNREC fishery monitoring and research programs through support of an environmental DNA and conventional fishery management data collection along the Brandywine Creek and in the area proposed for construction of the Port expansion project. Funding for the eDNA program will include both sampling and the purchase of sampling and analytical equipment to help sustain the program. Data collected will help inform future resource management decisions. The cumulative expected positive benefits of enhanced monitoring and data collection does not provide an ecological function enhancement but deserves consideration as an indirect benefit to the aquatic resources associated with the Delaware River and its tributaries.

5.4 Calculating Credits

The intertidal habitat rehabilitation at the Fox Point State Park will offset 1.33 of the 5.0 acres that will be lost to fill of an intertidal area.

The remaining 3.67 acres required for offsetting the fill of an intertidal area result from the access to 12.57 acres of habitat created from the establishment of fish passage through the rockweir, nature-like fishway.

Mitigation for the 7.13 acres of impacted area resulting from construction and shading comes from the 8.67 acres of habitat remaining from applying 3.67 acres to offsetting impacts from fill. The application of credits in this manner results in an excess of 1.78 acres that is also considered part of the proposed mitigation, with the additional consideration of the cumulative benefits provided by the support of the regional fisheries efforts noted in Section 5. 3.

Table 2: Mitigation Credit Summary

Net Impacts for Mitigation	Mitigation Credits
5.0 acres for fill impacts	1.33 acres intertidal wetland habitat
	2.49 acres accessible riffle stream habitat
7.13 acres for shading/construction	9.38 acres accessible pool and run stream habitat
	0.68 acres of pool habitat (stagnant)
12.1 acres total	13.88 acres total

5.5 Conclusion

Impacts from the loss and reduced function of 12 acres of intertidal area of the Delaware River at Edgemoor are more than compensated for through:

- The establishment of a rock weir, nature-like fishway on the Brandywine Creek that provides fish passage for American shad and river herring as well as resident species and access to more than 12 acres of spawning, nursery and foraging habitat; and
- The rehabilitation of an approximately 1.33 acre intertidal habitat with wetlands at Fox Point State Park along the Delaware River; and
- Funding support for a DNREC environmental DNA monitoring and research program for areas around the proposed Edgemoor expansion site; and
- Support for fishery monitoring efforts on the Brandywine Creek, beyond the monitoring efforts related to the rock weir, nature-like fishway.

The Applicant understands that the benefit of both eDNA and traditional fishery monitoring programs cannot be evaluated by applying a value in acreage as may be appropriate for determining credits assignable to the restoration of habitat. However, the Applicant believes that the sum of the direct and indirect benefits of this Compensatory Mitigation Plan offset the impacts from the effects of filling and shading intertidal areas at the proposed project site.

6. Site Protection Instrument

6.1 Fox Point State Park Wetland Rehabilitation

The site is owned and managed by the State of Delaware through DNREC's Division of Parks and Recreation whose charge according to Delaware law is to "plan, develop and maintain all areas entrusted to its administration as to preserve in every reasonable degree the scenic, historic, scientific, prehistoric and wildlife values of such areas." Public activities and access are limited through regulations administered by DNREC.

The Applicant will provide legal protection of the compensatory mitigation areas in the form of a restrictive covenant. A survey of the area included in the restrictive covenant and survey will be submitted to USACE for approval and included in the recorded covenant. A copy of the Declaration or Restrictive Covenant language has been provided in Appendix C. The restrictive covenant will be recorded in New Castle County a minimum of 60 days prior to the start of construction at the impact site and will be provided to USACE within 30 days of recordation. This shall be accomplished no later than January 1, 2023.

The Site is currently under an environmental covenant that restricts most earth disturbing activities onsite without the written approval of Delaware DNREC. While this environmental covenant covers a portion of the limit of disturbance of the compensatory mitigation (primarily the construction access), the mitigation area is not within the existing environmental covenant.

6.2 Brandywine Creek Dam 2 Site

The Site is owned by the City of Wilmington and includes Dam 2 and the associated water supply and wastewater infrastructure located at the site. Adjoining lands on both the north and south banks of Brandywine Creek are owned by the City of Wilmington. Brandywine Park, owned by the City of Wilmington and managed by the Delaware DNREC, is located on the north side of the Creek. The land within the creek is public subaqueous land, which is overseen by Delaware DNREC.

The Applicant will provide legal protection of the compensatory mitigation area in the form of a restrictive covenant. A survey of the area included in the restrictive covenant and survey will be submitted to USACE for approval and included recorded covenant. A copy of the Declaration or Restrictive Covenant language has been provided in Appendix D. The restrictive covenant will be recorded in New Castle County a minimum of 60 days prior to the start of construction at the impact site and will be provided to USACE within 30 days of recordation. This shall be accomplished no later than January 1, 2023.

7. Baseline Information

7.1 Fox Point State Park Wetland Rehabilitation

The use of the site as an area for placement of industrial fill, the environmental assessment and associated remediation activities through its use as a County Park and cleanup and conversion to what is now Fox Point State Park are well documented, largely through the remedial action plan[1] records. Those records will be relied on to determine the extent of any further site assessment in the area identified for wetland creation and will be more fully detailed in the final plan. The intertidal wetland rehabilitation area has been documented by the USFWS wetland mapper as consisting of Palustrine, Emergent, Phragmites australis, Seasonally Flooded (PEM5R) as indicted in Chart 1: US Fish and Wildlife Mapping Chart. This is consistent with the visual indications of overgrown phragmites. The State of Delaware does not map the area as regulated wetlands.

Chart 1: USFWS Wetland Mapping

A wetland delineation of the project site was performed in October 2021 and February 2022 and is indicated in the existing conditions plans included in Appendix E. Additionally photographs of the existing conditions are also included in Figure 5. The mitigation site was undeveloped and occupied by a mixture of emergent and scrub/shrub plant communities. Much of the mitigation area was occupied by a wetland. The methods outlined in the U.S. Army Corps of Engineers' Wetlands Delineation Manual (1987) as modified by the Regional Supplement to the Corps of

Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (2010) were used to delineate the boundaries of this wetland.

The wetland located within the mitigation site was dominated by an emergent plant community. Common reed (*Phragmites australis*) dominated this community. Trees noted along the fringes of the wetland community included red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), pin oak (*Quercus* palustris), American sycamore (*Platanus occidentalis*), and black willow (*Salix nigra*). No shrubs or vines were noted within the wetlands. Trees observed in the upland riparian area included black cherry (*Prunus serotina*), white mulberry (*Morus alba*), and staghorn sumac (*Rhus typhina*). Shrubs and vines noted in this community included Amur honeysuckle (*Lonicera maackii*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*L. japonica*), grape vines (*Vitis sp.*), and poison ivy (*Toxicodendron radicans*). The herbaceous stratum included Japanese knotweed (*Reynoutria japonica*), an aster species (*Aster sp.*), and golden rod species (*Solidago sp.*). Both the wetland and upland riparian scrub/shrub communities were dominated by invasive plant species.

Based on the visual review of the hydrology of the area, the northern end of the site appears to receive tidal flow at extreme high tides, which is consistent with the survey information. The dominant hydrologic feature on the mitigation site was the tidal fluctuations of the Delaware River, although the bulk of the area contains shallow areas of stagnant water (as seen in the site photographs in Figure 5. The typical tidal flows range of the site are indicated in Table 3.

Table 3: Tidal Conditions at Fox Point State Park

Mean Higher High Water (Ft, Elevation NAVD 88)	3.19
Mean High Water (Ft, Elevation NAVD 88)	2.81
Mean Low Water (Ft, Elevation NAVD 88)	-2.80
Mean Lower-Low Water (Ft, Elevation NAVD 88)	-2.98
Mean Tidal Range (Feet)	5.62
Tidal Data based ON NOAA Tide Gauge 8540433	

The soil underlying the wetland and riparian upland was characterized by a veneer of organics overlying fill, which consisted of slag. A berm of slag bordered the wetland area to the north and east. An opening in the berm provided a hydrologic connection between the river and the wetland. Based on the relative elevations, the hydrologic connection only occurs at high tide, and represents less than 1 foot of potential tidal variation, opposed to the 6-foot typical tidal variation of the Delaware River.

Based on the relative elevations in the survey, this stagnant water appears to be primarily supported by runoff from the surrounding uplands with site grading that currently prevents effective drainage. The applicant evaluated the existing conditions of the area surrounding the

wetland enhancement areas and established a preliminary score of 15 in accordance with the State of Delaware Rapid Assessment Procedure (DERAP)[4] resulting in a value category of limited.

As part of the site assessment, the Applicant worked with the State of Delaware DNREC team to identify and evaluate an appropriate reference site for the enhancement work. An appropriate reference site for the proposed mitigation would consist of a naturally occurring intertidal wetland located on the Delaware River. Reference sites should be of higher quality wetlands which have good diversity and limited invasive species cover. The following criteria was identified as desired for the appropriate reference site:

- Intertidal wetland
- Experiences riverine conditions (high turbidity)
- Low invasive species cover (<10%)
- DERAP score of greater than 30
- Within the Delaware River Terraces and Uplands Level III Ecoregion

It is noted that the shoreline in the immediate vicinity of the enhancement site is highly industrialized and has been entirely modified from its natural condition. Accordingly, an appropriate reference site on the Delaware River within 1 mile of the project site was not identified. Additionally, there are numerous healthy wetland areas that have been restored or protected from the tidal energy of Delaware River that, while not appropriate reference sites, are an indication that appropriately designed intertidal wetlands can be constructed in this section of the Delaware River.

To identify an appropriate reference site, the evaluation process identified numerous natural shallow intertidal wetlands along the coastline, many of which were dominated by invasive species such as phragmites, making them less desirable as reference sites. However, through an extensive review process, a reference wetland site meeting the desired reference criteria was located. The selected reference site for this project is a natural wetland area located at DNREC's Ommelanden facility in New Castle, Delaware, approximately 11 miles south of the enhancement area. The reference site is indicated in Figure 6 and depicts a wetland area which is protected from the river energy with a beach and has a tidal access point with established flow channels to permit tidal exchange. The site experiences river conditions (e.g. tidal range within the turbidity maximum of the river). The narrowleaf cattail community was located approximately 0.5 to 1.5-ft. lower in elevation than the area where the common reed was prevalent. A fringe of palustrine forest wetlands was located adjacent to portions of this community. The tree species noted in the palustrine forest wetland included red maple (*Acer rubrum*), American sweet gum (*Liquidambar styraciflua*), and black gum (*Nyssa sylvatica*) as indicated in Figure 7.

The dominant hydrologic feature on the reference site was the tidal fluctuations of the Delaware River. The variations in the tidal conditions between the referenced project site is indicated in Table 4. The soil underlying the reference wetland reportedly has a veneer of organics overlying fine textured sediments.

[4] Delaware Department of Natural Resources and Environmental Control "Guidance for Rating Wetland Values in Delaware Version 1.1, September 2014.

Table 4: Tidal Conditions at Reference Site

	Reference Site	Variation from Project Site
Mean Higher High Water (Ft, Elevation NAVD 88)	2.87	0.32
Mean High Water (Ft, Elevation NAVD 88)	2.55	0.26
Mean Low Water (Ft, Elevation NAVD 88)	-2.79	0.01
Mean Lower-Low Water (Ft, Elevation NAVD 88)	-2.97	0.01
Mean Tidal Range (Feet)	5.84	0.22
Tidal Data based ON NOAA Tide Gauge 8551910		

Based on an online USFWS Information for Planning and Consultation (IPaC) environmental review process, one listed threatened species, the Northern Long-eared Bat, was identified as being potentially present on the uplands adjacent to the project site. No further consultation was requested under Section 7 due to the disturbance area of less than 15 acres. Additionally, one species listed as a candidate was identified, the Monarch Butterfly; however no critical habitat was identified. An environmental review by the DNREC's Species Conservation and Research Program (SCRP) indicated that two state-rare or federally listed species under the jurisdiction of the NOAA Fisheries exist at the project site—the shortnose sturgeon and the Atlantic sturgeon. The impacts of this project have been assessed though the preparation of a Biological Assessment[5] which has been submitted for formal consultation to the NOAA Fisheries . The Biological Assessment has concluded that the mitigation project will have no impact to the federally listed species due to the location of the action within the upper land area along the shore where the listed species are not present. DNREC's SCRP identified the presence of several rare plant species along the natural shoreline of Bellevue Cove, upriver of the project site. These species were not observed at the project site by the state botanist or the Applicant's representative. Due to the presence of these species, the state botanist has requested to maintain involvement in the restoration efforts, which has been considered in the work plan included in Section 8.

The DNREC's SCRP environmental review letter indicated that no in-water work should occur from March 15th through June 30th, to minimize potential impacts to Atlantic and shortnose sturgeon (both currently listed as endangered) as well as other commercially and recreationally valuable species during their spawning periods. No additional species were identified that differed from those identified under NOAA Fisheries' jurisdiction. A certification letter provided

[5] Environmental Research and Consulting, Inc. and Duffield Associates LLC "Biological assessment of the potential impacts of the Edgemoor container port project to species listed under the Endangered Species Act Application CENAP-OP-R-2019-278" dated October 20, 2021.

by the USFWS is included in Appendix G and a copy of the DNREC-SCRP's environmental review response letter, dated December 8, 2021, is included in Appendix H.

The extent of the Fox Point State Park site has been identified as areas which were originally river shoreline which had been filled by industrial development. The Delaware State Historic Preservation Office (SHPO)made an official determination that no historic properties, eligible for or listed in the National Register of Historic Places were affected by the Fox Point Project[6].

7.2 Brandywine Creek Dam 2 Site

The manmade impediments on the Brandywine Creek restrict the natural migration of anadromous fish. The goal of restoring access to the Brandywine Creek habitat has been well documented. The current efforts to restore the Brandywine Creek date to a 2005 feasibility study[7] performed by the Brandywine Conservancy, which expanded efforts to restore fish passage in the 1980s. These efforts were then reinitiated in 2016 by a group led by the University of Delaware and the Nature Conservancy[8] which now includes Brandywine Shad 2020, a collaboration of educational organizations, non-profits, governmental agencies, and private citizens with the primary objective of restoring American Shad and other migratory fish to the Brandywine Creek.

The Brandywine Creek flows from southeast Pennsylvania into the Christina River in Wilmington Delaware. Due to the fall of the creek and the proximity of the creek to the industrial center of Wilmington, more than 100 mills and dams were constructed along the Creek to support manufacturing in early America. Currently, 11 dams remain on the creek, restricting fish migration. Historically, technical fishways have been constructed at several of the Brandywine dams, including Dam 2; however these fishways have been damaged beyond repair and their effectiveness was not fully documented. Dam 1 was removed in 2019 and Dam 2 is currently the downstream impediment.

The removal of Dam 1 included the lowering of a sanitary sewer force main within the dam that provided the restoration of 11.5 acres of creek habitat to anadromous fish. Young of the year studies performed by Delaware Sea Grant in 2020[9] demonstrated that in the year following the dam removal, spawning occurred in the pool area at the base of Dam 2 as indicated in the summary presented in Table 5. The sampling program identified a series of resident species up river of Dam 2, but did not observe the presence of the primary target species during the seven sampling events.

[6] Port of Wilmington Edgemoor Expansion Project, SHPO Review No 2018.06.01.01, SHPO Letter March 31, 2022
[7] The Restoration of American Shad to the Brandywine River, Brandywine Conservancy 2005
[8] Brandywine Creek Shad Restoration Project, April 2016
[9] Annual Report Examining the Recovery of Diadromous Fishes in the Brandywine Creek DE, 2020

Table 5: Summary of 2020 Juvenile Shad Seining 2020 Event

	Below Dam 2 Location	Above Dam 2 Location
Seining Event 7/14/20	Adults: 5 Juvenile:0 Other Species: 13	Adults: 0 Juvenile: 0 Other Species:13
Seining Event 7/28/20	Adults: 3 Juvenile: 159 Other Species:0	Adults: 0 Juvenile: 0 Other Species:16
Seining Event 8/11/20	Adults: 0 Juvenile: 1 Other Species: 34	Adults: 0 Juvenile: 0 Other Species:12
Data Summarized from "Annual Report Examining the Recovery of Diadromous Fishes in the Brandywine Creek DE, 2020"		

Between 1986 and 2020, the University of Delaware and Delaware DNREC's Fish and Wildlife Section conducted fish surveys in the Brandywine Creek, primarily downstream of Dam 2. The methods included seining, electrofishing and creel surveys. In all surveys combined, 1,292 anadromous fish including Alewife (107), American Shad (482), Blueback Herring (691) and Hickory Shad (12) were collected downstream of Dam 2. No fish of these species were collected above Dam 2 during these surveys. A total of 675 American Eel (a catadromous species) were also collected as well as several marine species including Atlantic Needlefish, Atlantic Menhaden and Spot. Game and panfish species observed were Bluegill, Redbreast Sunfish, Smallmouth Bass, Largemouth Bass, Rock Bass, Striped Bass, Channel Catfish, Muskellunge, White Perch, Walleye, Yellow Perch, Striped Bass hybrid, and Tiger Muskie. Prey species were dominated by several cyprinids, Gizzard Shad and to a lesser degree darters and

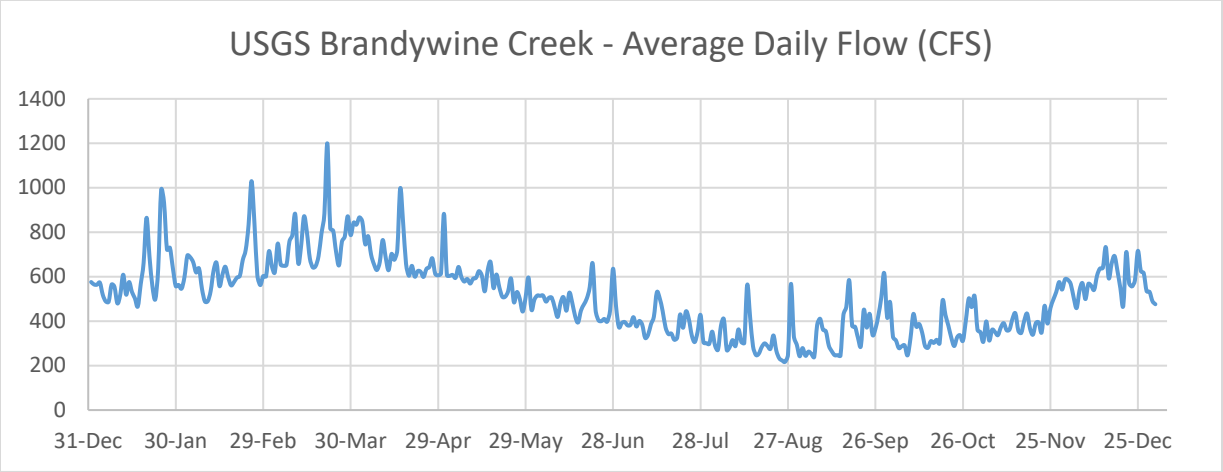


Chart 2: Brandywine Creek Tide Gauge 1946-2020

dace. The most common cyprinid species collected were Common Carp, Satinfin Shiner, Spottail Shiner and Cutlips Minnow. The reach of the creek where Dam 2 is located is characterized by the USGS Tide Gauge at Rising Sun Bridge (approximately 9200 feet upstream

of the dam). The flow of the creek has been in place since 1946 and provides established flow characteristics as indicated in Chart 2.

The average daily flows demonstrate that through the migration season, typical flows in excess of 500 cubic feet per second (cfs) are anticipated. Typical weirs in fish passage systems are constructed to pass 20 to 30 cfs, depending on the design depth and width. Based on these anticipated flows, a system with four weirs can be detailed to maintain flow during the migration season.

The Dam 2 impoundment provides water supply for the City of Wilmington residents through a raceway built into a dam and a pump station upriver of the dam at the western end of the pond area. The sediments accumulated behind the dam have been tested by DNREC Watershed Approach to Toxics Assessment and Restoration (WATAR) Team. The Applicant will perform additional studies and consultation as outlined in Section 8.

The existing conditions in the footprint of the Brandywine Dam 2 mitigation project, including the disturbance area associated with the mitigation work is outlined in the permit drawings included as an attachment within the hydraulic report, provided as Appendix F. This existing condition included the wetland delineation of the impact area that was performed in February 2022, which found that wetlands were not present within the impact area. The delineation is also included in Appendix F.

Based on an online USFWS IPaC environmental review, one listed threatened species, the Northern Long-eared Bat, was identified as being potentially present on the uplands adjacent to the project site. However, no further consultation was requested under Section 7 due to the disturbance area equaling less than 15 acres. Additionally, one species listed as a candidate was identified, the Monarch Butterfly. No critical habitat was identified. An environmental review by the DNREC's SCRP indicated that no state-rare or federally listed species exist at the project site. The database utilized by the DNREC-SCRP is comprehensive and site-specific, unlike the IPaC review which utilizes a generalized, five-mile radius search around the project site.

The DNREC's SCRP review letter requested that no in-water work occur from March 1st through June 30th to minimize potential impacts to commercially and recreationally valuable species during their spawning periods. A certification letter provided by the USFWS is included in Appendix G and a copy of the DNREC-SCRP's environmental review response letter, dated December 8, 2021, is included in Appendix H.

The location of the Brandywine Dam 2 site is noted as a contributing element of the Brandywine Park Historic District, but Dam 2 is not listed in the National Register of Historic Places. At this time, areas have been identified that were originally river shoreline which had been filled by industrial development. The consultation related to this project is ongoing.

The extent of the Dam 2 site has been identified as areas which were originally river shoreline which had been filled by industrial development. A Phase 1 Archaeological Survey[10] and a

[10] Richard Grubb Associates "Phase 1A Archaeological Survey, Fish Passage at Brandywine Creek Dams 2, 3,4 and 6"

Phase II Architectural Investigation[11] has been completed at the site by the Brandywine Shad 2020 team. The State Historic Preservation Office under Delaware Historic & Cultural Affairs Office has concurred with the conclusion that the Dam 2 structure is be eligible for inclusion in the national register6. Through the ongoing consultation under Section 106, the Applicant is in the process of developing a Memorandum of Agreement with Delaware Historic & Cultural Affairs to continue documentation of the structure impacted by this work. As discussed further in Section 8.2 the work plan considers an approach which minimizes the impact on the historic structures.

[11] University of Delaware Center for Historic Architecture and Design "Phase II Architectural Investigations for Fish Passage at the Lower Brandywine River Dams 2, 3, 4, 5 and 6"

8. Work Plan

8.1 Fox Point State Park Wetland Rehabilitation

The primary goal of the project is to create an intertidal habitat with hydraulic connection to the Delaware River with functional wetland habitat to provide foraging and nursery habitat to the species impacted by the Project.

The intertidal wetland mitigation plan consists of the removal of fill that has been placed by others to restore the area to tidal flow and construct intertidal wetland habitat within the footprint of the existing 1-acre phragmites stand to rehabilitate the wetland. The invasive phragmites (and any other invasive species) will be removed from the wetland area and the site will be treated to control the existing invasive species, and the 1-acre area will be excavated down to appropriate elevations to provide intertidal interaction and hydrology. High tide water depths are proposed to vary between 2.0 and 3.5 to provide a range of habitat communities going from deep to shallow and emergent intertidal wetlands consistent with the reference site.

The tidal flow will be provided by excavating through portions of the existing revetment along the northern portion of the park which had been constructed, by others, to contain the fill that is to be removed during the wetland construction. The excavation and grading within the wetland area and revetment removal will restore intertidal flow to the wetland area and provide connection to the river and access to the wetland habitat to the marine species of the river. The connection is proposed to be located in the portion of the existing revetment where the limited tidal connection currently exists.

Following invasive species removal and associated excavation, the wetland area will be stabilized with coir matting and will be planted with native emergent wetland plants. Plant species and locations will be selected based on anticipated water and tidal depths in the wetland as appropriate, and are anticipated to include:

- Wild Rice (Zizania aquatica)
- Narrow leaf cattail (Typha angustifolia)
- Small Saltmarsh Spikerush (Eleocharis parvula)
- Chairmakers Bulrush (Schoenoplectus pungens)
- Pickerelweed (Pontederia cordata)
- Rice Cutgrass (Leersia oryzoides)
- Flatsedge (Cyprerus spp.)
- Switch Grass (Panicum virgatum)
- Sharp-fruited Rush (Juncus acuminatus)
- Rose Mallow (Hibiscus mosheutos)

These species are consistent with the reference site which is primarily Wild Rice. The permit design included as Appendix E will be further developed to incorporate any relevant findings from the existing design investigation and supplemental site studies and feedback from the

project stakeholders. The design will restore intertidal wetland habitat and include features to provide productive foraging habitat for native fish species as well as habitat for many other aquatic species which have been impacted by the proposed Edgemoor project.

This design will incorporate our team's knowledge of viable Delaware River shoreline and intertidal marsh wetland management practices, and principles of wetland functional design to create a restored site with diverse habitat and minimal invasive species. This restoration project will be designed to be resilient to fluctuating water levels and storm surge events and will incorporate recommendations and guidance provided by project stakeholders. The restoration plan features native plant communities historically present in the area and have an overall landscape aesthetic suitable for this prominent location along the Delaware River.

The intertidal wetland design development addresses the following:

- Potential to improve fish and wildlife habitat,
- Fluctuating water levels associated with the tidal influence on the Delaware River,
- Projected impacts from climate change.

The Permit Design plans include:

- Identification of targeted plant community structures, species compositions, and habitat enhancement features based on the reference site;
- Summary of existing conditions and details of relevant information gathered during the site evaluation activities;
- Site grading and earthwork activities (e.g., site preparation, excavation, grading, etc.) based on the reference site;
- Proposed site improvements and final end-use plan depicting contours, dimensions, locations, and materials for each improvement feature;
- General erosion and sediment control plan;
- Revegetation plan and planting schedule;
- Performance Criteria and definition of success measurements; and,
- Monitoring Criteria and methods;

The intention of the permit design plans and documents is to show a level of detail necessary to enable the issuance of all appropriate authorizations to construct and develop a design based on the reference site which represents a reasonable expectation of a successful outcome.

Based on input received from the federal and state project stakeholders during Preliminary Design Review Meeting, the applicant will update the design plans and will prepare the Final Design plans to be used to direct construction. During the development of the Final Design plans, the Applicant consultant will prepare final plans to support construction that will include:

- All construction documents, plans, notes and specifications required for construction;
- Access agreements and environmental covenants;
- O&M Plan; and

- Updated Monitoring and Performance Criteria.

The intention of the Final Design Plans is to be prepared to be used for project implementation and construction by the Applicant with oversight by DNREC, as the land owner.

To conclude the Final Design stage, the Applicant consultant will provide the Final Design plans to the project stake holders for review and comment, in accordance with the input from DNREC SCRP, the final design plans will also be provided to the state botanist. Following the meeting, the Applicant will incorporate and update the Final Design plans with stakeholder comments and submit the completed Final Design plans to be used for construction. Construction will not commence without the approval of the Final Design plans by DNREC and USACE.

The construction of the wetland will substantially include the removal of the existing invasives as well as the excavation of soil to the target elevations and the subsequent soil amendments of the substrate. While this action occurs, the tidal flow will be temporarily restricted to allow for work activities and prevent sediment loss. Due to the scale of this operation, the application of herbicides to treat invasives is anticipated to be limited to the riparian buffer areas. At the completion of grading within the wetland area, the hydraulic connectivity to the Delaware River will be restored and the removal of the bank to permit long term connectivity will be performed.

Following establishment of the tidal wetland areas, the herbicide application will be periodically performed throughout the growing season to control the spread of invasives. In areas where herbaceous plants are observed to establish, hand pulling or digging has been shown to be effective. The removed plants would be placed in plastic bags and landfilled offsite, no removed invasives should be left onsite as they may continue to produce seed following removal.

It is noted that elements of the State of Delaware Compensatory Mitigation Plan[12] include design elements in the riparian areas of the wetland including the construction of a boardwalk, riparian buffer improvements, landscaping, and walkways. While these elements are not considered in the federal mitigation plan, it is the intention of the Applicant that these projects be constructed simultaneously, and that the deed restrictions and maintenance plans (for the wetland) will be developed in concert.

The construction and maintenance for the Fox Point Mitigation Project will be implemented subject to the conditions of the State of Delaware Compensatory Mitigation Plan[12] which was approved through the State of Delaware regulatory process. As documented in the plan, the Applicant, who is responsible for the design and construction of the mitigation project is provided access to the site to implement the design in accordance with the construction sequence and initial monitoring period.

[12] Duffield Associates, LLC, "State of Delaware Compensatory Mitigation Plan, Port of Wilmington Edgemoor Expansion" dated September 24, 2021, Approved by DNREC Wetland and Subaqueous Lands Section on September 29 ,2021 for State of Delaware Permit No SP-101/20.

8.2 Brandywine Dam 2 Site

The primary goal of the project is to restore access of upstream habitat to anadromous fish by constructing a rock weir, nature-like fishway constructed at Dam 2, the current downstream impendent to fish passage. The majority of the project work will consist of modifications to the dam and raceway structures to accommodate the improvements, reconstruction of the stream bed on the downstream side of the dam and the construction of the rock weirs. The permit drawings have been enclosed as an appendix in the hydraulic design report enclosed as in Appendix F. The design and implementation of the Brandywine Dam 2 project will be subject to terms of the Memorandum of Understanding between the City of Wilmington and DSPC which is included as Appendix I.

The project elements include:

- *Utility Condition Assessment and Relocation Planning.* There are two existing 42- inch sanitary sewers that extend below Brandywine Creek in the target area of the rock weirs. Additionally, there are also existing sanitary sewers extending along each bank of the creek and a combined sewer overflow outfall in the project area. In order to document the stability of the utility, preconstruction and post construction condition assessments of utilities within the mitigation impact area will be performed. The Applicant has worked with the city, who will maintain responsibility for the utilities in accordance with the memorandum of understanding, has indicated that long term management of these lines would include the placement of an internal reinforcement lining.
- *Environmental Site Assessments.* Limited environmental assessments are anticipated to be performed as part of the project. It is understood that the Brandywine Shad 2020 has coordinated environmental assessments of sediments impounded behind the dam, which were performed by DNREC.
- *Hydraulic Modeling and Fishway Design. Hydraulic* Modeling will be performed to assess flows though the fishway and evaluate the effects of the fishway on the creek. The modeling will be based on the historic flow conditions in the creek at the USGS Tide Gage at Rising Sun Bridge (approximately 9200 feet upstream of the dam) with consideration for each water withdraw structure that is present between the gage and the creek. At a minimum, the 5% exceedance and 95% exceeded flows during the migration season and throughout the year will be considered. The modeling results will be utilized to adjust the fishway to achieve the maximum flows and drops in accordance with the USFWS Design Manual for the primary target species of American Shad, river herring and alewife, with consideration for the secondary species of hickory shad, if appropriate. Based on discussions with the resource agencies, passage of striped bass or sturgeon are not proposed to be considered. The preliminary Hydraulic Modeling Report supporting the permit drawings has been enclosed as Appendix F to this report.
- *Regulatory Permitting and Final Design Submissions.* The construction of the nature-like fishway will include several levels of regulatory permitting. It is currently anticipated that an individual permit from USACE and State of Delaware subaqueous permit will be required. The City of Wilmington regulatory approval will also be required, which is anticipated to include a review by the City of Wilmington Design Review and Preservation Commission and Floodplain permit. It is anticipated that the approval is

likely to include an application with the Federal Emergency Management Agency associated with the approved permit drawings. .

- *Stream Bed Construction.* In order to limit the height of the rock weirs, a portion of the bed of the river will be filled with stone to construct a maximum 2.8 percent base slope at the proposed pond depth of 4 feet. The stream bed will be constructed into the existing stream banks with consideration for existing infrastructure and the long-term stability of the constructed bank to support the increased hydraulic loading of the nature-like stream.
- *Rock Weir Construction.* The boulder rock weirs will be constructed with bearing into the constructed stream bed to the existing stream bed. Each rock weir will be placed to the design elevation with three or four integrated rock weirs. In order to promote fish passage of various species, each rock section will include two weir sizes based on the target species. Weir depths of 1 foot and 2.25 feet will be incorporated to develop passage for American Shad, River herring and Alewife.
- *Dam and Raceway Modification*. Modifications to the dam and raceway structure are anticipated to consist of three notches cut into the dam, sized to meet the design hydraulic requirements. The dam notches will be configured with a means to restore the current elevation in the event of low flow periods. It is currently proposed to limit the closure of the dam weirs river flows of less than 150 cfs, which corresponds to approximately half of the 95% exceedance flow during the passage season for the Brandywine Creek. This low flow limitation corresponds to the minimum flow levels required to maintain flow the City of Wilmington water withdrawals which are considered critical infrastructure for the city residents. The closure gates in the weirs are anticipated to be stop logs, which will be manually operated and stored, protected from the elements by the city, and require minimal maintenance.
- *Operations and Maintenance.* The rock weir system is anticipated to require minimal maintenance as described in Section 11. The rock weirs are not proposed to be constructed with wearable parts that would require replacement. The applicant will develop an operations and maintenance plan that details the anticipated maintenance and operation requirements of this compensatory mitigation plan for the long-term stewardship of the system.

It is noted that through the design development that has occurred to date, the Applicant has considered several alternatives for fish passage, which have included a partial review of the dam structure (e.g., the hybrid full width concept). To reduce the impact to the dam structure, the Applicant has selected the full width nature like fishway design constructed on the face of the existing dam structure. In the permit design drawings included as Appendix F, the impact to the early elements of the structure is limited to one notch through the mass remnants of the original portion of the dam structure (e.g. the 15 foot wide section of the dam), and two notches through the portions of the dam that have been substantially reconstructed and modified since the original construction and the early elements of the dam are limited (e.g. less than 5 feet wide). This alternative minimized impacts to the dam structure as compared to other alternatives considered to provide fish passage.

The design work associated with the final design has been initiated. The survey work required to support the permit level drawings was completed in January 2022 and is the basis of the permit drawings included in this submission. The collection of data to support the final hydraulic

modeling refinements have been initiated to collect flow data throughout the 2022 fish passage season. Based on the Port of Wilmington, Edgemoor Expansion Project schedule, it is anticipated that regulatory decisions may be completed by Summer 2022, which corresponds to the completion of final design work for the fishway. It is assumed that construction will commence following the approval of the Project Section 204(f), concurrent with the start of Project construction. It is noted that similar seasonal restrictions are anticipated for both the project and the mitigation project, with tentative construction at the project site proposed in Summer 2023. The proposed sequence of construction and detailed discussion of the work plan is provided in Appendix F.

Based on the anticipated timelines, construction of the mitigation project will be completed prior to the completion of the Project construction, with construction at the mitigation project completed within one construction season, with construction at the site occurring over several construction seasons.

8.3 Establishment of the State of Delaware eDNA Monitoring and Research Program

This section provides a scope-of-work for an Environmental DNA (eDNA) Monitoring and Research Program that will be funded by the Applicant and implemented by the Delaware DNREC. Establishment of the program will allow for collection and analysis of routine and meaningful data that will support future resource management decisions.

DNREC Environmental DNA Program Establishment and Port Construction Monitoring

In conjunction with the dredging activities proposed to occur in the Delaware River associated with the Port of Wilmington – Edgemoor Expansion Project, the Applicant is proposing to fund monitoring and research activities performed by DNREC in the immediate and adjacent areas through the use of eDNA sampling and analysis. Monitoring activities will help evaluate and understand potential impacts of the dredging project on resident and transient fish species that use this portion of the Delaware River. It is well documented that the region of the Delaware River where the Edgemoor Expansion and the Fox Point State Park mitigation projects include essential habitat for recreationally/commercially valuable species and critical habitat for endangered species[1]. As such, the Applicant will provide the funding for the purchase of the necessary sampling and analytical equipment to allow for an expansion of the DNREC Environmental Laboratory Section's (ELS) existing eDNA monitoring capabilities. In addition, the Applicant proposes to fund expanded eDNA sampling activities in the Delaware River to monitor state and federal public trust species. The sampling activities will be conducted by DNREC's DFW Fisheries Section and/or by DNREC's DW- ELS for the three years (cycles) coinciding to the construction period anticipated for the Port of Wilmington Expansion Project. In addition, sampling activities will be conducted in other areas of the state, not related to Port construction, to assist in ongoing research activities and to assist in the identification of potential future habitat restoration and enhancement projects.

eDNA Overview

Environmental DNA (eDNA) are intra- and extra-cellular forms of DNA released by organisms into the water, soil, or air, and data is generally used as a supplement to traditional sampling means. The eDNA identified in a sample can be compared to existing databases to determine the presence of specific species. It has proven to be cost-effective, safe, and to perform well in comparing changes in fish communities over time. eDNA sampling has many advantages over traditional sampling of fish communities. First, it is non-invasive; in-water work is minimized as only a simple water sample is needed for detection of species presence/absence. Second, it is time and cost effective; the number of staff needed to conduct sampling is minimized as only water samples and the associated processing equipment are needed. Samples can be collected temporally to document runs of several anadromous species that are sequential during the spring. Finally, with proper storage, eDNA samples can be retained indefinitely for future analysis to determine additional species' presence without the need to re-collect samples. eDNA methods have proven to consistently detect species absent from traditional sampling such as rare[13], invasive[14], and endangered[15] species. eDNA allows for better estimates of biodiversity[16], a key indicator of overall ecosystem health. As eDNA methods have continued to evolve it has also shown merit for use in estimating species abundance[17] .

DNREC Programmatic Need

According to the DNREC-DFW, numerous immediate needs for eDNA data have recently come to light. For the last 4 years, the Fisheries Section has obtained presence/absence fisheries data at 118 sites throughout the State using traditional sampling techniques and gear. Their traditional data collection efforts were hampered at 30 additional sites, however, due to access issues such as variable water depth, unfavorable bottom type, obstructions (e.g. down trees, steep banks, and uneven ground), and private property limitations. The collection of eDNA from surface water, which doesn't necessarily require a boat and other cumbersome equipment, would allow for the evaluation of species' presence/absence at these critical but challenging sample locations.

The Applicant also understands from DNREC-DFW that the monitoring requirements of federally mandated fisheries management plans typically take priority for their staff during the months of March through June. This leaves less time for additional sampling related to other fisheries management priorities using traditional methods. Time efficiency associated with eDNA sampling will potentially allow DNREC to expand its data acquisition efforts on anadromous fish stocks, including the federally endangered Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*) and the shortnose sturgeon (*Acipenser brevirostrum*).

[13] Jerde, et al., D.M., 2011. ''Sight-unseen'' detection of rare aquatic species using environmental DNA: eDNA surveillance of rare aquatic species
[14] Hinlo et. al., 2018 Performance of eDNA assays to detect and qualify an elusive benthic fish in upland Streams
[15] Strickland, G. J., & Roberts, J. H. 2018. Utility of eDNA and occupancy models for monitoring an endangered fish across diverse riverine habitats
[16] Evans et.al. 2016. Quantification of mesocosm fish and amphibian species diversity via environmental DNA metabarcoding
[17] Lacoursiere-et. Al., L. 2016. Quantifying relative fish abundance with eDNA: A promising tool for fisheries management

Just as eDNA data will supplement physical monitoring of the endangered Atlantic sturgeon and Shortnose Sturgeon in the Delaware River as part of the proposed study, there are apparent and similar data needs in Delaware's tidal Chesapeake Bay watersheds (e.g., Nanticoke River and Broad Creek).

According to DNREC-DFW, invasive species monitoring is yet another ongoing charge that demands time and effort from staff. From Flathead Catfish (*Pylodictis olivaris*) in the C&D Canal to Blue Catfish (*Ictalurus furcatus*) in the Nanticoke River to Northern Snakehead (*Channa argus*) in Delaware's rivers and ponds, data derived from eDNA sampling would provide a more efficient supplemental means of documenting the distribution of these species.

Finally, species specific data derived from eDNA analysis will be used as a barometer of fish species concentration (per unit volume), which can be an indicator of good or poor adult spawning stock abundance during the spring runs. This type of information, if available, would be a major asset to fisheries managers and biologists for population trend analysis.

Scope of Work

After consultation with DNREC-DFW, the Applicant proposes that eDNA monitoring be conducted regularly in the immediate vicinity of the port expansion project dredging area, and also in areas outside of the immediate dredging area and in adjacent rivers and creeks of the larger Christina River watershed (due to the transient nature of the species of greatest concern). These areas will be evaluated prior to dredging, during dredging, and after dredging (for each dredging cycle), to evaluate what impacts to fish populations are occurring.

Of special interest in the Delaware River are Atlantic sturgeon and shortnose sturgeon. Sturgeon DNA monitoring associated with this Port of Wilmington Expansion Project State Mitigation Plan will address several DNREC management directives and provide much needed information for the conservation and recovery of these species. The data collected during this three-year project will be vital for state and federal fisheries managers to mitigate impacts from dredging, water withdrawals, shoreline stabilization projects, development of breakwater structures and other possible future perturbations within the Delaware River. The results of this study will also be used to guide the DNREC-DFW time-of year restrictions that reduce anthropogenic impacts on sturgeon (and other species). The eDNA monitoring for river-resident juvenile Atlantic sturgeon and migratory adult Atlantic sturgeon in the Delaware River will provide a better understanding of habitat use within the Delaware River Estuary and provide guidance for traditional sampling efforts to evaluate changes in the location of nursery habitat.

For the focus area (Delaware River), the DNREC-DFW recommends that sampling occur approximately once per river kilometer, monthly, from Liston Point to the State line (or slightly above). At a distance of approximately 50 kilometers, this would equate to 600 samples annually. As part of this monthly sampling DNREC-DFW will also include targeted sampling on Cherry Island Flats to monitor striped bass populations. The adjacent Christina River watershed includes the main stem of the river, as well as Brandywine Creek, Red Clay Creek, and White Clay Creek. DNREC-DFW staff recommend that sampling occur bi-weekly from March through October for the main stem Christina River at each river kilometer (10 km), for a total of 160 samples annually. Alosine spawning is well documented in the Brandywine Creek and therefore should have an increased sampling frequency. To supplement targeted sampling associated with the Dam #2 fish passage project, DNREC-DFW recommends eDNA sampling at each of the 10 bridges as well as above each of the 10 dams which currently exist on the creek. Sampling

should be conducted bi-weekly in March, weekly in April and May (when anadromous species presence is believed to be at its highest), and bi-weekly again in the months of June through October. This increased frequency of sampling equates to approximately 400 samples annually. Finally, sampling in the Red Clay and White Clay creeks should occur at each bridge crossing (12 per creek) bi-weekly for the months of March through October for a combined total of 384 samples annually. This eDNA collection plan equates to 1,544 individual samples per calendar year in the Delaware River and the adjacent Christina River watershed.

All eDNA samples collected during the monitoring period will be collected by DNREC-DFW and/or DNREC-ELS, and all samples will be analyzed by the DNREC-ELS. In addition to Atlantic sturgeon, species of interest may include, but not be limited to: Shortnose Sturgeon, Striped Bass (*Morone saxatilis*), American Shad (*Alosa pseudoharengus*), Blueback Herring (*Alosa aestivalis*) and Alewife (*Alosa sapidissima*; collectively, river herring), Hickory Shad (*Alosa mediocris*), and/or American Eel (*Anguilla rostrata*).

In addition to the sampling strategy summarized above for the Delaware River and greater Christina River watershed, it is proposed that DNREC-DFW extend their eDNA monitoring to other rivers, creeks, and ponds in the State over the same three-year period to meet their additional eDNA data needs and to supplement their existing data. Based upon information provided by DNREC-DFW, an additional 570 samples (190 samples annually) could be collected from the Nanticoke River and Broad Creek to evaluate interests related to Atlantic sturgeon and shortnose sturgeon. An additional 2,700 samples (900 samples annually) could be collected from Delaware rivers, creeks and ponds for interests related to invasive species and other species of interest. Last, an additional 1050 samples (350 samples annually) could be collected in waters not already being sampled for other reasons described above.

Summary

eDNA data can be used as an indicator of species presence/absence, and potentially species abundance as advances are made in this field. This type of information, in conjunction with traditional fisheries survey methods, can be used by DNREC to direct additional field sampling efforts, for fisheries and watershed management purposes, and to validate past fish collection data. In addition, eDNA data can be utilized to identify future potential mitigation areas in relation to critical habitat and with regard to dam removal/fish passage projects in the State. Finally, eDNA data can be used to identify and track invasive species in the State's water bodies without relying solely upon traditional field collection methods.

If funds remain after completion of the proposed three-year work plan described herein, additional eDNA sampling can be added at the discretion of the DNREC-DFW or can be utilized for additional juvenile sturgeon research in the Delaware River and/or Nanticoke River to meet Atlantic States Marine Fisheries Commission sampling confirmation protocols. In addition, the capital expenditure for analytical equipment will allow DNREC to continue its eDNA monitoring efforts into the future.

The Memorandum of Understanding between the Applicant and the State of Delaware DNREC to implement the eDNA program has been enclosed as Appendix J.

9. Ecological Performance Standards

9.1 Fox Point State Park Wetland Rehabilitation

The ecological performance standards would be determined by the final approved permit for the project, including the final compensatory mitigation plan. In general, performance standards for the habitat creation area and wetland enhancement will focus on verification that the in-kind habitat area is constructed, and that the sustaining native vegetation is established.

The constructed, functional intertidal zones that provide habitat that is equal to or greater than the unvegetated habitat that is impacted by the Edgemoor project. The elevations for the final design shall be similar to the range of elevations impacted, and the area of the intertidal and subtidal zones shall be consistent with the requirements of the mitigation plan.

The substrate of the shallow intertidal zone shall be modified such that the suitable soils for establishment of vegetation are provided. The selected vegetation shall be sufficiently sized to prevent damage from tidal flow (e.g., limited use of seeds). Further, the site should be designed with minimum water depth to reduce the prevalence of invasive species such as phragmites, and the maintenance plan should be sufficient to control the growth of invasive species during the establishment periods. The establishment period will be extended until such a time that the current phragmites stand is improved from a PEM5R classification in accordance with the NWI Code Definitions to a E2EM1N or greater classification.

The ecological performance standards are focused on providing resilient intertidal wetland habitat. The standards include:

- *Wetland Vegetation Dominance.* Establish a wetland community within the vegetated area where more than 50 % of the dominant plant species are rated obligate, facultative wet, or facultative utilizing the USACE established vegetation sampling procedures.
- *Aerial Cover Standards.* Achieve long term stability of the wetland by establishing a 5-year aerial coverage of native species consistent with the reference site of 75 percent of the vegetated area. To achieve this long -term goal, incremental aerial cover standards of 45 percent at 1 year and 60 percent at three years shall be considered.
- *Control of Invasive Species.* The design of the wetland has incorporated grade changes to minimize the extent of the wetland area that is at elevations prone to invasive species (primarily phragmites). The wetland shall be managed to not greater than 5 percent invasive species.
- *Wetland Hydrology.* The restored habitat is to consist of intertidal wetland with connectivity to the Delaware River. The Applicant shall survey the constructed wetland to document that the habitat provided includes the proper tidal hydrology and substrate elevations, and that the wetland areas flood during typical tidal fluctuations.

The performance criteria for the wetlands will be based off the reference site as the relative target end-use condition for the wetlands. While the enhancement site may have limiting factors

which prevent it from reaching the same quality of the reference, the reference serves as a guide for the potential condition.

9.2 Brandywine Dam 2 Site

The ecological performance standards for the nature-like fishway have been developed to provide fish passage at Dam 2 for the target Alosine species American Shad, Alewife and Blueback Herring (Alewife and Blueback Herring collectively known as "river herring") by the Applicant's fisheries consultant, Kleinschmidt Associates. The design of the fishway will provide for weirs with varied flow depths, widths and velocities to maximize the variety of anadromous and resident species which may utilize the fishway. The ecological performance standards have been enclosed as Appendix K.

The ecological performance standards are focused on providing effective fish passage to the existing impediment as well as demonstration of the use of the habitat to which access will be restored. The standards include:

- *Fishway that follows Design Criteria and Contemporary Guidance.* The nature-like fishway will be constructed to meet the target passage criteria for the primary species of concern including American Shad, Alewife and Blueback Herring with consideration for additional passage for secondary (non-target) species including hickory shad.
- *Fishway meeting upstream passage efficiency.* The nature-like fishway will operate with a three-year running average or three out of four sequential years minimum efficiency of 70 percent for the target species.
- *Demonstration of the Access to the Habitat.* The nature-like fishway will restore access to available habitat for migrating adults of the target species up to the base of Dam 4.
- *Demonstration of the Use of the Habitat.* The migrating adults of the target species will utilize the upstream habitat for spawning and young of the year will utilize the upstream habitat for foraging, within the area where access is restored.

While the restored habitat is likely utilized through the season, the migration of adults primarily occurs during the spring. The design of the fishway is based on established flows during the migration period. The operations plan will restrict closure of the system (e.g. closing the gates installed in the existing dam) to extremely low flow events, which have infrequently occurred during the summer period outside of the target migration period, which may put the City of Wilmington water supply at risk. The fishway will remain open through the year during normal flows.

10. Monitoring Plan

10.1 Fox Point State Park Wetland Rehabilitation

The performance standards for the intertidal habitat and wetland rehabilitation will be demonstrated through a monitoring plan which will be performed by the Applicant through the 5-year monitoring period. The monitoring plan shall be implemented to document compliance with the performance standards, primarily that the rehabilitation efforts provide:

- Intertidal habitat
- Tidal exchange of river flows
- A stable habitat free of invasive species.

These standards will be monitored through a combination of quantitative and qualitative assessments.

Initially, qualitative assessments will consist of a review of:

- Overall site conditions
- Flow conditions
- Plant survival
- Vegetative cover
- Species Composition
- Inlet/outlet structures.

These initial, monthly qualitative assessments (i.e., during the first year) will include photographic documentation that would be distributed to the project stakeholders, including USACE and Delaware DNREC and the resource agencies on the project mitigation team. Additional qualitative assessments will be performed whenever the Delaware River reaches 100 years flood flows or elevation. Should any damage or invasive species (e.g., phragmites) be identified during the qualitative assessments, they will be reported to the maintenance team for corrective action.

The performance of quantitative assessments will target the end of each growing season (likely September) at quadrants established in each habitat type, including a reference area in adjacent emergent wetlands. Each vegetation community/habitat type will be quantified to assess performance of the mitigation areas and the need for institutional controls (e.g., management of invasive species), if necessary. The quantitative assessments will also verify the stability of the intertidal habitat and that habitat loss has not been experienced through sedimentation or other means. Further, the quantitative assessments will verify sufficient growth and survivability to meet the anticipated survivability performance standard rate of the plants for the establishment period and dictate sufficient supplemental plantings to achieve a stable wetland environment or to employ other adaptive management measures.

The qualitative assessments will be performed yearly between June 15th and September 30th,

beginning the first season following the completion of construction. For each quantitative assessment event, a quick, visual review of the area will be performed followed by sampling of six discrete field cells. Each field cell is a randomly selected plot approximately four feet by four feet in size and will be maintained for the monitoring period. The following data will be documented for each field cell:

- Dominant vegetation species
- Percent of ground cover
- Number of woody plants stems greater than 10 inches in height
- The percentage of dominant species facultative or greater.
- The percent survival by planted species; and
- The percent cover of invasive species.

In addition to field data, the quantitative assessments will also include photographic documentation. Quantitative assessments will occur annually for a period of 5 years unless it can be demonstrated that the mitigation goals have been met prior to that. Conversely, the quantitative monitoring may extend beyond the 5-year period if adaptive management is required to meet the performance standards.

Following the qualitative and quantitative monitoring events, a concise report (i.e., less than 10 pages) will be prepared to document the findings. The report will be submitted to the U.S. Army Corps of Engineers, Philadelphia District prior to December 31 of each monitoring year. The cover of the report will include the project name, monitoring year and Army Corps project number. A template of the Fox Point State Park Wetland Rehabilitation Monitoring report has been enclosed as Appendix L.

In addition, to document progress of the rehabilitation effort, as-built surveys will be conducted within 3 months of construction and during monitoring year 3 and 5. The survey will include a delineation of the mean high-water elevation and high tide line, which will verify the area of the wetland, as well as the elevation of the inlet/outlet structure inverts and observed vegetation "bare spots."

10.2 Brandywine Dam 2 Site

The design ecological performance standards will be demonstrated through a monitoring plan which will be performed by the Applicant through the 5-year target monitoring period. The draft monitoring plan has been prepared by the Applicant's fisheries consultant, Kleinschmidt Associates and has been enclosed in Appendix M and includes elements to demonstrate that the performance standards are focused on providing effective fish passage to the existing impediment as well as demonstration of the use of the habitat to which access will be restored. The standards include:

- *Fishway that Follows Design Criteria.* An as-built survey of the nature-like fishway will be performed following construction. The survey will demonstrate that the design weir dimensions, minimum pool depths and minimum pool areas have been constructed. The survey will include measuring hydraulics in the target weirs to ensure they are appropriate for target species.

- *Fishway meeting upstream passage effectiveness.* The Applicant will perform a multi-year radio telemetry study to establish the efficiency of the system. The study will be performed annually for a minimum of three years (or until a minimum efficiency of 70 percent has been demonstrated for three consecutive years). The target sample size of the study during the first year will include tagging of 60 American Shad and 60 river herring, tagged at the beginning of the migration season in mid-March. The target sample size of 60 fish for each species includes an additional 10 fish per species to account for drop-back and mortality.
- *Demonstration of Spawning and Foraging Habitat Use.* The Applicant will demonstrate that the migrating adult fish of the target species are accessing and utilizing suitable upstream habitats between Dams 2 and 4 for spawning and foraging. This will be demonstrated on a quantitative and qualitative basis and are likely to use the following methods:
    - PIT tagging/skilled angler study consisting of an additional 150 adult target fish species PIT tagged below Dam 2 for potential recapture by anglers upstream of Dam 2. Skilled anglers fishing above Dam 2 will be paired with a biological technician who will collect morphometric data and scan the collected fish at locations based on a statistically derived study design.
    - Haul seining twice monthly from July through October at two existing locations (one downstream and one upstream of Dam 2) and a minimum of two additional locations upstream of Dams 2 and 3. Haul seining will be conducted annually to document successful reproduction of Alosines between Dams 2 and 4.
    - Ichthyoplankton Sampling to verify the presence of egg deposition as a qualitative confirmation of spawning within the Dam 2 to Dam 4 reach.
    - E DNA sampling which allows detection of target fish in the area between Dams 2 and 4 without visual identification and/or physical capture of target fish.

In addition to the methods described above, radio telemetry and visual observations of spawning activities by the target species will be used to qualitatively confirm use of the upstream reaches between Dams 2 and 4.

Following the field monitoring a concise report, less than 10 pages, will be prepared to report the findings of the above noted monitoring event. The report will be submitted to the U.S. Army Corps of Engineers, Philadelphia District prior to December 31 of each monitoring year and the cover of the report will include the Army Corps project number.

The assessments will occur annually for a period of 5 years unless it can be demonstrated that the mitigation goals may be extended if adaptive management is required to meet the performance standards. In order to further the research activities supporting the return of anadromous fish to the Brandywine Creek, the Applicant is proposing a variety of sampling methods through the monitoring period to further develop the baseline information for other restoration efforts. This monitoring, as well as other potential monitoring as outlined in Section 4.3, will be coordinated though DNREC and Brandywine Shad 2020.

11. Maintenance Plan

11.1 Fox Point State Park Wetland Rehabilitation

The Applicant shall be responsible for the maintenance of the constructed intertidal habitat area and wetland enhancement areas. The Applicant will be responsible to perform maintenance as identified by the monitoring reports, project stakeholders, or other appropriate parties. At a minimum, the applicant shall:

- Perform annual invasive species treatment and removal for five years as needed to maintain an invasive species abundance of 5% or less.
- Replace dead plants and/or perform supplemental planting as needed to achieve targeted plant densities within the wetland areas.
- Clear debris trapped within or blocking wetland inlet. Excess accumulation of sediment within inlet shall be removed if determined to be impeding wetland tidal interaction.

The Fox Point State Park is maintained by Delaware DNREC. The Applicant anticipates that at the completion of the initial maintenance period in Year 6, the ongoing maintenance may be performed by the park personnel though an agreement with the Applicant. The applicant will maintain a maintenance fund to support maintenance and repairs (i.e., invasive removal and supplemental planting).

While the applicant anticipates that the maintenance may be performed by DNREC, it is understood that the responsibility to ensure the maintenance is performed remains with the Applicant. The formal maintenance plan will be prepared with the design documents and will depend on the final elements of the intertidal habitat and wetlands.

It is noted that elements of the State of Delaware Compensatory Mitigation Plan[12] include design elements in the riparian areas of the wetland including the construction of a boardwalk, riparian buffer improvements, landscaping, and walkways. While these elements are not considered in the federal mitigation plan, it is the intention of the Applicant that these projects be maintained simultaneously, and that the maintenance plans for the wetland and the access areas may be combined.

11.2 Brandywine Dam 2 Site

The maintenance of the rock weir, nature-like fishway consists of tasks both prior to ("Pre-NLF Acceptance Tasks) and after ("Post-NLF Acceptance Tasks") the required evaluation period to determine that the fishway meets the performance criteria. Maintenance tasks also include post-flood inspections and repairs to the nature-like fishway. The Applicant will assume responsibility for all maintenance activities for the foreseeable future and may complete the maintenance activities themselves or assign maintenance activities to agents, employees, contractors or designee(s). The maintenance plan, prepared by Kleinschmidt Associates, has been enclosed as Appendix N and is summarized below.

- *Pre-NLF Acceptance Tasks*. These tasks include visual inspection, accumulated debris removal and Dam 2 flow control system maintenance. Visual inspection of the nature-like fishway will occur four times per year during the pre-acceptance evaluation period. The first inspection is to be conducted prior to the fish passage season while the second and third inspections would occur during the fish passage season, generally considered to be March 15th to June 15th. The fourth inspection would be conducted during the seasonal low-flow period (anticipated to be September). Visual inspections will be performed by a qualified observer as defined in the Maintenance Plan. Debris removal will be triggered only if two or more zone of passage notches are more than 75% blocked on a single weir and safe access is feasible. Since the flow control structures are not intended to be used frequently, it is anticipated that only minimal maintenance of the Dam 2 flow control system will be required.
- *Post-NLF Acceptance Tasks*. Once it has been determined that the nature-like fishway meets the performance criteria, the Applicant will be responsible for ensuring the fishway is inspected, maintained and functional. Visual inspection by a qualified observer will occur twice annually in late winter (target February) and during the low flow period (target August). Accumulated debris removal will be performed as needed and the Dam 2 Flow Control System Maintenance will be conducted annually. The performance of both tasks is based on the same criteria as the Pre-NLF Acceptance tasks.
- *Post Flood Inspection.* This task, which will occur for the life of the fishway, will be triggered whenever flows at the USGS gauge on the Brandywine Creek in Wilmington, Delaware reach a 10-year return period flow of 17,300 cfs or more. A visual inspection by a qualified observer will occur within two weeks of the return to baseflow conditions. This task will also include debris removal, similar to the tasks above.
- *NLF Repairs*. In the event the hydraulics of the fishway are substantially impaired in a manner that prohibits reasonable fish passage of the target species, repairs may be required after consultation with relevant parties (including the USACE, City of Wilmington, USFWS, NOAA Fisheries, DE SHPO and DNREC). Within three months of learning of the damage or poor performance, DSPC will prepare a short proposal outlining the poor conditions and what is being proposed to remedy those conditions. Prior to initiating any remedial work, the proposal will be submitted to and accepted by USACE, USFWS, NOAA Fisheries DE SHPO and DNREC. As-built drawings for the fishway will guide repair efforts.

The records of the initial maintenance periods will be included in the compensatory mitigation monitoring plan report. DSPC will also maintain the records of the annual inspections. The applicant will maintain a maintenance fund to support up to 4 significant repairs (i.e., ramp modifications requiring regulatory notification).

12. Long Term Management Plan

12.1 Fox Point State Park Wetland Rehabilitation

The implementation of the intertidal habitat is intended to establish a functional, self-sustaining community with tidal connection to the Delaware River. The Applicant will perform monitoring and maintenance to ensure that a sustaining environment is constructed. Following the initial maintenance period, and when the performance standards have been achieved, the Applicant proposes to maintain the habitat with typical maintenance that is performed in the park to control invasive species that has been established as effective for a period of at least 10 years. As outlined in the State Mitigation Plan, it is the expectation that the DNREC Park Personnel will be responsible to implement the long-term maintenance; however, the ultimate responsibility of the project remains with the Applicant.

12.2 Brandywine Dam 2 Site

The implementation of the rock weir, nature-like fishway has considered self-sustaining elements. The project is intended to establish functional self-maintaining elements that require minimal maintenance beyond removal of accumulated debris. The primary element of the project that will require long term replacement or regular mechanical maintenance is the gates within the dam structure which may be closed during low flow periods. The City of Wilmington water infrastructure currently includes two gates at the dam. The selection of a gate system that operates in a similar manner as the existing infrastructure will limit the impact of the new system.

When the performance standards have been achieved, the stewardship of the project is transitioned from the Applicant to the New Castle County Conservation District (the District), a governmental subdivision of the State of Delaware. Under Delaware law the District is authorized to enter into agreements to provide aid for, among other things, the development and utilization of land and water resources. The District is a stable State of Delaware governmental entity which is capable of maintaining the system in accordance with guidance solicited from the resource agencies to comply with the federal and state permit conditions for the nature-like fishway. While the Applicant intends to transition the performance of the long-term management, it is understood that the Applicant remains responsible to ensure that regular maintenance occurs and that repairs, when needed, are performed.

A Memorandum of Understanding to perform inspection and maintenance of the NLF between DSPC and the District is included as Appendix O.

13. Adaptive Management Plan

13.1 Fox Point State Park Wetland Rehabilitation

The Applicant will be responsible for implementing the proposed wetland enhancement and habitat creation at Fox Point State Park and ensuring that all as built and performance criteria are met during the monitoring period. In the event the Applicant determines that the site is not achieving the performance standards identified in the Performance Standards Section of the final Compensatory Mitigation Plan, a Notice of Deficiency shall be developed by the Applicant and submitted to USACE and DNREC. The Notice will define the deficiency and propose the adaptive management that is needed or required. The adaptive management will be approved by the USACE/DNREC in accordance with 33 CFR 332.4 (c) (12) and implemented by the Applicant.

The Applicant has identified several potential Adaptive Management activities that could be utilized at the project site:

- Invasive species management will be performed as needed to achieve and maintain the project performance standards for total invasive species cover for invasive plant species such as phragmites. Following invasive species removal, supplemental planting of native wetland vegetation will be performed as needed.
- Supplemental plantings will be installed during the period of establishment as needed if monitoring results show that the project is not on track to meet to meet the performance standards outline in this plan. Supplemental vegetative plantings will be selected based on the final mitigation plan specifications. Adjustments may be made to locations of supplemental plantings based on the observed water levels of the as-built wetland area to optimize the hydraulic conditions for various plant species.
- Engineering changes or modifications to the wetland inlet to optimize inter-tidal interaction and function if monitoring activities find that it is not functioning as designed. Potential issues which could arise include excessive deposition or erosion, leading to a negative change in function of the wetlands or damage from wave impacts.
- Inspection of the inlet/outlet structures to assess stability, evidence of scour and overall condition.

It is the Applicant's position that there are reasonable opportunities for adaptive management at the project site to support achieving the performance standards.

13.2 Brandywine Dam 2 Site

The Applicant will be responsible for implementing this mitigation plan at Brandywine Dam 2 and ensuring that all as built and performance criteria are met during the monitoring period. In the event the Applicant determines that the site is not achieving the performance standards identified in the Performance Standards Section of the final Compensatory Mitigation Plan, a

Notice of Deficiency shall be developed by the Applicant and submitted to USACE. The Notice will define the deficiency and propose the adaptive management that is needed or required. The adaptive management will be approved by the USACE in accordance with 33 CFR 332.4 (c) (12) and implemented by the Applicant.

The Applicant has identified several potential Adaptive Management activities that could be utilized at the project site:

- Engineering changes to optimize hydraulics or other modifications to weirs if monitoring of performance standards indicate fish passage is not being achieved.
- Stocking of Brandywine Creek upstream of Dam No. 2 with American shad if juvenile surveys at the project site and downstream, catch rates by anglers and eDNA concentrations indicate a decline in American shad populations over the 5-year monitoring period.
- Stream restoration at Dam No. 3 if monitoring indicates that performance standards for fish passage are not being achieved.
- Modifying the stagnant, backwater area near dam #3 to potentially connect it on upstream side to main stem of the Brandywine.

It is the Applicant's position that there are reasonable opportunities for adaptive management at the project site to support achieving the performance standards.

14. Communications

The Applicant expects to establish a routine and coordinated process for information sharing in order to facilitate decision-making on key project elements. Technical experts from USACE and appropriate federal and state agencies will be included, and participants may vary depending on issues under consideration. As noted in the work plan outlined in Section 8, the Applicant has committed to provide the final design documents to the resource agencies for additional review and comment. As outlined in the referenced memoranda of understanding with the project partners, the Applicant remains responsible for managing the future communication with USACE, as well as maintaining ultimate responsibility for the project implementation, performance, and maintenance.

15. Financial Assurances

The DSPC is a public corporation of the State of Delaware. The corporation receives funding from the operation of the port and has the ability to receive additional funding from the State of Delaware.

At the time of submission of the compensatory mitigation plan the Delaware General Assembly has allocated $3,000,000 on behalf of the DSPC to DNREC for the purpose of implementing the State of Delaware Compensatory Mitigation Plan that was included in the issuance of the State of Delaware Subaqueous Lands Permit for the project (Permit No. SP-101/20 dated September 30, 2021). A significant proportion of that funding is intended to support the wetland enhancement at Fox Point State Park and the eDNA elements of this Compensatory Mitigation Plan as well as the additional elements of the State of Delaware Compensatory Mitigation Plan, not associated with this plan. The State is committed to funding the implementation of the approved, implementable compensatory mitigation plan and is in the process of obtaining the necessary funding, which would be based on the cost estimates developed after the mitigation plan is approved.

A letter documenting the applicant's financial assurance to the project has been included as Appendix P.

16. Other Considerations.

The benefits of the compensatory mitigation plan, including a rock weir, nature-like fishway on the Brandywine Creek and preservation of subaqueous lands on the Christina River, are presented within the context of a regulatory framework and generally considered through the applicable feasibility, monitoring and performance standards to assure effectiveness of the project. There are significant project attributes outside of that regulatory framework that are worthy of consideration.

Additive Resources – A mission critical element to restoration of access to the Brandywine Creek watershed for migratory and resident fish species rests with the creation of passage at Dam 2 as it presents the most significant financial and engineering challenges. This proposed mitigation enables the success of this important initiative through the allocation of resources to this project by DSPC, with other entities, notably Brandywine Shad 2020 and its partners, to direct energy and resources to less challenging dams. While the goal of Brandywine Shad 2020 is to "restore anadromous and domestic fish passage to 17.6 miles and 250 acres of freshwater spawning habitat from tidewater to the Piedmont in Delaware and Pennsylvania", the project also assists in implementation of the American Shad Habitat Restoration Plan for the Delaware River.

Biodiversity and Recreation – The re-establishment of fish passage at Dam 2 and beyond will also enhance the biodiversity of the Brandywine Creek as migratory and resident species will be able to expand their range, and potentially their populations, as additional structures are removed. A greater abundance of fish will likely add recreational opportunities for anglers along this waterway which is located in a highly urbanized area.

Public Awareness – The location of Dam 2 within the City of Wilmington and its proximity to Brandywine Park and Brandywine Zoo, popular recreational amenities for the City and region, also provides opportunities to enhance public awareness of the importance of the Brandywine Creek as fisheries habitat. Placement of interpretive signage at the site could facilitate this awareness. Brandywine Shad 2020 hosted a shad festival in July 2021 with an estimated attendance of 500 people. Similar events throughout the mid-Atlantic have become annual eco-tourism events. One of Brandywine Shad 2020's initiatives is to raise public awareness through public information materials, workshops and other events.

Historical Preservation – While these dams were a key component to the economic development of the Brandywine Valley through the 17th through 20th centuries, reliance on these structures for hydropower has dissipated. The Brandywine remains the primary source of water supply for the City of Wilmington and Dam 2 has also been designated as an historic structure as part of Brandywine Park Historic District. Preliminary discussions with SHPO indicate the construction of the project is possible while maintaining the historic integrity of the structure.

FIGURES

Date: 12/2018	FIGURE 1	DESIGNED BY: JWF	verdantas PEOPLE FOCUSED FUTURE
SCALE: AS SHOWN	**Site Location Sketch**	DRAWN BY: JWF	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 11139.LH	**Port of Wilmington** **Edgemoor Expansion**	CHECKED BY: RLH	
SHEET: FIGURE 1	EDGEMOOR - NEW CASTLE COUNTY - DELAWARE	FILE: 11139.LD SiteLocationSketch	

Port of Wilmington – Edgemoor Expansion

PROJECT AREA
EXISTING CONDITION OF SHORELINE

PAGE 1 OF 2

verdantas
PEOPLE FOCUSED FUTURE

5400 Limestone Road
Wilmington, Delaware 19808
Tel: (302) 239-6634 Fax: (302) 239-8485

Project No. 11139.LH | Figure 2

Port of Wilmington – Edgemoor Expansion

PROJECT AREA
EXISTING CONDITION OF SHORELINE

PAGE 2 OF 2

verdantas
PEOPLE FOCUSED FUTURE

5400 Limestone Road
Wilmington, Delaware 19808
Tel: (302) 239-6634 Fax: (302) 239-8485

Project No. 11139.LH

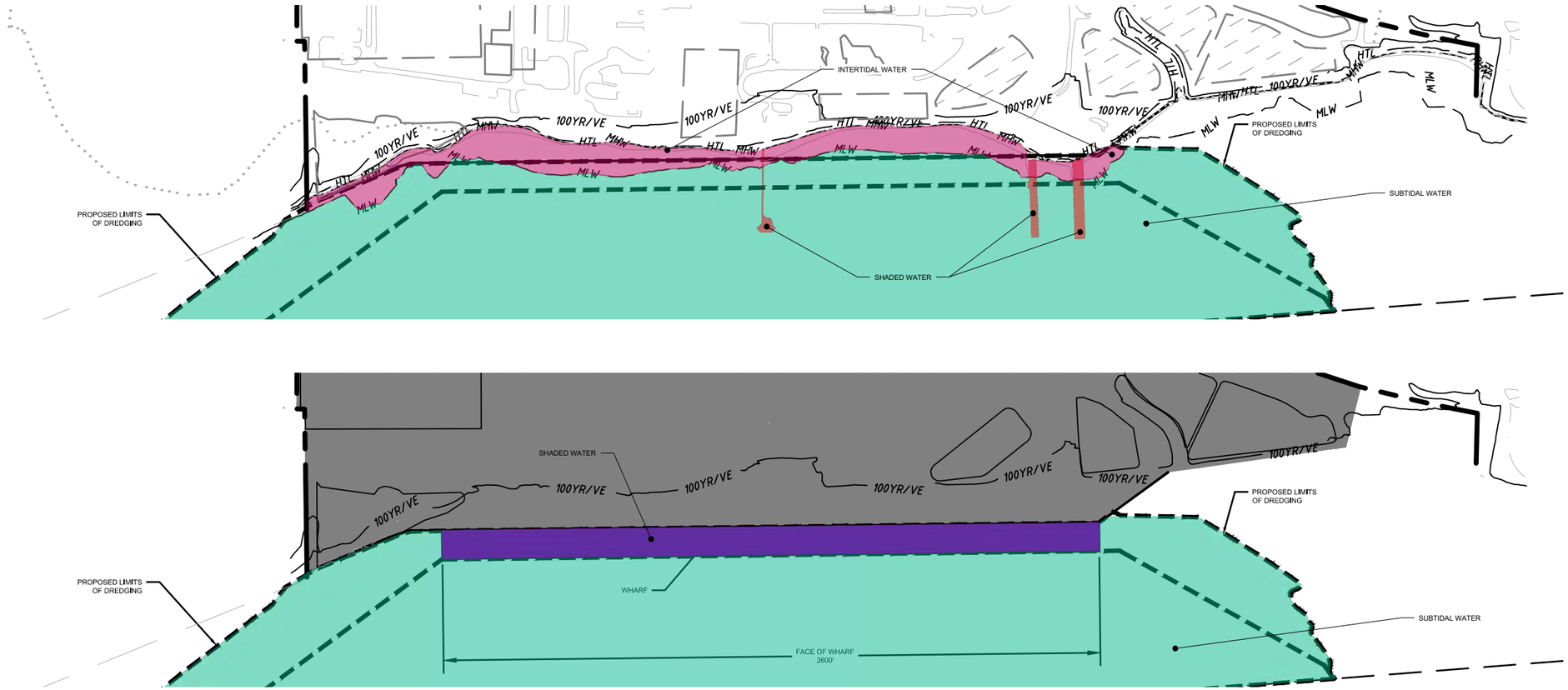
Figure 2

verdantas
PEOPLE FOCUSED FUTURE
5400 LIMESTONE ROAD
WILMINGTON, DE 19808-1232
TEL 302.239.6634
FAX 302.239.8485

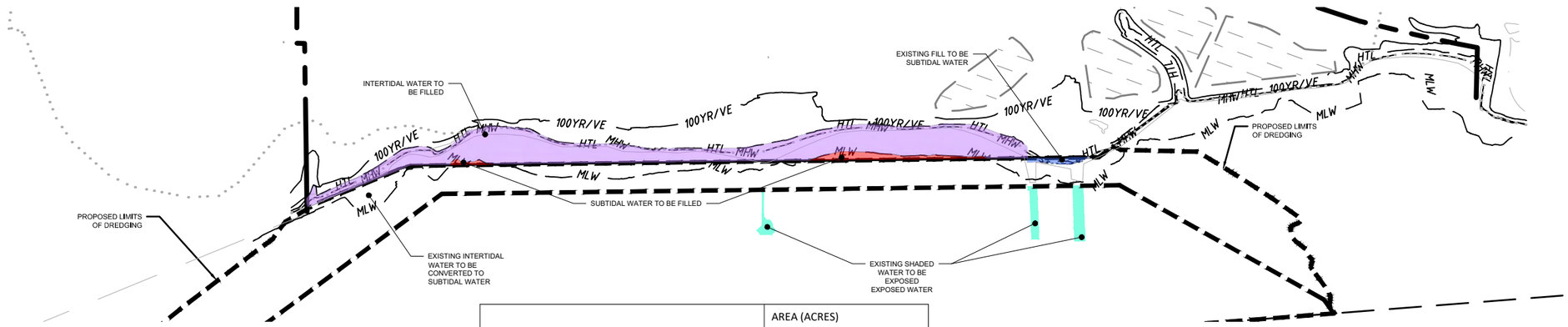
DESIGNED BY: MRB
DRAWN BY: AR
CHECKED BY: BJD
FILE: EX-Impact-111139LH

PROJECT IMPACT SUMMARY
PORT OF WILMINGTON EDGEMOOR EXPANSION
BRANDYWINE HUNDRED ~ NEW CASTLE COUNTY ~ DELAWARE

EXISTING CONDITION



PROPOSED CONDITION



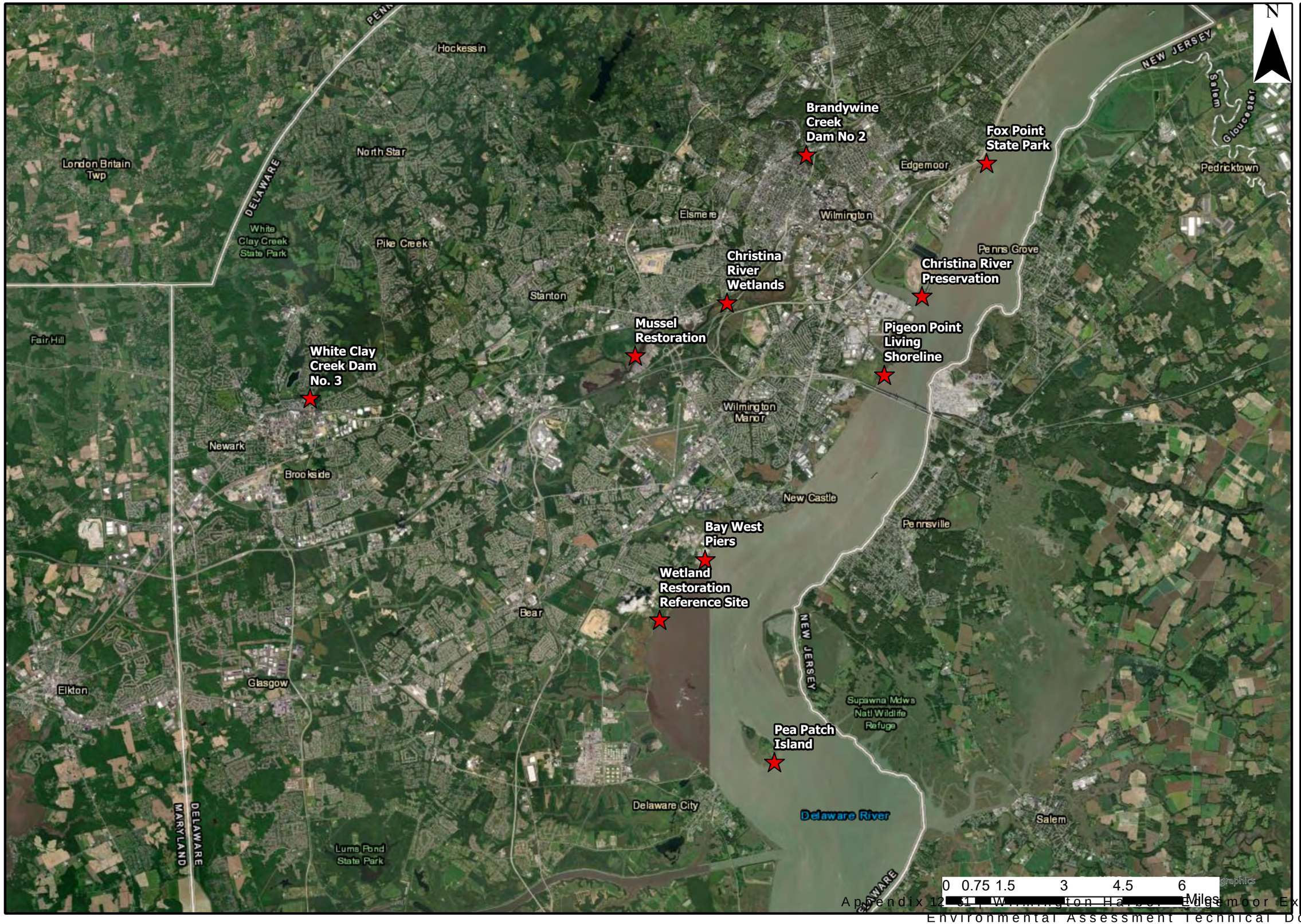
CHANGES

	AREA (ACRES)
SUBTIDAL WATER TO BE FILLED	0.35
INTERTIDAL WATER TO BE FILLED	5.15
SUBTIDAL WATER TO BE SHADED	7.13
SHADED WATER TO BE EXPOSED WATER	0.43
EXISTING FILL TO BE SUBTIDAL WATER	0.10

500' 0 500' 1000'
DRAWING SCALE 1" = 500'

LEGEND
- PROPERTY LINE
- ADJOINER LINE
- 100YR — 100 YEAR FLOODPLAIN (BASE FLOOD ELEVATIONS, BFE DETERMINED)
- 100YR/VE — 100 YEAR FLOODPLAIN (COASTAL FLOOD ZONE WITH VELOCITY HAZARD, BFE DETERMINED)
- ZONE AE (EL.9) / ZONE VE (EL. 12) — FLOODPLAIN DIVIDE
- HTL — HIGH TIDE LINE EL. = 4.56' (N.A.V.D. 88)
- MHW — MEAN HIGH WATER LINE EL. = 2.51' (N.A.V.D. 88)
- MLW — MEAN LOW WATER LINE EL. = -2.79' (N.A.V.D. 88)
- CHANNEL LIMITS

DATE: JULY 8, 2021
SCALE: 1" = 500'
PROJECT NO. 11139.LH
SHEET: FIGURE 3



verdantas

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FAX (302)239-8485

OFFICES IN DELAWARE, MARYLAND, PENNSYLVANIA, AND NEW JERSEY

E-MAIL: DUFFIELD@DUFFNET.COM

Legend

★ Mitigation Locations

BASEMAP: ESRI Aerial

DRAWN BY: FAW

CHECKED BY: BD

FILE:

Potential Mitigation Site Locations

Port of Wilmington Edgemoor Expansion

WILMINGTON-NEW CASTLE-DELAWARE

DATE: OCTOBER 2021

SCALE: AS SHOWN

DUFFIELD PROJECT NO. 11139LH

FIGURE: 4

verdantas

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WILMINGTON, DE 19808
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E-MAIL: DUFFIELD@DUFFNET.COM

Legend

Mitigation Locations

BASEMAP:
ESRI Aerial

DRAWN BY:
FAW

CHECKED BY:
BD

FILE:

Wetland Reference Site

Port of Wilmington Edgemoor Expansion

WILMINGTON-NEW CASTLE-DELAWARE

DATE:
OCTOBER 2021

SCALE:
AS SHOWN

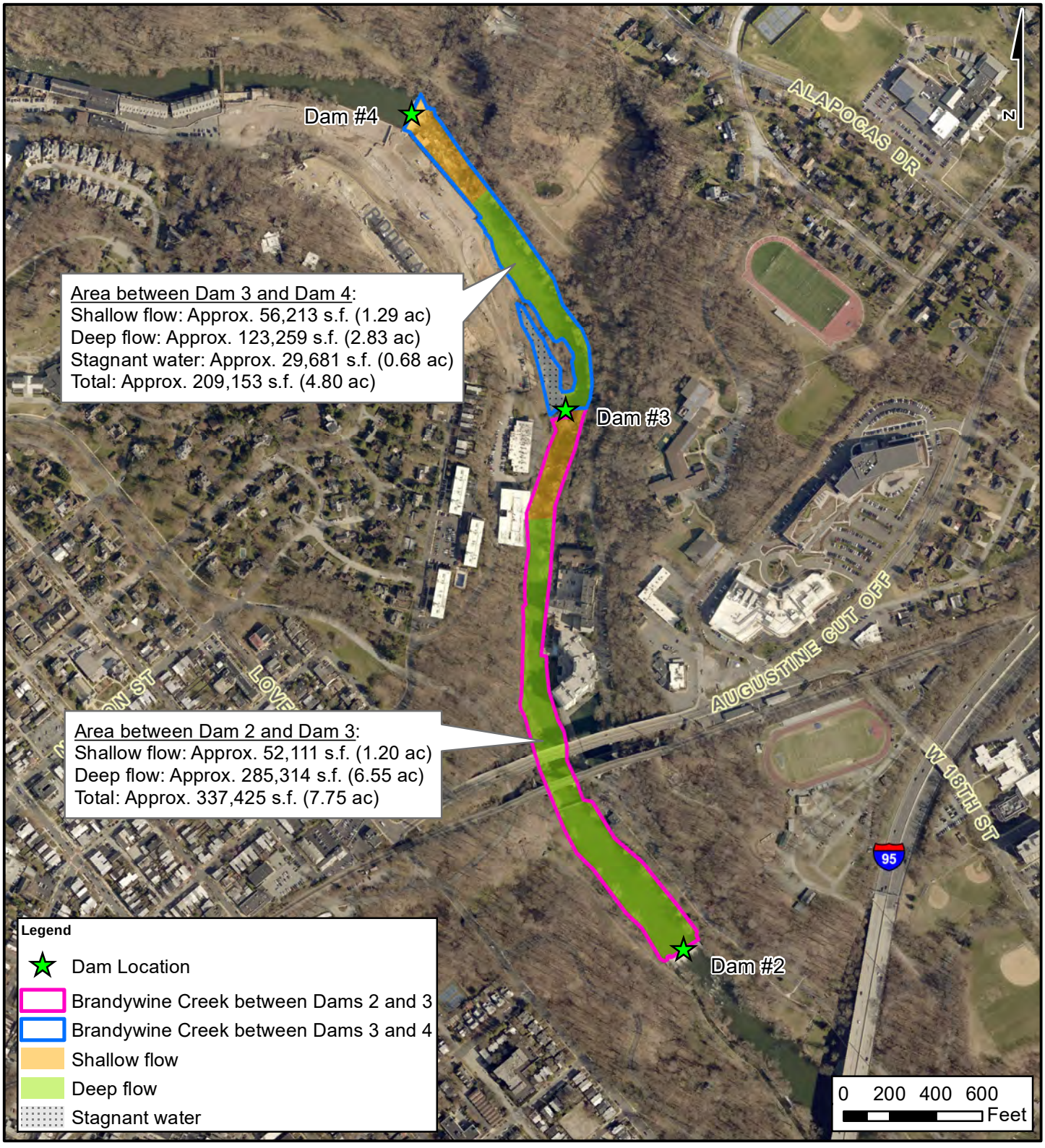
DUFFIELD PROJECT NO.
11139LH

FIGURE:
5

verdantas PEOPLE FOCUSED FUTURE	**Port of Wilmington – Edgemoor Expansion**	Date:
	Fox Point State Park Wetland Enhancement	October 2021
	Site Photographs	Project Number 11139.LH.08:
	Existing Conditions	Figure 6
	Wilmington, Delaware	Page1 of 2

verdantas PEOPLE FOCUSED FUTURE	**Port of Wilmington – Edgemoor Expansion**	Date:
	Fox Point State Park Wetland Enhancement	October 2021
	Site Photographs	Project Number 11139.LH.08:
	Existing Conditions	Figure 6
	Wilmington, Delaware	Page2 of 2

verdantas PEOPLE FOCUSED FUTURE	**Port of Wilmington – Edgemoor Expansion**	Date:
	Fox Point State Park Wetland Enhancement	October 2021
	Site Photographs	Project Number 11139.LH.08:
	Reference Site Conditions	Figure 7
	Wilmington, Delaware	Page 1 of 1



Date: 09/2021	BRANDYWINE CREEK AVAILABLE HABITAT AREA	DESIGNED BY: BD	verdantas
SCALE: AS SHOWN		DRAWN BY: KLS	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 11139.LH	**PORT OF WILMINGTON EDGEMOOR EXPANSION**	CHECKED BY: BD	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
FIGURE: 8	WILMINGTON~NEW CASTLE~DELAWARE	FILE: 11139.LH.Available_Habitat_Area	

APPENDIX A

USACE CENAP Compensatory Mitigation Checklist

COMPENSATORY MITIGATION PLAN CHECKLIST

Project Name: Wilmington Harbor - Edgemoor Expansion **CENAP-OP-R** 2019-278

☐ *Mitigation Goals and Objectives*
- [X] Describe functions lost at impact site. See Page 6
- [X] Describe functions to be gained at mitigation site. See Pages 15 and 16
- [X] Describe overall watershed improvements to be gained. See Pages 15 and 16

☐ *Baseline Information for Impact and Proposed Mitigation Sites Baseline.*
- [X] Provide data on physical attributes of sites (soils, vegetation, hyrology). See pages 6, 22 - 29
- [X] Describe historic and existing land uses and resources impacted. See pages 6, 22-29
- [X] Describe reference site attributes if available. See page 24

☐ *Mitigation Site Selection and Justification*
- [X] Describe process of selecting proposed site. See Section 3 - Pages 8-14
- [X] Likelihood of success, future land use compatibility, etc. See Section 16 - Page 51

☐ *Mitigation Work Plan*
- [X] Location. See Section 8 - Pages 30-38
- [X] Construction Plan. See Section 8 - Pages 30-38 and Appendices E and F
- [X] Describe planned hydrology, vegetation, soils, buffers, etc. See Section 8 - Pages 30-35

☐ *Performance Standards*
- [X] Identify success criteria. See Section 9 - Pages 39-40
- [X] Compare functions lost and gained at impact and mitigation sites. See Section 2 - Page 6, Section 9 - Pages 39-40
- [X] Desscribe soils, vegetation and hydrology parameter changes. See Section 9 - Pages 39-40

☐ *Site Protection and Maintenance*
- [X] List parties and responsibilities. See Appendices I, J and O
- [X] Provide evidence of legal protective measures. See Appendices C and D
- [X] Maintenance plan and schedule. See Section 11 - Pages 44-45

☐ *Monitoring Plan*
- [X] Provide monitoring schedule, identify party (ies) and responsibilities See Section 10 - Pages 41-43
- [X] Specify data to be collected, including assessment tools and methodologies See Section 10 - Pages 41-43

☐ *Adaptive Management Plan*
- [X] Identify party (ies) and responsibilities. See Section 13 - Pages 47-48, Appendix O
- [X] Remedial measures (financial assurances, management plan, etc.). See Section 13 - Pages 47-48, Appendix O

☐ *Financial Assurances*
- [X] Identify party (ies) responsible for assurances. See Section 15 - Page 50 and Appendix O
- [X] Specify type of assurance, contents and schedule. See Section 15 - Page 50 and Appendix O

Project Manager: _____ Date: _____

U.S. Army Corps of Engineers *Philadelphia District*

APPENDIX B

City of Wilmington Letter of Support for Brandywine Dam 2

City of Wilmington

MICHAEL S. PURZYCKI
Mayor

September 20, 2021

VIA EMAIL: gbailey@port.state.de.us

Mr. Eugene Bailey, Director
Diamond State Port Corporation
Carvel State Office Building
820 N. French Street
Wilmington, DE 19801

Re: Expansion of Port of Wilmington – Rock Ramp at Dam 2 on Brandywine Creek

Dear Eugene,

You have requested a letter of support for the construction of a full-width rock ramp on the face of Dam 2 on the Brandywine Creek in the City of Wilmington to allow passage of migratory and resident fish species. It is my understanding this project is being proposed is in the context of the various pending permit applications before federal regulatory agencies for the proposed expansion of the Port of Wilmington on the Edgemoor site. Specifically, the federal regulatory agencies are requiring mitigation as part of the permitting process, and the above-referenced proposed project is a critical component of the mitigation plan.

As you are aware, Dam 2 on the Brandywine Creek is critical to the City's water supply as it is the primary mechanism by which the City provides potable water to its residents. As a result, any project along the lines suggested must not negatively impact this critical dam and the City's water supply. It is my understanding engineering consultants for the Diamond State Port Corporation have reviewed this issue carefully and have consulted with the Department of Public Works for the City of Wilmington and that based on that review and consultation, preliminary assessments indicate such a project is feasible without jeopardizing the City's water supply. It is also my understanding that the various state and federal regulatory agencies are fully aware of the mission critical importance of Dam 2 to the City's potable water supply and accept the necessity of protecting the City's water supply in the construction of any such project.

With that understanding, it is important to note that I view this issue through the larger lens of job creation and environmental justice as it relates to the residents of the City of Wilmington. Simply put, we need to assure that historically marginalized communities have access to badly needed investments to rebuild our economy and infrastructure. Historically, the Port of Wilmington provides some of the best opportunities for residents of the City to secure family-sustaining jobs, thanks in large part to the strong efforts of the International Longshoremen's Association. However, too often in the past, communities like the City of Wilmington have disproportionately absorbed the negative impacts of industry, without the economic benefits. Thus, the proposed expansion of the Port of Wilmington at the Edgemoor site by way of public-private partnership investments presents an incredibly important opportunity to help address this long-standing disparity by providing economic/employment opportunities for lower income residents of the City of Wilmington. It is this opportunity that drives my support for this issue.

OFFICE OF THE MAYOR
LOUIS L. REDDING CITY/COUNTY BUILDING • 800 FRENCH STREET • WILMINGTON, DELAWARE • 19801-3537
WWW.WILMINGTONDE.GOV • PHONE: (302) 576-3100 • FAX: (302) 571-4102

Second, I also understand the benefit of the proposed rock ramp on the Brandywine Creek includes increased recreational fishing opportunities for residents of the City of Wilmington. Championed by the Brandywine Shad 2020, this is also an important environmental justice component and one that I support. Similarly, I understand the expansion at the Edgemoor will also help better manage the legacy environmental issues at the site and electrification of Port operations is also contemplated, which will improve air quality.

I have spent much of my professional life seeking out economic opportunities for the City of Wilmington that also preserve and enhance the environment. This can be difficult but with this project, we have the rare opportunity to create family-sustaining jobs while improving the environment by restoring habitat currently inaccessible to anadromous fish, electrifying port operations and better managing a site with environmental challenges. We need to get this done.

To that end, it is my belief that the City and DSPC will be able to develop and implement plans and measures to ensure that the construction, operation and long-term maintenance of the full-width rock ramp supports the structure's design and function. The City also understands these issues will need to be formalized with appropriate agreements between the City and the DSPC, including a commitment from DSPC to manage the rock ramp once constructed. In short, provided the rock ramp project can be constructed and managed in a manner that does not jeopardize the City's water supply and the planned expansion of the Port of Wilmington at the Edgemoor site can move forward expeditiously, the City is in support of this effort on the Brandywine Creek.

Sincerely,

Michael S. Purzycki
Mayor

APPENDIX C

Proposed Deed of Restrictive Covenant Fox Point State Park

Tax Parcel Nos: 06-147.00-017
Prepared By/Return To:
Michael A. DeNote, Esquire
Barnes & Thornburg LLP
1000 N. West Street, Suite 1500
Wilmington, Delaware 19801

STATE OF DELAWARE
COUNTY OF NEW CASTLE

DECLARATION OF RESTRICTIVE COVENANTS

THIS DECLARATION OF RESTRICTIVE COVENANTS is made this _____ day of ____, 20____, by the Delaware Department of Natural Resources and Environmental Control ("DNREC") ("Declarant").

RECITALS

WHEREAS, Declarant is the owners of certain real property *("Property" which shall include wetlands, any interest in submerged lands, uplands, associated riparian/littoral rights, and other aquatic resources)* located in New Castle County, Delaware, more particularly [*tract description*] and shown in Exhibit A (i.e., metes and bounds of the Property), and Exhibit B (i.e., a metes and bounds and scaled plat of the area subject to the Declaration, the "Conservation Area"), and made a part hereof; and

WHEREAS, the Diamond State Port Corporation ("DSPC") submitted an application for a permit to construct a primary harbor access channel and ship berth in the Delaware River at DSPC's Edgemoor property, and regulators require compensatory mitigation to offset the possible environmental impacts of this construction; and

WHEREAS, as compensatory mitigation under Federal and State law for Department of the Army Permit No. CENAP-OP-R-2019-278 ("Permit") issued by the U.S. Army Corps of Engineers, Philadelphia District ("Corps" or "Philadelphia District," to include any successor agency), and certification(s) and/or permit(s) No. : SP-101/20 issued by DNREC, to include any successor agency), and incorporated by reference in this document, and in recognition of the continuing benefit to the permitted property, and for the protection of waters of the United States and/or the State of Delaware and scenic, resource, environmental, and general property values, Declarant has agreed to execute and record this Declaration of Restrictive Covenants ("Declaration") placing certain restrictive covenants on a Conservation Area within the Property, in order that the Conservation Area shall remain substantially in its natural condition forever predominately in accordance with the vegetative and hydrological conditions described in the attached compensatory mitigation performance standards (Exhibit C); and

WHEREAS, the Conservation Area may contain land, functions, values, and services that serve as compensation and mitigation for impacts to waters of the United States and/or waters of the State that were permitted by the Corps and/or DNREC; and

WHEREAS, the Corps is a third-party beneficiary under this Declaration.

NOW THEREFORE, Declarant hereby declares that the Conservation Area shall be held, transferred, conveyed, leased, occupied or otherwise disposed of and used subject to the following restrictive covenants, which shall run with the land and be binding in perpetuity and forever on all heirs, successors, assigns (they are included in the terms, "Declarant," below), lessees, or other occupiers and users.

1. Purpose. **The purpose of this Declaration is to preserve, protect, and enhance the native flora, fauna, soils, water table, aquifers, springs, drainage patterns, wetland resources, and other related environmental functions and values of the Conservation Area in perpetuity and to prevent any use of the Property that will impair or interfere with the aquatic resource values of the Property;**

2. Covenants and Restrictions. **Neither the Declarant, nor any subsequent owner or owners of the Conservation Area or any portion thereof, shall undertake or cause to be undertaken within or upon the Conservation Area, within the Property, as described in the site plan attached, any of the following:**

a. Removal, excavation, or dredging of soil, sand, gravel, minerals, organic matter, or materials of any kind;

b. Changing existing drainage characteristics, sedimentation patterns, flow patterns, or flood retention characteristics;

c. Disturbance of the water level or water table by drainage, impoundment, or other means;

d. Dumping, discharging of material, or filling with material, including the driving of piles and placing of obstructions;

e. Grading or removal of material that would alter existing topography;

f. Destruction or removal of plant life that would alter the character of a nontidal wetland, or introduction of exotic species;

g. Agricultural or forestry activities, such as aquaculture, plowing, tillage, cropping, seeding, cultivating, and grazing and raising of livestock, sod production, harvesting for production of food and fiber products. Forestry activities mean planting, cultivating, thinning, harvesting, or any other activity undertaken to use forest resources or to improve their quality or productivity;

h. Use of off-road vehicles and motor vehicles;

i. Destruction or alteration of the Conservation Area EXCEPT:

> **(i) Alteration necessary to construct the mitigation areas and associated improvements proposed to be built, as approved in the mitigation plan approved by the Permit and the certification(s) and/or permit(s) issued by the Corps and DNREC;**
>
> **(ii) Alteration necessary to ensure the success of the mitigation areas including monitoring, reconstruction, maintenance, or repair of the constructed mitigation areas, as approved by the Corps and DNREC;**
>
> **(iii) Removal of vegetation when approved by the Corps and DNREC and conducted for removal of noxious or invasive plants;**

(iv) Maintenance of the existing utilities right of way in accordance with existing easement.

j. Utilizing a non-reporting Nationwide Permit, Regional Permit, or State Programmatic General Permit under Section 404 of the Clean Water Act or state general permits under DNREC regulations to impact any aquatic feature on the Property. Notification shall be required to the Corps and DNREC for the use of any Nationwide Permit, State Programmatic General Permit, or Regional Permit.

3. Duration and Amendment. The covenants and restrictions listed herein are created pursuant to 7 Del. C. § 6901 et seq. and shall run with and bind the Property, and be binding on the Declarant, their personal representatives, heirs, successors and assigns, unless and until terminated or modified by the Corps, or other Federal, State, or County agencies which have the legal authority to enforce these covenants and restrictions by regulations, permit, or agreement. The failure of the Corps, or other such agencies to enforce the provisions of this Declaration shall not be deemed a waiver of any rights created hereunder. After recording, this Declaration may only be amended by a recorded document signed by the Corps, and Declarant. The recorded document, as amended, shall be consistent with the Philadelphia District and DNREC model conservation restrictions at the time of amendment. Amendment shall be allowed at the discretion of the Corps, in consultation with resource agencies as appropriate, and then only in exceptional circumstances. Mitigation for amendment impacts will be required pursuant to Philadelphia District and DNREC mitigation policy at the time of amendment. There shall be no obligation to allow an amendment. The Corps shall be provided with a 60-day advance written notice of any legal action concerning this Declaration or of any action to extinguish, void, or modify this Declaration in whole or in part. This Declaration is intended to survive foreclosure, bankruptcy, condemnation, or judgments affecting the Property. This Declaration shall not be invalid solely because aquatic resources within the Conservation Area are determined not to be waters of the United States or waters of the State.

4. Notice to Government. Any permit application, or request for certification or modification, which may affect the Conservation Area, made to any governmental entity with authority over wetlands or other waters of the United States and/or waters of the State, shall expressly reference and include a copy (with the recording stamp) of this Declaration.

5. Reserved Rights. It is expressly understood and agreed that these restrictive covenants do not grant or convey to members of the general public any rights of ownership, entry or use of the Conservation Area. These restrictive covenants are created solely for the protection of the Property, and for the consideration and values set forth above, and Declarant reserves the ownership of the fee simple estate and all rights appertaining thereto, including without limitation the rights to exclude others and to use the property for all purposes not inconsistent with these restrictive covenants.

6. Monitoring and Maintenance. The permittee, and its/their authorized agents shall have the right to enter and go upon the lands of the Declarant to monitor and manage the Conservation Area to ensure compliance with the Mitigation Site Plan ("Mitigation Site Plan") and Long-Term Management Plan ("Approved Long-Term Management Plan") approved in connection with the Permit. This may include, but is not limited to, completing annual monitoring, controlling invasive species, planting native vegetation, repairing signs/fences, and repairing erosion.

7. Compliance Inspections. The Corps, and its authorized agents shall have the right to enter and go upon the lands of Declarant, to inspect the Conservation Area and take actions necessary to verify compliance with the approved Mitigation Site Plan, the Approved Long-Term Management Plan, and these restrictive covenants.

8. Enforcement. The Declarant grants to the Corps, the U.S. Department of Justice, a discretionary right to enforce these covenants in a judicial action against any person(s) or other entity(ies) violating or attempting to violate these restrictive covenants; provided, however, that no violation of these restrictive covenants 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 any other judicial remedy, such as civil penalties. Nothing herein shall limit the right of the Corps to modify, suspend, or revoke the Permit.

9. Property Transfers. Declarant shall include the following notice on all deeds, mortgages, plats, or any other legal instruments used to convey any interest in the Property and Conservation Area (failure to comply with this paragraph does not impair the validity or enforceability of this Declaration):

> **NOTICE:** This property Subject to Declaration of Restrictive Covenants Recorded at New Castle County Recorder of Deeds Book and Page.

Declarant agrees to give written notice to the Corps of the intent to transfer, sell, or convey any interest of the Property, or to amend this Declaration by any other means whatsoever, at least sixty (60) days prior to the date of transfer.

10. Marking of Property. The perimeter of the Conservation Area shall at all times be plainly marked by permanent signs saying, "Protected Natural Area," or by an equivalent, permanent marking system.

11. Recording. Within thirty (30) calendar days of execution of these restrictive covenants, the Declarant agrees to record this Declaration in the Land Records of the County and provide the Corps with proof of recordation within thirty (30) calendar days of recordation. A plat depicting the boundaries of the Conservation Area subject to these restrictive covenants shall be recorded in the deed records office for each county in which the Property is situated prior to the recording of these restrictive covenants. The plat(s) is/are recorded at New Castle County Recorder of Deeds Book and Page.

12. Separability Provision. Should any separable part of this Declaration be held contrary to law, the remainder shall continue in full force and effect.

13. Inaccurate or Fraudulent Information. Should an easement, right or lease on or to the Property not shown on the survey or listed in this Declaration and prior in time and recording to this Declaration, or unrecorded, be exercised in such a manner that it conflicts with or voids the prohibited uses of the Property set out in this Declaration, then the owners of the Property shall be responsible for providing alternative compensatory mitigation in such amounts and of such service and function as the Corps or any enforcer of this Declaration shall determine in accordance with the Clean Water Act and/or the Delaware Wetlands Act, 7 Del. C. § 6601 et seq. (the "Delaware Wetlands Act").

14. Eminent Domain. NOTICE TO PARTIES WITH EMINENT DOMAIN AUTHORITY: If the Property is taken in whole or in part through eminent domain, the consequential value of the Conservation Area protected by the Clean Water Act and/or the Delaware Wetlands Act is the cost of replacement of the conservation functions, services and values with other property in the same watershed. Exercise of eminent domain by any party ("Condemning Party") to take land held as part of a mitigation site under this Declaration may remove restrictions that the Declarant, or the Corps, intend will protect, in perpetuity, the Conservation Area, and preserve the land serving as compensation for permitted impacts. Where the Condemning Party: (1) intends to take action(s) that will have impacts on the Conservation Area, and (2) is required to obtain a Corps or DNREC permit for such impacts, the Corps

and DNREC have discretion to increase the Condemning Party's wetland and/or stream compensation requirements, as part of the permitting process, in order to account for the loss of functions and values associated with the compensatory mitigation site.

IN WITNESS WHEREOF, the Declarant has duly executed this Declaration of Restrictive Covenants the date written above.

[Signature page follows]

IN THE PRESENCE OF:

Declarant – Delaware Department of Natural Resources and Environmental Control

_____ By: _____

[*type name of witness under signature line*] Shawn M. Garvin

Its: Secretary

STATE OF DELAWARE

COUNTY OF NEW CASTLE

PERSONALLY appeared before me _____, the undersigned witness, and made oath that *he/she* saw the within named _____ [, *by* _____, *its* _____,] sign, seal and as *his/her/its* act and deed, deliver the within named Declaration of Restrictive Covenants; and the *he/she* with the other witness named above witnessed the execution thereof.

_____

[*type name of Notary Public under signature line*]

SWORN to and subscribed before me
This _____day of _____, 20___.

NOTARY PUBLIC FOR
My Commission Expires:

APPENDIX D

Proposed Deed of Restrictive Covenant Brandywine Dam 2

Tax Parcel Nos: 26-014.10-006
26-013.40-075

Prepared By/Return To:
Michael A. DeNote, Esquire
Barnes & Thornburg LLP
1000 N. West Street, Suite 1500
Wilmington, Delaware 19801

STATE OF DELAWARE
COUNTY OF NEW CASTLE

DECLARATION OF RESTRICTIVE COVENANTS

THIS DECLARATION OF RESTRICTIVE COVENANTS is made this _____ day of ____, 20____, by the Delaware Department of Natural Resources and Environmental Control ("DNREC") ("Declarant").

RECITALS

WHEREAS, Declarant is the owner of certain real property *("Property" which shall include wetlands, any interest in submerged lands, uplands, associated riparian/littoral rights, and other aquatic resources)* located in New Castle County, Delaware, more particularly [*tract description*] and shown in Exhibit A (i.e., metes and bounds of the Property), and Exhibit B (i.e., a metes and bounds and scaled plat of the area subject to the Declaration, the "Conservation Area"), and made a part hereof; and

WHEREAS, the Diamond State Port Corporation ("DSPC") submitted an application for a permit to construct a primary harbor access channel and ship berth in the Delaware River at DSPC's Edgemoor property, and regulators require compensatory mitigation to offset the possible environmental impacts of this construction; and

WHEREAS, as compensatory mitigation under Federal law for Department of the Army Permit No. CENAP-OP-R-2019-278 ("Permit") issued by the U.S. Army Corps of Engineers, Philadelphia District ("Corps" or "Philadelphia District," to include any successor agency), and incorporated by reference in this document, and in recognition of the continuing benefit to the permitted property, and for the protection of waters of the United States and/or the State of Delaware and scenic, resource, environmental, and general property values, Declarant has agreed to execute and record this Declaration of Restrictive Covenants ("Declaration") placing certain restrictive covenants on a Conservation Area within the Property, in order that the Conservation Area shall remain substantially in its natural condition forever predominately in accordance with the vegetative and hydrological conditions described in the attached compensatory mitigation performance standards (Exhibit C); and

WHEREAS, the Conservation Area may contain land, functions, values, and services that serve as compensation and mitigation for impacts to waters of the United States and/or waters of the State that were permitted by the Corps; and

WHEREAS, the Corps is a third-party beneficiary under this Declaration.

NOW THEREFORE, Declarant hereby declares that the Conservation Area shall be held, transferred, conveyed, leased, occupied or otherwise disposed of and used subject to the following restrictive covenants, which shall run with the land and be binding in perpetuity and forever on all heirs, successors, assigns (they are included in the terms, "Declarant," below), lessees, or other occupiers and users.

1. Purpose. **The purpose of this Declaration is to preserve, protect, and enhance the native flora, fauna, soils, water table, aquifers, springs, drainage patterns, wetland resources, and other related environmental functions and values of the Conservation Area in perpetuity and to prevent any use of the Property that will impair or interfere with the aquatic resource values of the Property;**

2. Covenants and Restrictions. **Neither the Declarant, nor any subsequent owner or owners of the Conservation Area or any portion thereof, shall undertake or cause to be undertaken within or upon the Conservation Area, within the Property, as described in the site plan attached, any of the following:**

a. Removal, excavation, or dredging of soil, sand, gravel, minerals, organic matter, or materials of any kind;

b. Changing existing drainage characteristics, sedimentation patterns, flow patterns, or flood retention characteristics;

c. Disturbance of the water level or water table by drainage, impoundment, or other means;

d. Dumping, discharging of material, or filling with material, including the driving of piles and placing of obstructions;

e. Grading or removal of material that would alter existing topography;

f. Destruction or removal of plant life that would alter the character of a nontidal wetland, or introduction of exotic species;

g. Agricultural or forestry activities, such as aquaculture, plowing, tillage, cropping, seeding, cultivating, and grazing and raising of livestock, sod production, harvesting for production of food and fiber products. Forestry activities mean planting, cultivating, thinning, harvesting, or any other activity undertaken to use forest resources or to improve their quality or productivity;

h. Use of off-road vehicles and motor vehicles;

i. Destruction or alteration of the Conservation Area EXCEPT:

> **(i) Alteration necessary to construct the mitigation areas and associated improvements proposed to be built, as approved in the mitigation plan approved by the Permit and the certification(s) and/or permit(s) issued by the Corps;**
>
> **(ii) Alteration necessary to ensure the success of the mitigation areas including monitoring, reconstruction, maintenance, or repair of the constructed mitigation areas, as approved by the Corps;**
>
> **(iii) Removal of vegetation when approved by the Corps and conducted for removal of noxious or invasive plants;**

(iv) Maintenance of the existing utilities right of way in accordance with existing easement.

j. Utilizing a non-reporting Nationwide Permit, Regional Permit, or State Programmatic General Permit under Section 404 of the Clean Water Act to impact any aquatic feature on the Property. Notification shall be required to the Corps for the use of any Nationwide Permit, State Programmatic General Permit, or Regional Permit.

3. Duration and Amendment. The covenants and restrictions listed herein are created pursuant to 7 Del. C. § 6901 et seq. and shall run with and bind the Property, and be binding on the Declarant, their personal representatives, heirs, successors and assigns, unless and until terminated or modified by the Corps, or other Federal, State, or County agencies which have the legal authority to enforce these covenants and restrictions by regulations, permit, or agreement. The failure of the Corps, or other such agencies to enforce the provisions of this Declaration shall not be deemed a waiver of any rights created hereunder. After recording, this Declaration may only be amended by a recorded document signed by the Corps, and Declarant. The recorded document, as amended, shall be consistent with the Philadelphia District model conservation restrictions at the time of amendment. Amendment shall be allowed at the discretion of the Corps, in consultation with resource agencies as appropriate, and then only in exceptional circumstances. Mitigation for amendment impacts will be required pursuant to Philadelphia District policy at the time of amendment. There shall be no obligation to allow an amendment. The Corps shall be provided with a 60-day advance written notice of any legal action concerning this Declaration or of any action to extinguish, void, or modify this Declaration in whole or in part. This Declaration is intended to survive foreclosure, bankruptcy, condemnation, or judgments affecting the Property. This Declaration shall not be invalid solely because aquatic resources within the Conservation Area are determined not to be waters of the United States or waters of the State.

4. Notice to Government. Any permit application, or request for certification or modification, which may affect the Conservation Area, made to any governmental entity with authority over wetlands or other waters of the United States and/or waters of the State, shall expressly reference and include a copy (with the recording stamp) of this Declaration.

5. Reserved Rights. It is expressly understood and agreed that these restrictive covenants do not grant or convey to members of the general public any rights of ownership, entry or use of the Conservation Area. These restrictive covenants are created solely for the protection of the Property, and for the consideration and values set forth above, and Declarant reserves the ownership of the fee simple estate and all rights appertaining thereto, including without limitation the rights to exclude others and to use the property for all purposes not inconsistent with these restrictive covenants.

6. Monitoring and Maintenance. The permittee, and its/their authorized agents shall have the right to enter and go upon the lands of the Declarant(s) to monitor and manage the Conservation Area to ensure compliance with the Mitigation Site Plan ("Mitigation Site Plan") and Long-Term Management Plan ("Approved Long-Term Management Plan") approved in connection with the Permit. This may include, but is not limited to, completing annual monitoring, controlling invasive species, planting native vegetation, repairing signs/fences, and repairing erosion.

7. Compliance Inspections. The Corps, and its authorized agents shall have the right to enter and go upon the lands of Declarant, to inspect the Conservation Area and take actions necessary to verify compliance with the approved Mitigation Site Plan, the Approved Long-Term Management Plan, and these restrictive covenants.

8. Enforcement. The Declarant grants to the Corps, the U.S. Department of Justice, a discretionary right to enforce these covenants in a judicial action against any person*(s)* or other entity(ies) violating or attempting to violate these restrictive covenants; provided, however, that no violation of these restrictive covenants 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 any other judicial remedy, such as civil penalties. Nothing herein shall limit the right of the Corps to modify, suspend, or revoke the Permit.

9. Property Transfers. Declarant shall include the following notice on all deeds, mortgages, plats, or any other legal instruments used to convey any interest in the Property and Conservation Area (failure to comply with this paragraph does not impair the validity or enforceability of this Declaration):

> **NOTICE:** This property Subject to Declaration of Restrictive Covenants Recorded at New Castle County Recorder of Deeds Book and Page.

Declarant agrees to give written notice to the Corps of the intent to transfer, sell, or convey any interest of the Property, or to amend this Declaration by any other means whatsoever, at least sixty (60) days prior to the date of transfer.

10. Marking of Property. The perimeter of the Conservation Area shall at all times be plainly marked by permanent signs saying, "Protected Natural Area," or by an equivalent, permanent marking system.

11. Recording. Within thirty (30) calendar days of execution of these restrictive covenants, the Declarant agrees to record this Declaration in the Land Records of the County and provide the Corps with proof of recordation within thirty (30) calendar days of recordation. A plat depicting the boundaries of the Conservation Area subject to these restrictive covenants shall be recorded in the deed records office for each county in which the Property is situated prior to the recording of these restrictive covenants. The plat(s) is/are recorded at New Castle County Recorder of Deeds Book and Page

12. Separability Provision. Should any separable part of this Declaration be held contrary to law, the remainder shall continue in full force and effect.

13. Inaccurate or Fraudulent Information. Should an easement, right or lease on or to the Property not shown on the survey or listed in this Declaration and prior in time and recording to this Declaration, or unrecorded, be exercised in such a manner that it conflicts with or voids the prohibited uses of the Property set out in this Declaration, then the owners of the Property shall be responsible for providing alternative compensatory mitigation in such amounts and of such service and function as the Corps or any enforcer of this Declaration shall determine in accordance with the Clean Water Act and/or the Delaware Wetlands Act, 7 Del. C. § 6601 et seq. (the "Delaware Wetlands Act").

14. Eminent Domain. NOTICE TO PARTIES WITH EMINENT DOMAIN AUTHORITY: If the Property is taken in whole or in part through eminent domain, the consequential value of the Conservation Area protected by the Clean Water Act and/or the Delaware Wetlands Act is the cost of replacement of the conservation functions, services and values with other property in the same watershed. Exercise of eminent domain by any party ("Condemning Party") to take land held as part of a mitigation site under this Declaration may remove restrictions that the Declarant, or the Corps, intend will protect, in perpetuity, the Conservation Area, and preserve the land serving as compensation for permitted impacts. Where the Condemning Party: (1) intends to take action(s) that will have impacts on the Conservation Area, and (2) is required to obtain a Corps permit for such impacts, the Corps has

discretion to increase the Condemning Party's wetland and/or stream compensation requirements, as part of the permitting process, in order to account for the loss of functions and values associated with the compensatory mitigation site.

IN WITNESS WHEREOF, the Declarant has duly executed this Declaration of Restrictive Covenants the date written above.

[Signature page follows]

IN THE PRESENCE OF:

Declarant – Delaware Department of Natural Resources and Environmental Control

_____ By: _____

[*type name of witness under signature line*] Shawn M. Garvin

Its: Secretary

STATE OF DELAWARE

COUNTY OF NEW CASTLE

PERSONALLY appeared before me _____, the undersigned witness, and made oath that *he/she* saw the within named _____ [, *by* _____, *its* _____,] sign, seal and as *his/her/its* act and deed, deliver the within named Declaration of Restrictive Covenants; and the *he/she* with the other witness named above witnessed the execution thereof.

_____

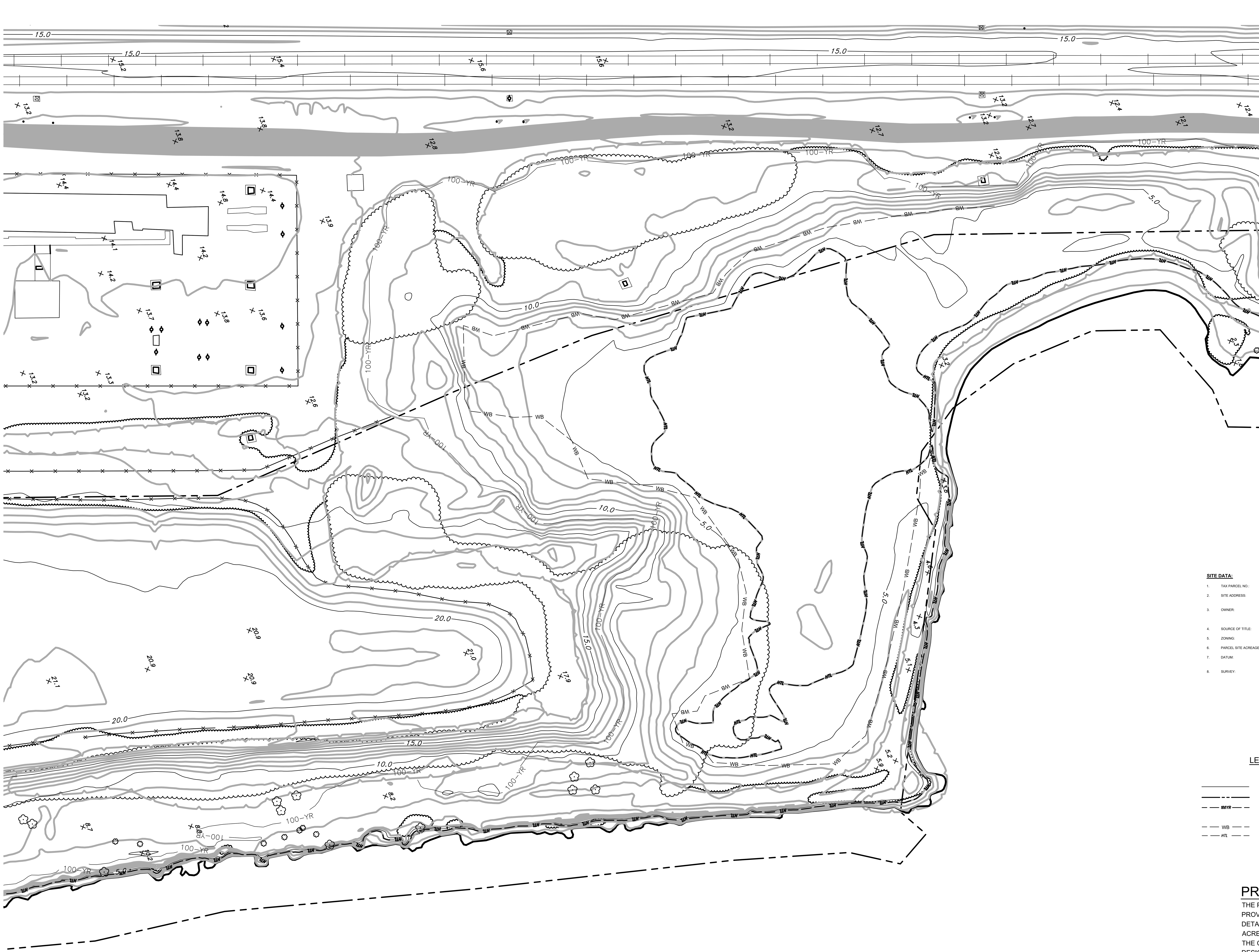
[*type name of Notary Public under signature line*]

SWORN to and subscribed before me
This _____day of _____, 20___.

NOTARY PUBLIC FOR
My Commission Expires:

APPENDIX E

Fox Pont State Park Intertidal Wetland Permit Drawings



SITE DATA:

1.	TAX PARCEL NO.:	06-147.00-017
2.	SITE ADDRESS:	1200 LIGHTHOUSE ROAD WILMINGTON, DE 19809
3.	OWNER:	STATE OF DELAWARE, DIVISION OF PARK AND REC P.O. BOX 1401 DOVER, DE 19903
4.	SOURCE OF TITLE:	IN1103 233
5.	ZONING:	S - SUBURBAN, I -INDUSTRIAL
6.	PARCEL SITE ACREAGE:	170.76 ± AC
7.	DATUM:	HORIZONTAL: NAD 83 DE STATE PLANE GRID VERTICAL: NAVD 1988
8.	SURVEY:	THE TOPOGRAPHIC SURVEY DEPICTED ON THIS PLAN WAS TAKEN FROM AN AERIAL SURVEY PREPARED BY TETRATECH DATED MAY 2, 2006.

LEGEND

PROPERTY LINE
ADJOINER LINE
100 YEAR FLOODPLAIN
WETLAND (FIELD OBSERVED
HIGH TIDE LINE (FIELD OBSERVED)

PROJECT PURPOSE:

THE PURPOSE OF THESE DRAWINGS IS TO PROVIDE THE CONCEPTUAL PLANS AND DETAILS FOR THE CONSTRUCTION OF A ONE ACRE INTERTIDAL WETLAND AREA AS NOTED IN THE COMPENSATORY MITIGATION PLAN. THIS DESIGN IS CONCEPTUAL AND IS NOT FOR CONSTRUCTION.

30' 0 30' 60'
DRAWING SCALE 1" = 30'

DUFFIELD ASSOCIATES
Soil, Water & the Environment
5400 LIMESTONE ROAD
WILMINGTON, DE 19808-1232
TEL. 302.239.6634
FAX 302.239.8485
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DESIGNED BY: BJD
CHECKED BY: BJD
DRAWN BY: GM
FILE NAME: FPST-CON-WETLAND-11139LH

STATE: P.E. #

No.	REVISION	CHK'D BY DATE
1	UPDATED WETLAND DELINIATION	RD/BJD 10/15/21
2	UPDATED ENVIRONMENTAL CONVENANT AREA AND ADDITIONAL WETLAND DELINIATION	SMC/BJD 03/07/22
3	UPDATED INLET STRUCTURE DETAILS	JFC 04/06/2022

OWNER:

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL DIVISION OF PARKS AND RECREATION

APPLICANT:

DIAMOND STATE PORT CORPORATION
800 N. FRENCH STREET, 4TH FLOOR
WILMINGTON, DE 19801

FOX POINT STATE PARK PERMIT DRAWINGS
EXISTING CONDITIONS
PORT OF WILMINGTON
EDGEMOOR EXPANSION

BRANDYWINE HUNDRED ~ NEW CASTLE COUNTY ~ DELAWARE

DATE: SEPTEMBER 2021
SCALE: 1" = 30'
PROJECT NO. 11139.LH.08
SHEET: 1 (OF 5)

LEGEND:

EXISTING ENVIRONMENTAL COVENANT AREA

PROJECT PURPOSE:

THE PURPOSE OF THESE DRAWINGS IS TO PROVIDE THE CONCEPTUAL PLANS AND DETAILS FOR THE CONSTRUCTION OF A ONE ACRE INTERTIDAL WETLAND AREA AS NOTED IN THE COMPENSATORY MITIGATION PLAN. THIS DESIGN IS CONCEPTUAL AND IS NOT FOR CONSTRUCTION.

30' 0 30' 60'
DRAWING SCALE 1" = 30'

DUFFIELD ASSOCIATES
Soil, Water & the Environment
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DESIGNED BY:	CHECKED BY:
BJD	BJD
DRAWN BY:	FILE NAME:
SC	FPST-CON-WETLAND-11139LH

STATE: P.E. #

No.	REVISION	CHK'D BY / DATE
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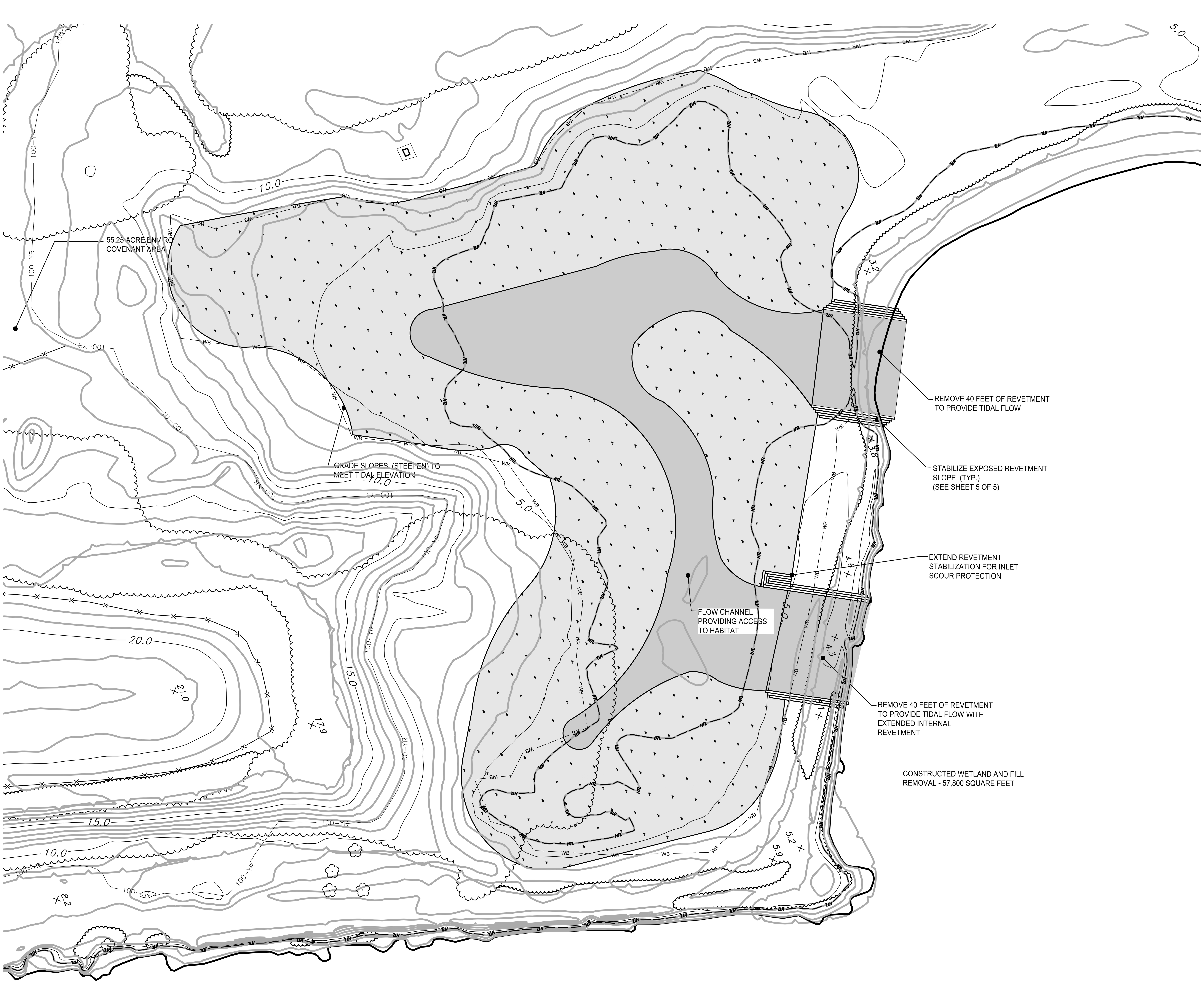
2	UPDATED ENVIRONMENTAL CONVENANT AREA AND ADDITIONAL WETLAND DELINIATION	SMC/BJD 03/07/22
3	UPDATED INLET STRUCTURE DETAILS	JFC 04/06/2022

OWNER:
DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL DIVISION OF PARKS AND RECREATION

APPLICANT:
DIAMOND STATE PORT CORPORATION
800 N. FRENCH STREET, 4TH FLOOR
WILMINGTON, DE 19801

FOX POINT STATE PARK PERMIT DRAWINGS
ENVIRONMENTAL COVANENT AREA
PORT OF WILMINGTON
EDGEMOOR EXPANSION
BRANDYWINE HUNDRED ~ NEW CASTLE COUNTY ~ DELAWARE

DATE: SEPTEMBER 2021
SCALE: 1" = 30'
PROJECT NO. 11139.LH.08
SHEET: 2 (OF 5)



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20' 0 20' 40'
DRAWING SCALE 1" = 20'

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3	UPDATED INLET STRUCTURE DETAILS	JFC 04/06/2022

OWNER:
DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF PARKS AND RECREATION

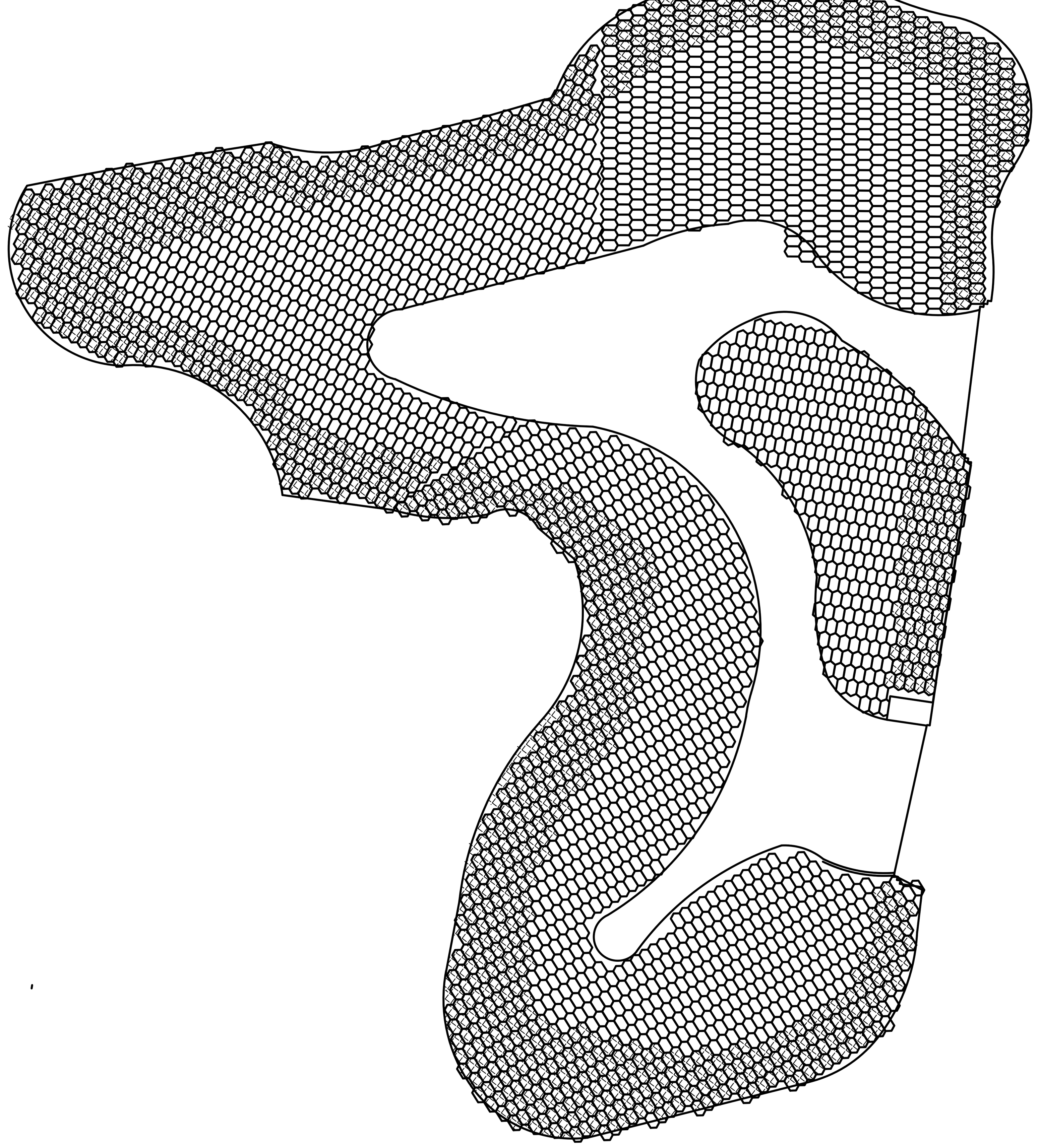
APPLICANT:
DIAMOND STATE PORT CORPORATION
800 N. FRENCH STREET, 4TH FLOOR
WILMINGTON, DE 19801

FOX POINT STATE PARK PERMIT DRAWINGS
INTERTIDAL WETLAND PLAN VIEW
PORT OF WILMINGTON
EDGEMOOR EXPANSION
BRANDYWINE HUNDRED ~ NEW CASTLE COUNTY ~ DELAWARE

DATE: SEPTEMBER 2021
SCALE: 1" = 20'
PROJECT NO. 11139.LH.08
SHEET: 3 (OF 5)

PROJECT PURPOSE:

THE PURPOSE OF THESE DRAWINGS IS TO PROVIDE THE CONCEPTUAL PLANS AND DETAILS FOR THE CONSTRUCTION OF A ONE ACRE INTERTIDAL WETLAND AREA AS NOTED IN THE COMPENSATORY MITIGATION PLAN. THIS DESIGN IS CONCEPTUAL AND IS NOT FOR CONSTRUCTION.

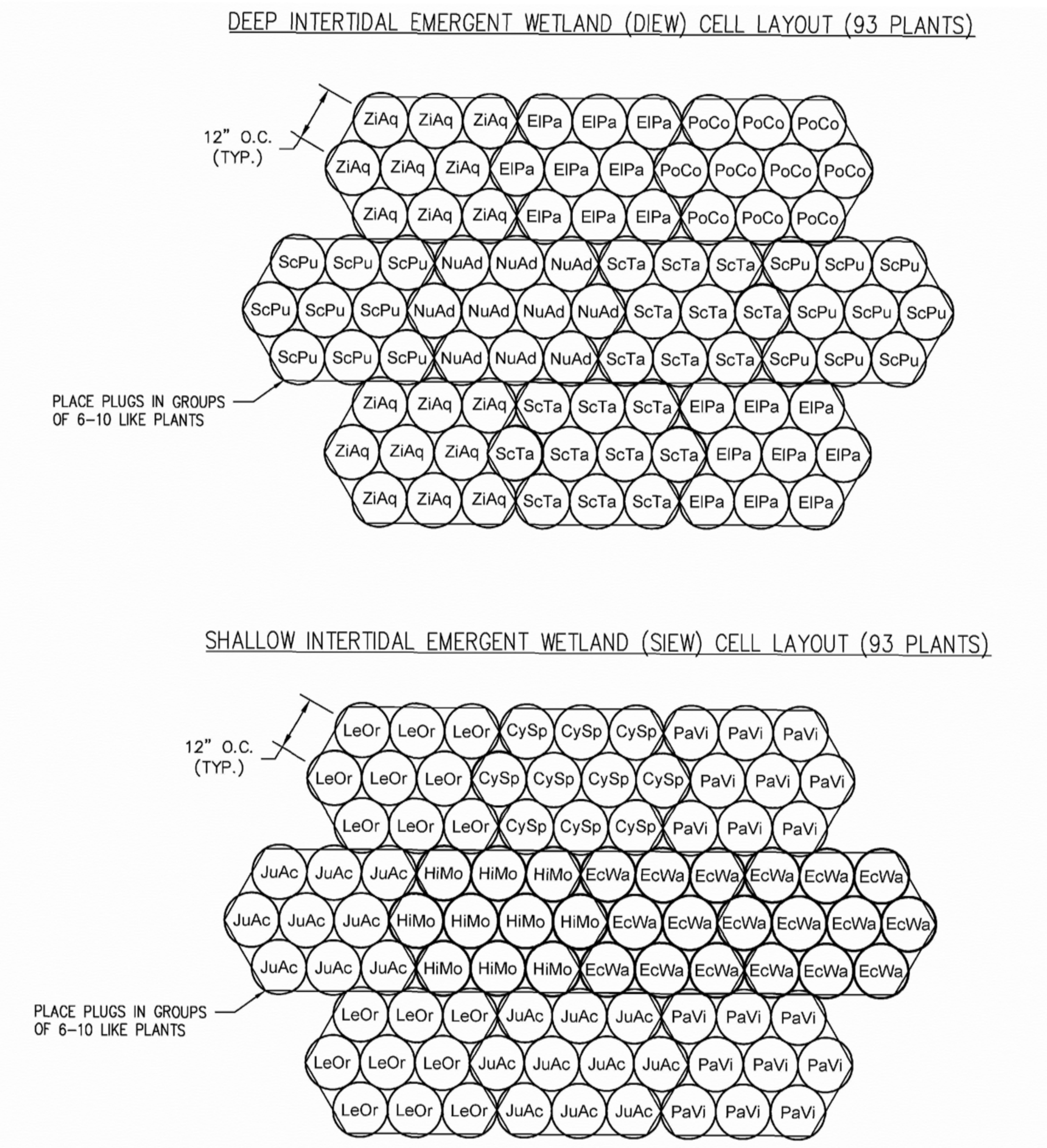


LEGEND:

- SHALLOW INTERTIDAL EMERGENT WETLAND CELL
- DEEP INTERTIDAL EMERGENT WETLAND CELL

DETAIL: TYPICAL INTERTIDAL WETLAND PLANTING PLAN

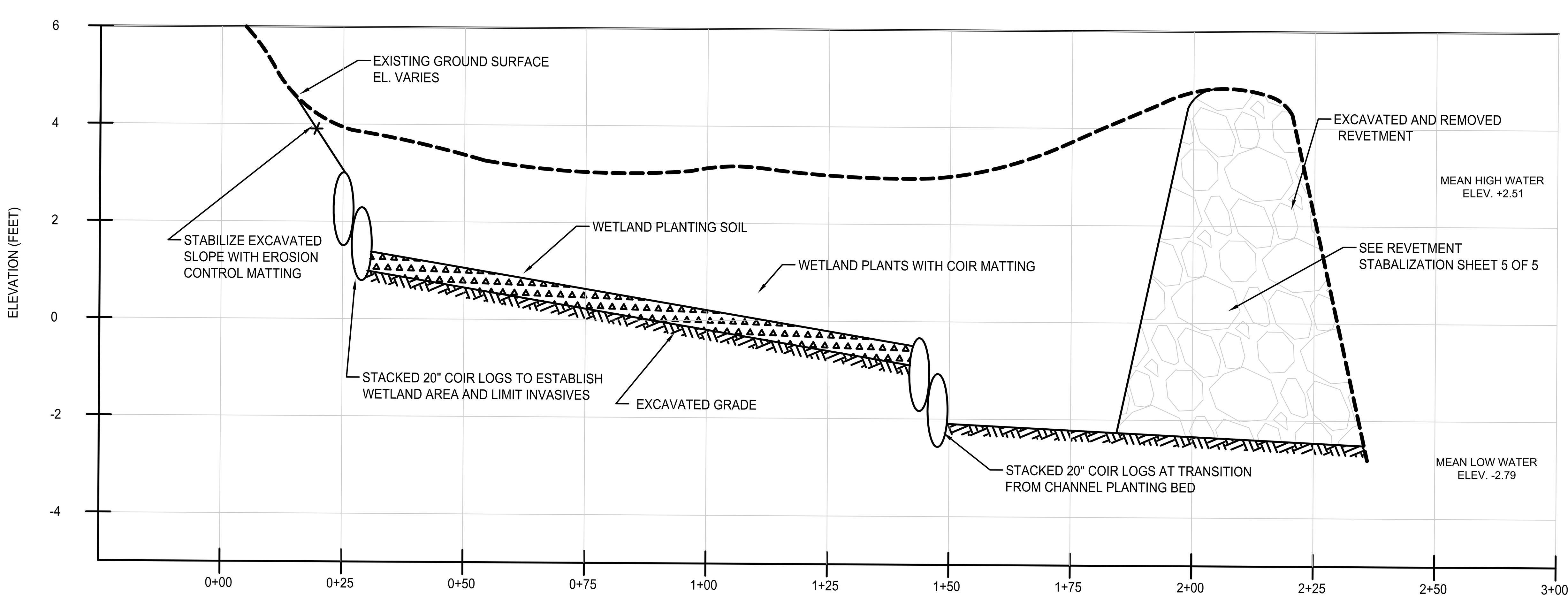
SCALE: HORIZ. 1"=20'



NOTES:

1. PLANTS SHALL BE SOURCED FROM A LOCAL REGIONAL VENDOR WHO PROPAGATES ITS OWN PLANTS FROM REGIONALLY-OBTAINED NATIVE STOCK OR SEED, VERIFIED NATIVE SPECIES. ORDERS SHALL BE PREORDERED THE YEAR PRIOR TO PLANTINGS, GROWN SPECIFICALLY FOR THE PROJECT IN APPLICABLE SOILS. PLANTS SHOULD BE PROPERLY ASSESSED PRIOR TO PLANTING.
2. PLANTING SHALL BE PERFORMED PEAK GROWING SEASON, PLANTING IN GROUPS OF 6-10 PER SPECIES. PLANT IN HOLES WITH PROPER DIMENSIONS FOR ROOT STRUCTURE, BACKFILLED AND TAMP SOIL. INDIVIDUAL PLUGS SHOULD BE PLANTED AT 12 INCHES APART ON CENTER.

DETAIL: TYPICAL INTERTIDAL WETLAND PLANTINGS



ELEVATION: TYPICAL WETLAND CROSS SECTION

SCALE: HORIZ. 1"=20'
VERT. 1"=2'

Botanical Name		Common Name	Indicator Status	Size	Spacing	Percent planted	Plants Per Cell*
Deep Intertidal Emergent Wetland Zone (DIEW)							
Zizania aquatica	ZiAq	Wild Rice	OBL	2" pot or tube	Plant 12" to 18" centers	0.2	1138
Eleocharis parvula	ElPa	Small Saltmarsh Spikerush	OBL	2" pot or tube	Plant 12" to 18" centers	0.2	1138
Schoenoplectus pungens	ScPu	Chairmakers Bulrush	OBL	2" pot or tube	Plant 12" to 18" centers	0.2	1138
Pontederia cordata	PoCo	Pickerelweed	OBL	2" pot or tube	Plant 12" to 18" centers	0.1	569
Nuphar advena	NuAd	Spatterdock	OBL	2" pot or tube	Plant 12" to 18" centers	0.1	569
Schoenoplectus tabernaemontani	ScTa	Softstem Bulrush	OBL	2" pot or tube	Plant 12" to 18" centers	0.2	1138
Shallow Intertidal Emergent Wetland Zone (SIEW)							
Leersia oryzoides	LeOr	Rice cutgrass	FACW	2" pot or tube	Plant 12" to 18" centers	0.2	1138
Cyperus spp.	CySp	Flatsedges	FACW	2" pot or tube	Plant 12" to 18" centers	0.1	569
Panicum virgatum	PaVi	Switch grass	FAC	2" pot or tube	Plant 12" to 18" centers	0.2	1138
Juncus acuminatus	JuAc	Sharp-fruited Rush	FACW	2" pot or tube	Plant 12" to 18" centers	0.2	1138
Echinocloa walteri	EcWa	Walter's Barnyard grass	OBL	2" pot or tube	Plant 12" to 18" centers	0.2	1138
Hibiscus moscheutos	HiMo	Rose mallow	OBL	2" pot or tube	Plant 12" to 18" centers	0.1	569

DETAIL: TYPICAL INTERTIDAL WETLAND PLANTING SCHEDULE

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No.	REVISION
1	UPDATED WETLAND DELINIATION
2	UPDATED ENVIRONMENTAL CONVENANT AREA AND ADDITIONAL WETLAND DELINIATION
3	UPDATED INLET STRUCTURE DETAILS

OWNER:
DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF PARKS AND RECREATION

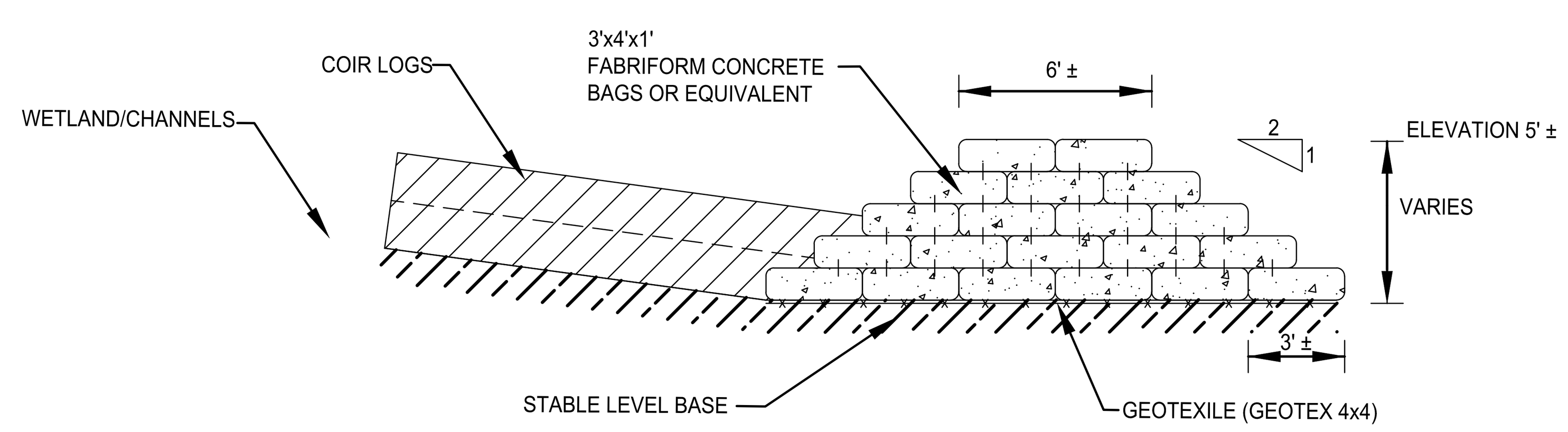
APPLICANT:
DIAMOND STATE PORT CORPORATION
800 N. FRENCH STREET, 4TH FLOOR
WILMINGTON, DE 19801

FOX POINT STATE PARK PERMIT DRAWINGS
INTERTIDAL WETLAND DETAILS AND SECTION

PORT OF WILMINGTON
EDGEMOOR EXPANSION

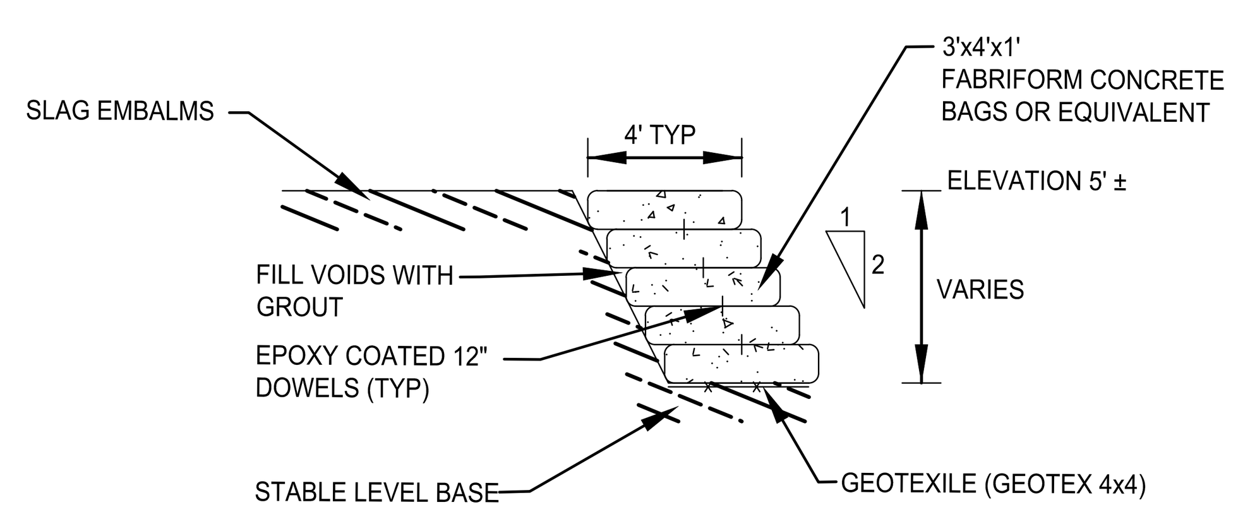
BRANDYWINE HUNDRED ~ NEW CASTLE COUNTY ~ DELAWARE

DATE: SEPTEMBER 2021
SCALE: AS SHOWN
PROJECT NO. 11139.LH.08
SHEET: 4 (OF 5)



DETAIL: TYPICAL REVETMENT STABILIZATION - PROFILE

SCALE: HORIZ. 1"=5'



DETAIL: TYPICAL REVETMENT STABILIZATION - SECTION

SCALE: HORIZ. 1"=5'

NOTES:

1. CONCRETE BAGS SHALL BE 3'x4'x1' (EXPANDED) FABRIFORM CONCRETE BAGS OR EQUIVALENT.
2. CONCRETE BAG GROUT FILL SHALL BE MINIMAL 4000 PSI @ 28 DAYS
3. EPOXY COATED DOWEL SHALL BE 12" LONG 5/8 " REFORMED STEEL DOWEL
4. ACTUAL DIMENSIONS AND QUANTITIES SHALL BE ADJUSTED TO FIELD CONDITIONS

DUFFIELD ASSOCIATES
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No.	REVISION	CHK'D BY DATE
1	UPDATED WETLAND DELINIATION	RD/BJD 12/15/21
2	UPDATED ENVIRONMENTAL CONVENANT AREA AND ADDITIONAL WETLAND DELINIATION	SMC/BJD 03/07/22
3	UPDATED INLET STRUCTURE DETAILS	JTC 04/06/2022

OWNER:
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FOX POINT STATE PARK PERMIT DRAWINGS
INTERTIDAL WETLAND DETAILS AND SECTION

PORT OF WILMINGTON
EDGEMOOR EXPANSION

BRANDYWINE HUNDRED ~ NEW CASTLE COUNTY ~ DELAWARE

DATE: SEPTEMBER 2021
SCALE: AS SHOWN
PROJECT NO. 11139.LH.08
SHEET: 5 (OF 5)

APPENDIX F

Brandywine Dam 2 Preliminary Design Report

BRANDYWINE DAM 2
NATURE-LIKE FISHWAY
PRELIMINARY DESIGN REPORT

Prepared for:

Diamond State Port Corporation
Wilmington Harbor – Edgemoor Expansion
Wilmington, Delaware

Project Location: Brandywine Park, Wilmington, Delaware

Prepared by:

Kleinschmidt
Strasburg, Pennsylvania
www.KleinschmidtGroup.com

Document No. 5023001.01

April 2022

BRANDYWINE DAM 2

NATURE-LIKE FISHWAY

PRELIMINARY DESIGN REPORT

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BRANDYWINE DAM 2

NATURE-LIKE FISHWAY

PRELIMINARY DESIGN REPORT

1.0 INTRODUCTION

As part of the United States Army Corp of Engineers (USACE) required compensatory mitigation for the proposed Wilmington Harbor – Edgemoor Expansion, Diamond State Port Corporation (DSPC) is proposing to install a nature-like fishway (NLF) to improve migratory fish passage at Dam 2 on the Brandywine River. This report has been prepared by Kleinschmidt Associates (Kleinschmidt) as part of their contract with DSPC to design fish passage enhancements at the project site. Kleinschmidt completed an alternatives analysis (Kleinschmidt, 2021) that identified a NLF as a viable alternative to enhance fish passage at the Brandywine River Dam 2. This preliminary design report, in combination with the permit-level design drawings (Appendix A), describes the background and design criteria, summarizes design assumptions, and documents the process used to develop the design of a NLF across the full width of the Brandywine River channel. The design of this fishway is not finalized, as DSPC still needs to perform additional hydraulic modeling and consultation with the Brandywine NLF Technical Subcommittee[1] to confirm that the proposed design for this fishway meets the design criteria for this project. This report summarizes the status of the project at the time of this report and provides additional information beyond that contained in the permit drawings.

Dam 2 is also known as the Brandywine Park Dam or Broome Street Dam and is located on the Brandywine River in Brandywine Park (River Mile [RM] 2.9), in Wilmington, Delaware. The latitude and longitude coordinates for the Dam 2 are 39.75142, -75.55502. Dam 2 serves to impound water for the City of Wilmington's two water intakes (one at the Compton Wills Pump Station and one at the South Raceway at the right/south abutment of Dam 2).

[1] This subcommittee consists of members of the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), United States Fish & Wildlife Service (USFWS), Delaware Natural Resources and Environmental Control (DNREC), and United States Army Corps of Engineers (USACE), as well as DSPC and their consultants.

The City of Wilmington's water extraction varies daily based on system demand and it is permitted to withdraw up to 63 million gallons per day (MGD; 97 cfs), but typically only withdraws an average of approximately 20 MGD (37 cfs). For the South Raceway intake, water is diverted into the mill race, on river right, which connects to the City's treatment plant downstream. Additionally, there is another water intake within the Dam 2 impoundment, the Compton Wills Pump Station, located approximately 600 feet upstream of Dam 2, on the river left/north bank. The City is the owner of Dam 2 and the Brandywine Park on either side of the dam.

The original dam at this location, known as the Upper Dam, was constructed along with the millraces on both banks in 1762 (Richard Grubb & Associates, 2021). The Upper Dam was modified during its life, with the dam being rebuilt in 1885 to have a concave shape with the concave side facing downstream. The Upper Dam is still visible as a submerged structure in the impoundment, directly upstream of Dam 2. The existing stone and concrete, straight dam replaced the original dam circa 1902 and a concrete Denil fishway was built on the north/left abutment in 1969 but was partially removed by 2007 due to debris clogging (Morrissey, et. al, 2021). The current configuration of the concrete dam consists of an ogee-shaped weir cap with steps on the downstream face. Dam 2 is approximately 140-ft-long with a structural height of 8.8 feet.

The North mill race, on the river left bank, was infilled between 1950 and 1953 (Richard Grubb & Associates, 2021). The South mill race on the river right bank is still utilized to divert water to the City's treatment plant approximately 0.9 mile downstream on river right. Flow into the mill race is controlled by headgates at the right abutment. A combined sewer overflow (CSO) crosses over the mill race and discharges into the river approximately 130 feet downstream on river right.

Note: flow is from northwest to southeast (left to right).

FIGURE 1-1. GENERAL LAYOUT OF THE DAM 2 STRUCTURES

The City, as a project stakeholder, is concerned about the potential for the fish passage enhancements to adversely affect water supply withdrawals from the Brandywine River at Dam 2. The City has been involved in the design process and the design criteria reflect the desire not to substantially impact their operations.

Diadromous fish travel between the ocean and freshwater waterbodies as part of their life cycles. Dams and other barriers affect fish migrations by impeding or totally blocking upstream migrations; thus, reducing access to spawning, feeding, and maturation habitats. To overcome these fish passage barriers, the integration of numerous scientific and engineering principles is required, including ichthyomechanics, fish behavior, hydraulics, hydrology, and geomorphology. With the removal of the downstream Dam 1 in the Fall 2019 (Brandywine RM 2.1). Dam 2 is the first physical obstacle to upstream migratory fish passage into this 325 square miles watershed, making migratory fish passage especially important at this location. If passage is provided at Dam 2, Dam 3 is partially breached and deemed passable at this time; therefore, fish would be free to swim approximately 4,100 feet further upstream and access that habitat for spawning and foraging once passing Dam 2.

2.0 DESIGN CRITERIA

To define the objectives and design criteria for this Project, Kleinschmidt engaged with the Brandywine NLF Technical Subcommittee (BNTS). The BNTS includes representatives from the following organizations:

1. Diamond State Port Corporation (DSPC, including Kleinschmidt and Verdantas)
2. United States Fish & Wildlife Service (USFWS) – Fish Passage Engineering Team
3. National Oceanic and Atmospheric Agency – National Marine Fisheries Service (NMFS)
4. Delaware Department of Natural Resources and Environmental Control (DNREC) – Fisheries Biologist
5. Army Corps of Engineers

The BNTS has advised on the design criteria and fishway design to date and will continue to be consulted as the NLF design has additional hydraulic modeling and design refinement. This consultation is expected to occur throughout the design refinement, with major reviews of the design by the BNTS after final hydraulic model development and review of the 90% design drawings and Final Report. At this time, we understand the BNTS will work with DSPC to develop the final design in support of the USACE's federal mitigation requirement to offset anticipated impacts at the proposed Wilmington Harbor – Edgemoor Expansion project.

As part of the design process, it is, and will be, necessary to demonstrate to the City of Wilmington that the proposed design will not reduce the size/volume/safe yield of the upstream impoundment, or adversely impact their water withdrawal operations. The 2021 Alternatives Analysis for Dam 2 (Kleinschmidt) considered an NLF, replacing the Denil fishway on the north bank, and developing a bypass channel on the north bank as alternatives. Of these options, the NLF is anticipated to have the highest passage efficiency and lowest long-term maintenance requirements and was therefore selected for this site, given the substantial infrastructure constraints to implement a bypass fishway at this dam. A full removal was not considered acceptable, given the need to maintain the City's water intakes. The dam is not currently notched; however, the dam will need to be notched to meet United States Fish and Wildlife Service's (USFWS), Region 5 Fish Passage Engineering Design for the target species.

Based on Kleinschmidt's understanding of the Brandywine River fisheries data, there are no migratory fish run sizes determined for the target species in the river, beyond the Brandywine Conservancy Report (2005) that identified an estimated shad production potential of 26,600 American Shad if Dams 1-11 were breached or provided with fish passage measures. However, it is not clear if this production potential includes all the potential habitat above this dam on the Brandywine River or just up to the next upstream barrier. If DNREC has an updated run size population for any of the target species in the Brandywine River at Dam 2, Kleinschmidt can use that to size the fishway, but at this time that information is not available to our knowledge. As suggested by St. Pierre (1979) for the nearby Susquehanna River, a ratio of five (5) river herring to one (1) American shad can be used to estimate the river herring run size, resulting in a maximum potential returning river herring target of 133,000 river herring at Dam 2, lacking any more precise information. Based on the USFWS Design Criteria (2019) equation 9, the peak hour run sizes are 599 American shad and 2,993 river herring using a 15% peak day factor, 15 % peak hour factor. This estimation is for high-level planning purposes only and should only be used as a very rough estimate of the returning fish populations. However, since this is the best available information regarding fish run sizes at Dam 2, these estimates will be used for design of the NLF, although they are low enough that they are not anticipated to control the design.

The design criteria for this Project were established with input from the BNTS to inform the design of the NLF. These criteria seek to provide fish passage at Dam 2, while minimizing impacts to existing water withdrawal operations. The following criteria will be used to guide the design of the NLF. The design process generally is iterative in nature, often with input from involved fisheries resource agencies and private fish passage professionals, non-governmental organizations, and the dam owners. As such, design criteria may be modified or "fine-tuned" as the design process progresses.

Primary Design Criteria

The NLF at Dam 2 is being designed to pass three primary target species:

1. American Shad,
2. Alewife, and
3. Blueback Herring

Depending on availability, Alewife and Blueback Herring may be combined into one category termed, "River Herring." In this case, test specimens used in monitoring studies to determine passage

effectiveness for herring would consist mainly of the most abundant species, most likely Blueback Herring. Table 2-1 indicates these species design guidelines based on swimming performance are essentially the same. At the request of DNREC, the performance of Hickory Shad in the NLF may be evaluated, but Hickory Shad will not be a target species and the success of the Brandywine NLF in meeting the NLF Performance Criteria will in no way be tied to the results of any Hickory Shad monitoring performed as described in the NLF Monitoring Plan.

Additional migratory species such as American Eel, as well as many resident fish species, are expected to use the NLF, but the design of the fishway will focus on providing passage for American Shad and River Herring. Physical design criteria will follow the fish passage criteria for the target species as summarized below in Table 2-1 from the Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes (Turek et al., 2016) ensuring that adequate water depth, velocity, and resting habitat for target species are provided. The most restrictive criteria for each of the three target species will be used to develop the fishway, with multiple zones of passage established to provide variable flows and depths to accommodate the target species. This approach ensures passage for the weakest swimmers from the target species. The NLF is anticipated to have pools with depths of at least 4 feet, widths of at least 20 feet, and lengths as dictated by site constraints and hydraulics. Velocities in weir notches will target less than 6.0 feet per second (fps) for River Herring (Alewives and Blueback Herring) and less than 8.25 fps for American Shad. The slope will be set to 1:30 (or shallower) to minimize hydraulic drops and maintain the recommended hydraulics in the channel. The hydraulics will be modeled with a 2-D hydraulic model and validated in the field after the project is constructed (see the NLF Monitoring Plan included in DSPC's Final Mitigation Plan for the project at Edgemoor).

TABLE 2-1. SUMMARY OF FEDERAL INTERAGENCY NATURE-LIKE FISHWAY PASSAGE DESIGN GUIDELINES FOR AMERICAN SHAD, BLUEBACK HERRING, AND ALEWIFE

	Minimum Pool/ Channel Width (ft)	Minimum Pool/ Channel Depth (ft)	Minimum Pool/ Channel Length (ft)	Minimum Weir Opening Width (ft)	Minimum Weir Opening Depth (ft)	Maximum Weir Opening Water Velocity (ft/second)	Maximum Fishway Channel Slope
Species	**W_p**	**d_p**	**L_p**	**W_N**	**d_N**	**V_{max}**	**S_O**
American Shad (*Alosa sapidissima*)	20.0	4.00	30.0	5.00	2.25	8.25	1:30
Blueback Herring (*Alosa aestivalis*)	5.0	2.00	10.0	2.25	1.0	6.00	1:20
Alewife (*Alosa*	5.0	2.25	10.0	2.50	1.0	6.00	1:20

Note: Blue shaded cells indicate most restrictive design guidelines for American Shad and river herring.

Additional Primary design criteria proposed for this project include:

1. Fish passage type: full-width Rock Weir Nature-like Fishway
2. Location: immediately downstream of Brandywine River Dam 2
3. NLF Operational Range: The NLF will provide suitable passage from the 95% exceedance to the 5% exceedance flows during the fish passage season, as based on the USGS Gage 01481500 on the Brandywine River at Wilmington for the past 20 years of data and removing permitted water withdrawal flows as noted below to account for the City of Wilmington's water withdrawal above Dam 2 (19 MGD/29 cfs Average Day, 63 MGD/97 cfs maximum permitted withdrawal).

TABLE 2-2. BRANDYWINE NLF DESIGN FLOWS.

Percent Exceedance (passage season)	River Flow above Dam 2 and City Withdrawal (cfs)*	Allowance for City Withdrawal (cfs)**	NLF Design Flow at Dam 2 (cfs)
5	1,326	0	1,326
50	470	29	441
95	233	97	136

* *Flow is from USGS Gage 01481500. The flow was not adjusted due to the small difference in drainage areas from the gage to the project site.*

** *Most conservative assumption for fishway flow; to be evaluated as design progresses and may be modified to be less conservative if this drives design to include an additional weir or other major cost implications*

to address these conservative design parameters, as it is understood that the City rarely, if ever, utilizes their maximum permitted withdrawal.

4. Design Flood/Stability Event: The structure will be designed to resist major structural failures during a reasonably anticipated 100-year return period flood event.
5. There will be no substantial impact to Wilmington's water withdrawal operations at the Dam or at their intake facility upstream of the Dam.
6. The fishway will have three "Zone of Passage" (ZOP) notches at varying elevations along each of the rock weirs below the concrete dam. At least two ZOP notches (3 if hydraulically feasible and approved by cultural resources staff) will be included in the crest of Dam 2.
7. The fish passage season is considered as March 15 through June 15 annually.
8. The 2019 USFWS Region 5 Fish Passage Engineering Design Criteria (USFWS, 2019) will be used to guide the design, but given the infrastructure constraints at the site, the design will be in accordance with the guidelines as much as practical and agreed to by the regulatory agencies.
9. To preserve the City of Wilmington's ability to a provide potable water supply, provisions for gates will be provided that allow the City of Wilmington to close the east and west notches in Dam 2 during periods of extremely low flow (<150 cfs at USGS Gage 01481500).
10. The ZOP notches will be suitable for downstream passage.

Recognizing that all design criteria for this Project may not be met, the BNTS agreed to establish primary criteria (required to meet, as listed above) and secondary criteria (meet to the extent feasible). The secondary design criteria for this Project are threefold:

Secondary Design Criteria

1. Minimize, to the extent feasible, the necessary operations and maintenance of the fishway.
2. Minimize, to the extent feasible, the amount of rock fill in the river, the overall project footprint, and the duration of construction.
3. Minimize any impacts to existing utilities.

The design of the NLF was conducted in consideration of these design criteria, as well as applying Kleinschmidt's understanding of the site and site operations, based on a review of data provided to-date. As listed in the Primary Design Criteria, the Federal Interagency Nature-Like Fishway Passage Design Guidelines (Turek et al., 2016) were used as recommended design guidelines for the target fish species as shown in Table 2-1.

3.0 SITE CONDITIONS AND ENVIRONMENTAL SETTING

3.1 SITE SURVEY

A site survey was performed for this Project by S.T. Hudson Engineers Inc. for DSPC and was delivered to Kleinschmidt by Verdantas. Verdantas delivered the best available coverage of survey data (some areas were unable to be surveyed due to weather and flow restrictions) to Kleinschmidt in February 2022. Kleinschmidt utilized additional survey from Ash Associates (completed in 2010, for design of Denil fishway concept that was never constructed) and our best interpretation of field conditions to fill in any gaps in the 2022 survey data. The topographic and bathymetric survey was mapped in the NAD 83 (2011) Delaware State Plane Coordinate System, in the NAVD88 Vertical Datum, and in United States survey feet. Transect surveys were performed to define the bathymetric contours by surveying a cross section approximately every 50 feet from the dam for the extent of the bathymetry. River water levels were recorded on February 7, 2022, when the river flow was approximately 440 cfs, is near the 50% exceedance flow during the fish passage season.

The site survey identified the location of a City of Wilmington-owned sewer line under the Brandywine River that will need to be protected during construction. The design of the NLF is developed to keep a 10' minimum buffer from the sewer line for any excavation, with any fill or equipment travel across this area needing to be carefully considered in light of the bearing capacity of the sewer line. Kleinschmidt understands that the City is looking at options to stabilize this utility, but the scope of that improvement and any work associated with that sewer line is outside the design of this fishway and necessary consultation should continue as the Brandywine NLF design is finalized.

3.2 HYDROLOGY AND DESIGN FLOWS

The primary goal of the hydrologic analysis is to determine the fish passage design flows, specified according to the design criteria discussed in Section 2.0. Additionally, the analysis is to provide peak flood discharges for events corresponding to specific annual chance exceedance probabilities which will be utilized to analyze the structural stability of the proposed design under flood conditions, as well

as to complete the Federal Emergency Management Agency (FEMA) no rise analysis required for this project and discussed briefly in this section.

3.2.1 FLOW DURATION ANALYSIS

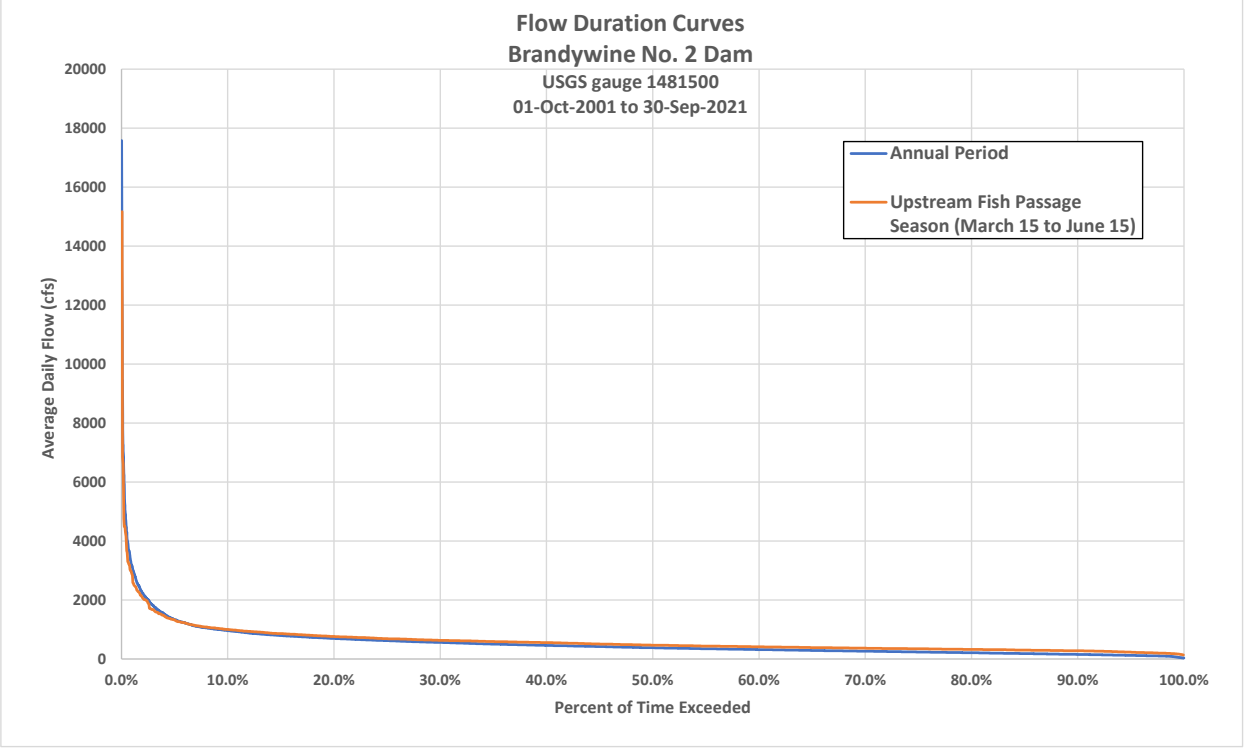
To determine the fish passage design flows a flow duration analysis was performed to determine the Flow Duration Curves (FDC) for the site for two periods of analysis: 1) the upstream fish passage season extending from March 15 to June 15 of each year; and 2) the complete water year. The average daily flow gage data used for this study was acquired from U.S. Geological Survey (USGS) gage 1481500 (Brandywine Creek at Wilmington, DE) for the period of January 1st, 2001, through November 18th, 2021 (This range defines the last 20 water years extending from 2002 to 2021). The stream gage is approximately 1.6 RM upstream of the project site. With very little lateral inflows between the gage and the project site, the gage is assumed to be an adequate representation of the normal flows at the project.

While there are no significant lateral inflows between the gage and the project, the city of Wilmington has two water withdrawal intakes upstream of the project dam. Daily discharge data is not available for the city intakes for the last 20 years so the average daily discharge series could not be adjusted to reflect the city withdrawals. To account for the city withdrawals in the NLF design, two approaches were taken: 1) the exceedance flows were adjusted by the most conservative assumption regarding the City's withdrawal by reducing the exceedance flows as shown in Table 2; and 2) the annual period was analyzed to determine the percent of time that flows drop below specified low flow thresholds. The Fishway must operate between the 5 percent and 95 percent exceedance probability flows for the upstream fish passage season, as defined by the historical record at the gage site. The 5 percent and 95 percent exceedance flow values for the upstream fish passage season are shown in Table 2 and the low flow threshold exceedance values are provided in Table 3-1. The BNTS agreed that the likelihood of extremely low flows is not very likely during the fish passage season and understand that for flows less than the 95% exceedance flow during the fish passage season and during other periods of low flow outside the fish passage season, the City may close up the proposed notches in Dam 2 in order to preserve their headpond and water supply for the City of Wilmington. Flow duration curves for the annual period and the passage season are provided in Figure 3-1. To highlight the differences between

the analyzed periods, an enlarged version of the curves focusing on the normal flow range was also provided.

TABLE 3-1 BRANDYWINE LOW THRESHOLD FLOW PERCENT EXCEEDANCE

Curve Flow at Brandywine Dam 2 (cfs)	Percent Exceedance (Annual Period)
100 (maximum withdrawal by City is 97 cfs)	98.2
150	91.1



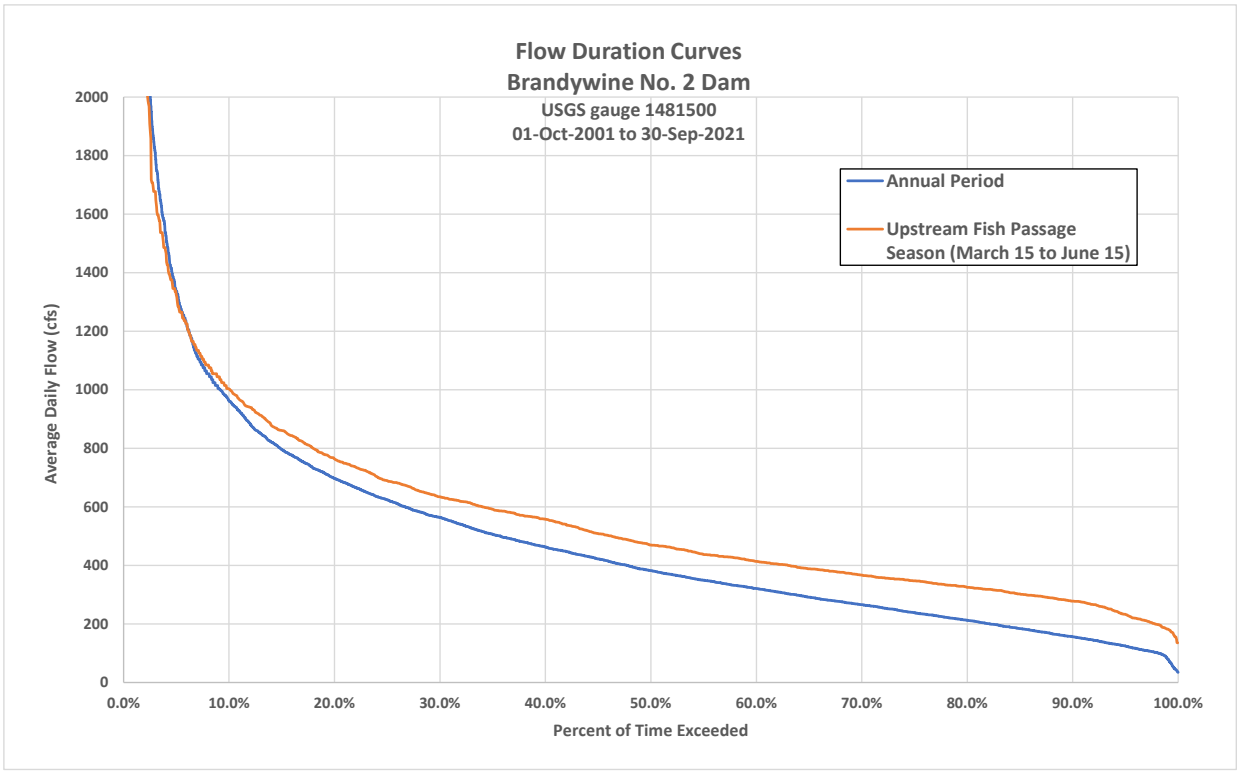


FIGURE 3-1. FULL (TOP) AND ENLARGED (BOTTOM) BRANDYWINE DAM 2 FLOW DURATION CURVES

3.2.2 FLOOD FREQUENCY ANALYSIS

A flood frequency analysis was performed to determine the 10.0 and 1.0 percent chance exceedance probability flows at the project using flow data from the upstream USGS stream gage discussed in Section 3.2.1. The peak annual discharge series for the entire period of record was downloaded and cataloged in HEC-SSP version 2.2. A peak flood flow frequency analysis was performed using the Bulletin 17C to determine percent chance exceedance probability flows and the resulting flood frequency curve for the gage is shown in Figure 3-2.

To translate the peak flows determined for the gage to the project site a drainage ratio was applied according to the procedure outlined in the regional USGS flood frequency report (Ries & Dillow, 2006). The drainage area for the site and the stream gage was delineated using the USGS StreamStats program (USGS, 2016[b]) and were compared against the USGS reported area at the gage (USGS 2016[a]), and FEMA reported areas at the gage and two locations bounding the project dam (FEMA, 2020). The StreamStats delineated areas match up well with the FEMA reported values, but the USGS reported area at the gage was slightly smaller (Table 3-2). Because the StreamStats drainage area at the project dam was to be used for the ratio analysis the StreamStats delineated drainage area was also used for the gage, as the areas were determined according to the same methodology and provides a more accurate translation of the peak flows at the gage to the project site. The resulting prorated peak flows for the 10.0 and 1.0 percent chance exceedance probabilities are summarized in Table 3-3.

TABLE 3-2 SUMMARY OF DRAINAGE AREAS

Location	Location and Source of Reported Drainage Area	Drainage Area (sq-miles)
USGS Gage	USGS reported at gage	314
	FEMA reported at gage	318.5
	StreamStats delineated at gage	318
Brandywine No. 2 Dam	FEMA reported approximately 1890 feet upstream of its confluence with Interstate Route 95/ US Route 202	320.5
	Stream Stats delineated at project dam	321
	FEMA reported approximately 50 feet downstream from Interstate Route 95/ US Route 202	321.5

TABLE 3-3 BRANDYWINE NO. 2 DAM PEAK FLOW CONDITIONS

Percent Chance Exceedance	Annual Return Period	Flow (cfs)
10.0	10-Year	18,100
1.0	100-Year	36,500

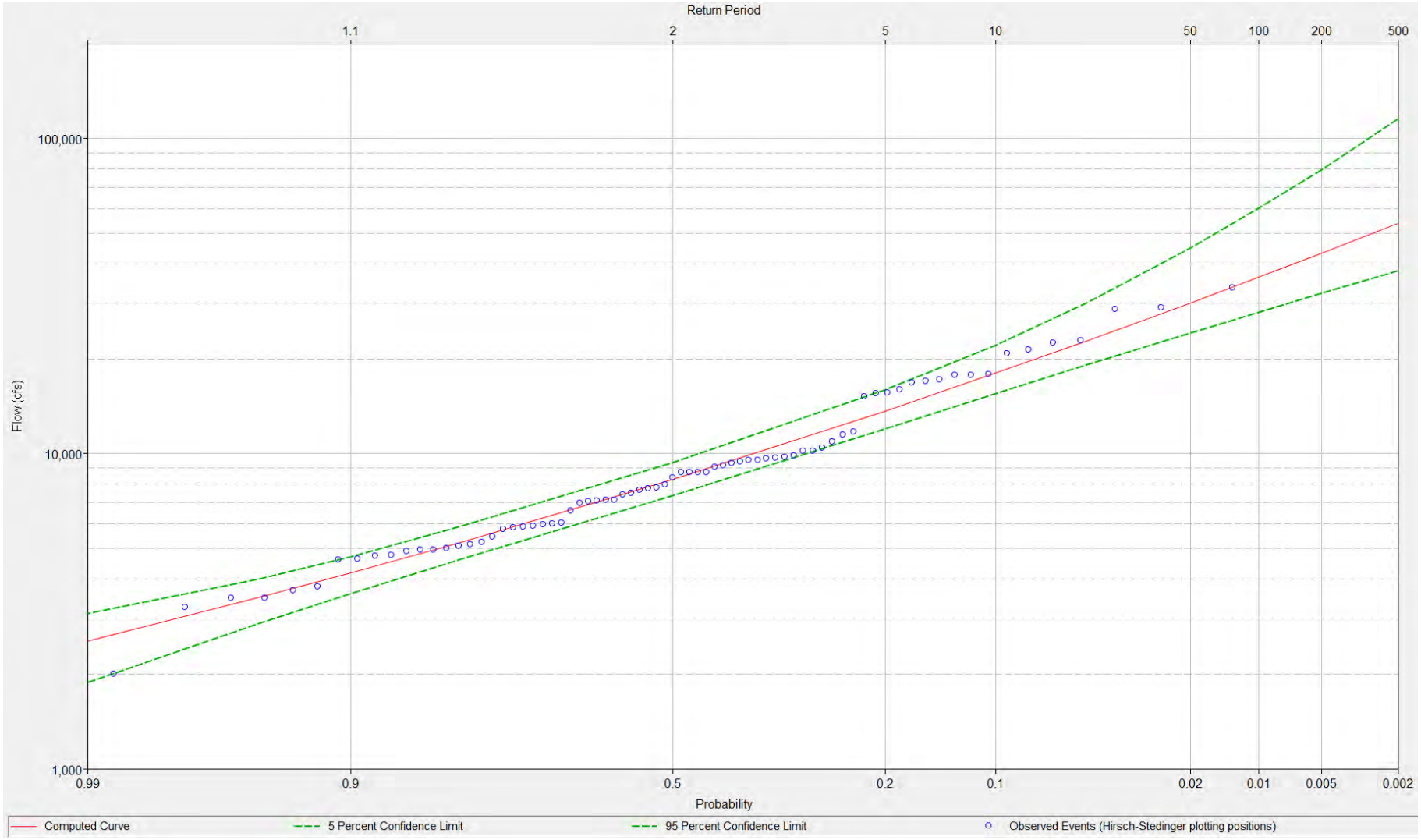


FIGURE 3-2. FLOOD FREQUENCY CURVE FOR USGS GAGE 1481500 WITH THE EXPECTED CURVE SHOWN IN RED, THE 95% AND 5% CONFIDENCE LIMITS SHOWN IN GREEN, AND THE OBSERVED EVENTS SHOWN BY BLUE POINTS.

The total river flows in the Brandywine River informed the design flows, per established guidance from the regulatory agencies, which have a recommendation that at least 10% of the flow be used for attraction water (Turek et al., 2016). However, given that a full-width fishway is proposed, all flow going over Dam 2 will become attraction water. Figure 3- provides two photographs of low (left) and moderate (right) design flows under which the fishway will need to function.

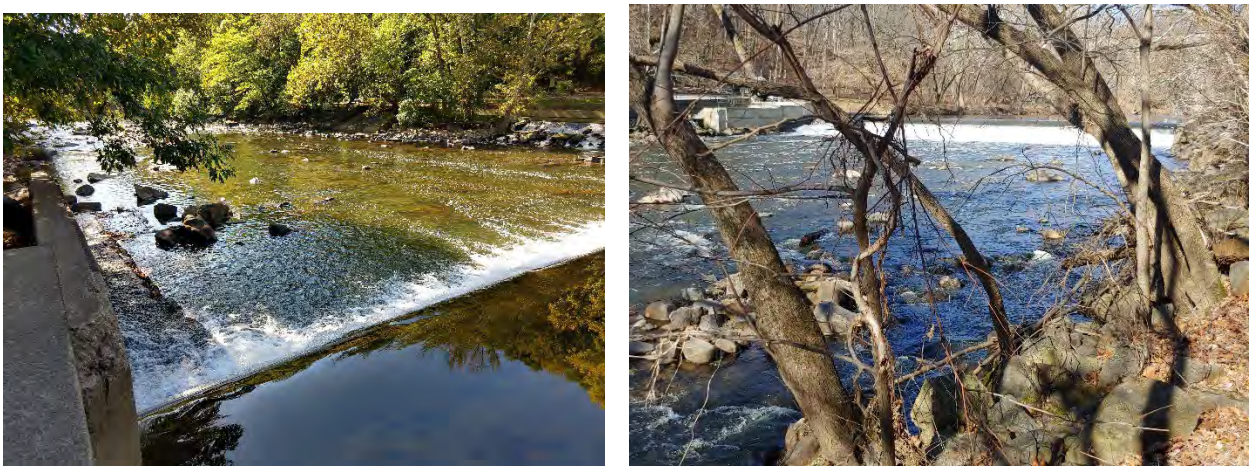


FIGURE 3-3. LOW FLOW OF 155 CFS (LEFT PHOTO) AND MODERATE FLOW OF 380 CFS (RIGHT PHOTO) AT DAM 2

According to the New Castle County, DE, Flood Insurance Report (FIS) and the Flood Insurance Rate Map (FIRM) for the project location, the Brandywine Dam 2 falls within the regulatory floodway of a FEMA mapped Special Flood Hazard Area (SFHA) (Figure 3-4). FEMA guidelines dictate that any project with construction within the regulatory floodway must be able to show no rise in 1% annual chance exceedance water surface elevations would be caused by the modifications within the floodway or complete a Letter of Map Revision (LOMR) analysis that revises the current map with changes to the floodway and Base Flood Elevation (BFE) caused by the project. The impact of this fishway on the floodway will be evaluated as part of further design and a LOMR will be prepared, if required by the final design condition.

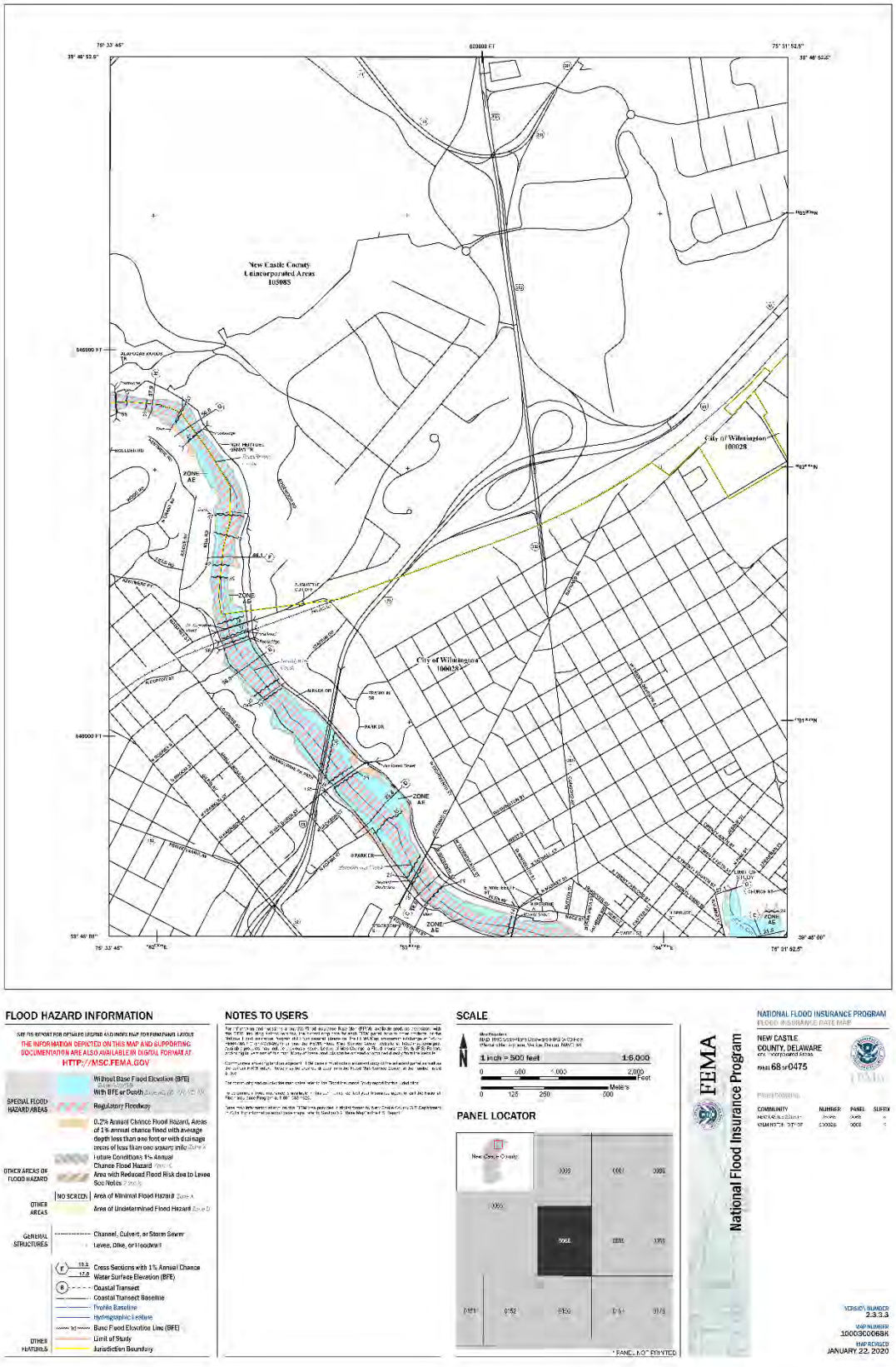


FIGURE 3-4. FEMA FIRM NO. 1003C0068K

3.3 SOILS AND GEOTECHNICAL INFORMATION

Soils in the vicinity of the NLF consist primarily of the Delanco-Codorus-Hatboro complex soils formed in alluvium washed from areas of micaceous crystalline rocks, as are common on stream floodplains in this area (USDA 2021). The complex typically consists of silt loam transitioning to loamy sand/sandy clay loam and gravelly loamy sand or clay at depth before encountering bedrock at 60 to 118 inches of depth (USDA 2021).

To date, no current geotechnical information is available for this project site, but bedrock is often found near the channel bed elevation, as evident based on bedrock outcroppings at Dams 4 and 5 upstream, as well as at the former location of Dam 1 downstream. This is supported by the fact that review of the survey data indicates that no scour holes have developed downstream of Dam 2, as is common for run of river dams. Based on this qualitative information, Kleinschmidt assumed that the substrate is competent rock that can provide a sound base for any fill placement without any settling or significant excavation of poor material. In the areas where boulders are needed to be placed at or below existing grade, additional pre-construction geotechnical investigations are recommended to confirm the substrate conditions in suspect areas, which will ensure the stability of the proposed fishway. The design will be completed assuming no abnormal conditions below the existing grades; if unsuitable conditions are encountered, the design will need to be revised to account for these conditions.

3.4 PERMITTING AND AGENCY COORDINATION

The construction of the nature-like fishway will include several levels of regulatory permitting given the use of the fishway as part of the USACE Final Mitigation Plan submission to offset anticipated impacts at the proposed Wilmington Harbor – Edgemoor Expansion project. It is currently anticipated that the USACE permit for the fishway will be approved as part of the overall Wilmington Harbor – Edgemoor Expansion project, but that an individual permit from State of Delaware (Subaqueous Lands permit) will be required. The City of Wilmington regulatory approval will also be required, which is anticipated to include a review by the City of Wilmington Design Review and Preservation Commission and a Floodplain permit. It is anticipated that the City approval is likely to include an application with the Federal Emergency

Management Agency associated with the hydraulic modeling results as it relates to the impacts, if any to the regulatory floodway.

Based on Kleinschmidt's 2022 Dam 2 wetland delineation report, there is a small wetland located approximately 150 feet upstream of Dam 2 on the left/north bank. This wetland is located well outside the proposed limit of disturbance, so impacts to wetlands are anticipated for this project. Additionally, an intermittent stream was delineated downstream of the project area. There will be fill in the Brandywine River below the ordinary high-water line (OHWL, as located in the Kleinschmidt 2022 wetland delineation report included as Appendix B), by nature of creation of the NLF, with anticipated permitted fill volumes and areas below OHWL shown in the permit drawings (Appendix A).

A Phase II Architectural Report and Phase 1B Archaeological Report are being finalized at the time of this report, but Kleinschmidt understands that Dam 2 is eligible for inclusion on the National Register of Historic Places as an individual resource and there are some areas of high archaeological potential within the Dam 2 limit of disturbance. Consultation with Delaware Historic & Cultural Affairs (DHCA) is on-going, and Kleinschmidt anticipates resolving any required mitigation required to offset any adverse effects that are identified through that consultation process. Additional consultation and/or permits may be required and will be further evaluated as the design of the NLF is finalized.

4.0 HYDRAULIC MODELING

A critical design factor will be providing adequate water depth, velocity, and resting habitat for the target species, as well as ensuring the stability of the NLF during flood conditions. It will be important to provide fish passage across a range of flows during the fish passage season, to maximize the opportunities for fish to pass over Dam 2.

Hydraulic analysis of the proposed design will be performed using the USACE HEC-RAS v 6.1 software. The software was used to develop a 2-dimensional (2D) model of the fishway and Brandywine River upstream of the project. The model geometry was developed within the HEC-RAS software's internal geographical information system (GIS) RAS Mapper. Processing of the terrain data used in analyses was completed using ESRI's ArcGIS Pro and AutoCAD Civil3D.

The purpose of the model is to provide more accurate estimates of local velocities and depths in different regions of the proposed fishway than could be provided using a 1-dimensional (1D) model. While the model provides detailed results of the hydraulic characteristics within the fishway, it only provides depth-averaged values and does not provide velocity changes with depth.

The existing condition model simulations will be calibrated to field observations collected over a range of flows representing the fishway design flow range. The field observations will also be used to determine the downstream rating curve used for the proposed condition model simulations.

4.1 MODEL DOMAIN AND COMPUTATIONAL MESH

The model domain is defined by a 2D mesh that extends from approximately 480 feet upstream of Dam 2 in the Brandywine River to approximately 590 feet downstream of Dam 2 (Figure 4-1). The mesh includes the floodplain area outside of the river to allow for the simulation of the 100-year flood, which overtops the banks of the river and is anticipated to be constrained by the elevated roadways on either side of the river. The sizes of the cells in the 2D mesh of the final hydraulic model are anticipated to vary from 60 feet by 60 feet in overbank areas down to 1 foot by 1 foot on the tops of the weirs in the proposed NLF (Figure 4-1). Figure 4-1 shows the existing condition terrain and cells. Dam 2 was included in the model terrain and was represented

in the model by aligning the 2D mesh cell faces along the crest of the dam. The rock weirs below Dam 2 will not be modeled as individual boulders because the boulders are generally all abutting except at the notches; the crest elevations for abutting boulders will be set to reflect the design top of the boulders. Kleinschmidt recognizes that some small gaps may exist between boulders, and that the very top of the boulder may also stick above this elevation because the boulders will not be "smooth" or "flat" topped. Small gaps between boulders and foundation fill under the boulders are anticipated to fill over time from the normal sediment load being transported downriver and are not expected to pass substantial amounts of flow, especially give the inclusion of either a coir fiber or geotextile layer in the foundation fill to restrict flow through and beneath the weirs. The City water intake structure itself will be modeled as a structural weir in the 2D mesh using a 2D area connection whose crest elevation is defined with station elevation data along the centerline of the structure. Flow moving over this structure is more accurately represented using the standard weir equation rather than the normal 2D equations. Therefore, the structure will be modeled as a weir and assigned a weir coefficient representative of that type of weir structure. The City water intake canal will be modeled with 2D mesh elements to capture the distribution of flow. Understanding how flow is distributed between the proposed NLF, the City water intake, and the combined sewer overflow is important to ensure the proposed design will not impact the existing utility operations.

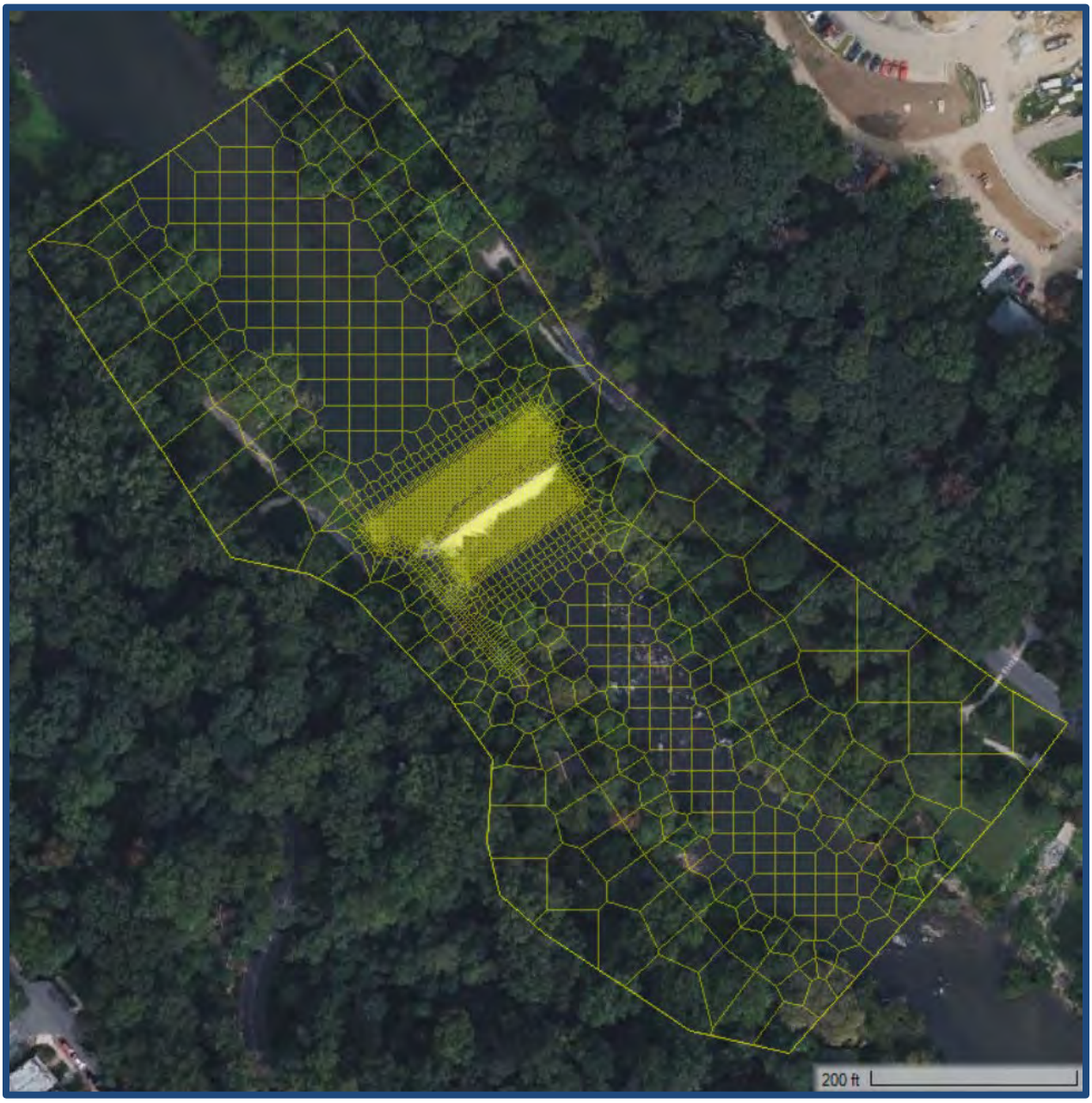


FIGURE 4-1. HEC-RAS MODEL DOMAIN AND EXISTING CONDITION MODEL MESH.

4.2 MODEL CALIBRATION AND MANNING'S ROUGHNESS COEFFICIENTS

Water Surface Elevation (WSE) information will be collected at three designated locations in the model domain (one upstream of the dam and two downstream) during a range of flows representing the fishway design flow range, with data collected at 1-hour intervals. Discharge data will also be collected upstream of the dam and City water intake structure (at the USGS gage) in 15-minute intervals and paired with withdrawal records obtained from the City of

Wilmington to aid in the calibration effort. The discharge, withdrawal, and WSE information will be used to calibrate the Manning's "n" values used to represent the channel roughness under normal flow conditions. The combination of calibrated "n" values and the measured downstream bed slope will be used to approximate the downstream normal depth rating curve for the fish passage modeling.

The calibrated "n" values will then be used in conjunction with relative roughness relationships derived by Limernios (1970) to estimate the expected roughness under a bankfull flood condition. The calculated flood condition roughness values will then be used to develop a flood condition rating curve that will be used for the modeling the predicted floods in the 2D model. These roughness values will also be compared against the "n" values used for the FEMA FIS, and if necessary, the FIS values will be updated as a part of the CLOMR FEMA modeling completed at a later stage of work (See Section 3.2.2).

Manning's roughness coefficients for the overbanks will be selected by examining aerial imagery for the model domain, generally using the National Land Cover Database (NLCD) (Multi-Resolution Land Characteristics Consortium 2011) land use classifications areas as a guide, and finally assigning roughness values corresponding to the land use types. It is anticipated that the NLCD land use layer will need to be adjusted spatially using areal imagery to more accurately capture the roughness elements at the desired scale due to the large resolution of the data base. Initial examination of the model domain showed that it contains several of the different land use types listed in Table 4-1, which also provides the assumed Manning's roughness that is anticipated to be utilized for each land cover type.

TABLE 4-1 LAND USE TYPES AND MANNING'S ROUGHNESS

Land Use Type	Manning's Roughness, n	Reference
Concrete	0.015	Chow 1959
Developed, Open Space	0.04	Mattocks & Forbes 2008; Zhang et al. 2013
Mixed Forest	0.10	Chow 1959
Large Structure	10.0	-
Open Water	0.035	Chow 1959
Riprap	0.045	Chow 1959

The area of the proposed NLF will be modeled using a Manning's n value equal to approximately 0.045 at the design flows to represent the roughness from the boulder weirs; however, this may be changed once final riprap gradations are determined. This aligns well with Chow's (1959) guidance for steep mountain streams with a bottom of cobbles with large boulders. Additional energy loss will be accounted for by using an Eddy Viscosity Mixing Coefficients for each simulation (Section 5.3).

A sensitivity analysis of the NLF Manning's n in the NLF will be completed using a Manning's "n" of approximately 20% less than the anticipated Mannings "n" for the 95% and 5% exceedance flows. The results of this analysis will be summarized and discussed with the BNTS relative to the velocity in the zones of passage, along with corresponding changes in depth.

4.3 MODEL COMPUTATION METHOD AND TIMESTEP

HEC-RAS can use two different computational equation sets for 2D modeling: the Diffusion Wave approximation (DW) and the Full Momentum set of equations (SWE). All simulations will utilize the Full Momentum solution method, which solves the Full Saint Venant equations (also known as the shallow water equations). The Full Momentum method is recommended for conditions that have abrupt contractions and expansions, which occurs in a NLF, and when detailed velocity and water surface elevation data at structures is needed (USACE 2016). It is assumed that a timestep equal to 0.10 second will be used for all simulations. Such a small timestep will likely be required in order to stabilize a 2D model with small cells (1-foot nominal cell sizes over the weirs)

Turbulence in HEC-RAS is modeled as a gradient diffusion process, controlled by the eddy viscosity mixing coefficient. This coefficient controls the transfer of momentum occurring as flow contracts and expands around the weirs and notches in the fishway (USACE 2016). It is assumed that the model will use 0.6, 0.6, and 0.2 for the 95%, 50%, and 5% exceedance flows, respectively. The HEC-RAS User's Manual recommends values of 0.3 to 0.77 for situations with moderate transversal mixing (gentle meanders and moderate surface irregularities) and 2.0 to 5 for situations with strong transversal mixing (strong meanders and rough surface). The eddy viscosity mixing coefficient allows for turbulence due to contractions and expansions to be captured by the model. This model is anticipated to use the values for moderate transversal

mixing instead of the strong transversal mixing values; thus, the model estimate will likely be conservative, and it is our opinion that the pools (and not the eddies) are the primary energy dissipater in the NLF. The eddy viscosity mixing coefficient is an optional parameter that is not required when running a 2D model (the default value is zero), and the numerical solution scheme in HEC-RAS provides some numerical diffusion (USACE 2021).

4.4 BOUNDARY CONDITIONS

The model will include one upstream boundary conditions to simulate the inflow from Brandywine River. For each simulation, the upstream boundary will be set as a constant inflow hydrograph based on the assumed flow condition at the Dam 2. Using a constant flow condition in a 2D model is known as a quasi-steady state solution. The model calibration simulation will use a dynamic flow hydrograph which matched the observed flow data over the observation period. The boundaries extended along the width of Brandywine River and up to the roadway embankment on either side of the river. Model results will be reviewed at specified observation cross sections, one upstream and one downstream of Dam 2, to ensure that the model solution reached computational equilibrium. The calibration model simulations will utilize warm up time in order to match the initial water surface elevations in the model to the water surface elevations from the observed data. The different flow conditions during the fish passage period at Dam 2 that will be analyzed using the hydraulic model are summarized in Table 4-2.

TABLE 4-2 BRANDYWINE NLF HYDRAULIC MODEL FLOW CONDITIONS

Flow Condition	Flow (cfs)
Low-Flow Design Flow: 95% Exceedance Design Flow	136
Average Design Flow: 50% Exceedance Design Flow	441
High-Flow Design Flow: 5% Exceedance Design Flow	1,326
100-Year Flow	36,500

For all flow conditions analyzed, the downstream boundary condition will be specified as a stage-discharge rating curve as described in Section 4.2.

4.5 MODEL RESULTS FOR FISH PASSAGE

The model will be used to compute hydraulic parameters for the range of design flows. This will include resulting velocities, water depths, and Froude numbers across the NLF, which can be used to determine if the expected hydraulic conditions align with the required design criteria. In a 1D HEC-RAS model, the modeler has the option to turn on "Mixed Flow Regime" when completing an unsteady flow analysis if it is expected that the flow regime may transition between subcritical and supercritical flow. However, there is no Mixed Flow Regime option for 2D computations, since the 2D solution computations automatically handle transitions from one flow regime to the other without needing an option turned on. The 2D results cannot be limited to subcritical or supercritical flow only. The resulting water surface, water depth, and velocity measurements will be obtained for a profile cut along the three zones of passage, as well as plan view figures showing velocity vectors through the fishway. These results will be discussed with the BNTS to determine if any NLF geometry modifications will be required.

It is anticipated that in order to achieve passage, some fish will need to swim near the shoreline to avoid zones of higher velocity that are anticipated to develop in the aligned notches, but there is anticipated to be a zone of passage (adequate depth and acceptable velocity) for each species at each of the flows. The ZOPs are generally a 5-ft-wide gap in the boulders established to meet the design criteria for notch widths. This area will only have foundation stone fill and a footer boulder up to the design grade and will not have boulders protruding up into the ZOP.

Under the median and low flows, the depth directly over Dam 2 may not be adequate for target species to pass upstream (although the velocities may be suitable); therefore, target species may have to swim through the zone of passage notches in Dam 2 to pass upstream where the depth and velocity meet the design criteria (Table 4-2). At the 5% exceedance flow, Kleinschmidt anticipates that River Herring and American Shad can swim directly over Dam 2, as the depth and velocity are anticipated to fall within the recommended design criteria, although portions of the notches and the dam may not be passable for River Herring at this flow.

Based on Kleinschmidt's experience with nature-like fishways, the velocity dynamics will likely change across the spectrum of the flows, and the features are designed to promote suitable velocities across this entire flow range. Based on the results of hydraulic modeling at other fishways, and as will be confirmed with the Dam 2 NLF hydraulic model, Kleinschmidt

anticipates that this design will generally meet the velocity criteria for the River Herring (the controlling design species for velocity). Edge velocities in the fishway are anticipated to be lower due to micro-eddies resulting from substrate roughness and will provide additional low velocity zones of passage.

The design provides multiple routes for the fish to travel, including the thalweg where velocities are higher and the zones of passage on the outer edges of the weirs, where the velocities are lower. This distribution of velocities across the fishway is anticipated to provide suitable passage conditions for the target species across all design flows. The fishway is also anticipated to provide reasonable passage non-target species as well; however, the weaker non-target species may need to delay passage or utilize pockets of slower water along the fishway to work their way upstream over the fringes of the NLF during the highest flows.

4.6 MODEL RESULTS FOR MATERIAL SIZING

Based on the proposed model runs, the performance of the fishway against the design guidelines will be summarized in a table in a later version of this report. The results of that hydraulic analysis will be used to size the materials for the weir boulders and foundation stone to withstand the anticipated hydraulic conditions as described in Section 5. Although flood flow conditions create substantial depth over the fishway, the velocities and water surface (energy) slope may drop as the flood flow spreads into the floodplain. Thus, the controlling velocities will be evaluated to determine if the fish passage season or flood flows result in the highest velocities and shear stresses in the NLF.

5.0 NATURE-LIKE FISHWAY DESIGN

The NLF design (permit drawings located in Appendix A) was primarily based on the design criteria in this report (Section 2), as well as the Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes (Turek et al., 2016) and the Fish Passage Engineering Design Criteria (USFWS, 2019), collectively "Guidelines," as well as taking into consideration lessons learned from previous nature-like fishway designs.

5.1 ROCK WEIR DESIGN DETAILS

The first step in the design process was to identify what style of NLF would be used for the site. There are two primary types of NLFs: rock weir fishways and roughened channel fishways. Rock weir fishways (also known as rock-arch fishways) use a series of arch-shaped boulder weirs (weirs) across the river channel to create a natural pool and weir configuration. Roughened channel fishways use an unsymmetrical array of boulders across the surface of the NLF to slow the flow of water down the ramp and create velocity shelters for fish. Rock weir fishways are the focus of the design criteria in the Guidelines. Rock weirs are more effective than roughened channels at dissipating the energy of the flow passing through and therefore, can generally be designed and built with steeper slopes and smaller footprints than roughened channel fishways. To minimize the footprint of the fishway within the river channel and reduce how far the fishway extends downstream, the rock weir style of fishway was selected for Dam 2.

5.1.1 ROCK WEIR DIMENSIONS

The design of the fishway includes thirteen rock weirs below Dam 2, (spaced approximately 20-25 feet apart) with boulders embedded in each weir to form fourteen pools with approximately 0.65 foot of drop between each pool water surface elevation. This design meets the Minnesota Department of Natural Resources (MNDNR) recommendation of "less than 0.8 foot of head loss" per weir (Aadland, 2010), although if the hydraulic modeling shows excessive velocities, this drop may need to be reduced. The resulting step-pool configuration has an overall structure slope of approximately 2.8%, which is less than the maximum recommended slope of 3.33% in the Guidelines for American shad and river herring.

The weirs have a center zone of passage (ZOP) notch that is flat and 5-ft-wide to provide adequate notch depth (2.25 feet minimum) at the low-flow design flow. The center ZOP is located in a flat thalweg that is approximately 40-feet wide and is flat to minimize flood impacts. The arms of the weirs slope up at 0.4 feet per 100 feet from the thalweg until they meet the riverbank or concrete structures along the riverbank, in accordance with guidance from the MNDNR (Aadland, 2010). This design forces flow into the center of the river during low flow events as well as directs scouring energy away from the riverbanks. The Dam 2 configuration (a straight weir) *cannot* be modified to accommodate the arched design that is typical of the most upstream weir on most fishways.

The weirs consist of a foundation of smaller stone (cobble to boulders) that has a 10-ft-wide crest, 2:1 side slopes, and non-woven geotextile or coir fiber mat in the core of the weir to provide stability under the range of flow conditions. The crest will have 4-ton (minimum, approximately 4'x4'x4') boulders embedded at least 40% in the foundation stone and placed to minimize space between boulders. To facilitate fish passage, there are three defined zones of passage (one at the thalweg and one at the north and south sections of the weir arms) that have at least 5 feet between boulders on each weir to meet the recommendations for the target species from the Guidelines. The width of the weir is selected to provide additional stability in each weir given the relatively shallow depth of each weir and the anticipated shallow depth to bedrock in the existing riverbed that may result in mobilization of stone on the riverbed more quickly than a gravel-bed system. Additionally, this width provides support for the footer boulders that will be placed below the weir boulders in the weir. These footer boulders are critical to preventing failure of the weir boulders (Mooney et al., 2007).

At the time of the bathymetric survey, no scour hole was found downstream of the dam and anticipated slopes are similar to the existing riffle in the NLF footprint; therefore, no substantial scour is anticipated in this area, as this area is assumed to have an erosion resistant stream bed. If this is not found to be the case during construction, this area should be armored to prevent scouring, while limiting any impacts to any ZOPs.

5.1.2 POOL SIZING

The pools between each weir were based on the recommendations in the Guidelines for the target species, including a minimum depth of 4 feet, a minimum width of 20 feet, and a minimum length of 30 feet. The 30-foot pool length could not be maintained due to anticipated flooding impacts, the steep grade in the Brandywine River near the end of the proposed fishway, and the civil infrastructure surrounding this fishway. The USFWS provided input on the pool length and a lower pool length of 20-25 feet was found to be acceptable, as long as the modeled velocities and depths are suitable for passage of the target species. Hydraulic modeling will be used to confirm that under the low-flow design flow, the pools will generally be at least 4 feet deep and more than 20 feet wide, thereby meeting the recommendations from the Guidelines.

Additionally, the USFWS design criteria document (USFWS, 2019) has guidance for pool volumes to accommodate the peak minute run size of each target species. Given the relatively small run sizes on the Brandywine River, those minimum pool volumes are 1,317 cubic feet (ft^3) and 823 ft^3 for an American shad peak hour run size of 599 fish and a River Herring peak hour run size of 2,993 fish, respectively, utilizing a 10% non-target species and 0.50 ft^3/lb of fish. These design criteria are anticipated to be met by the proposed design.

Additionally, for sizing pools in fishways, the USFWS design criteria document (USFWS, 2019) has recommended energy dissipation factor (EDF) values to ensure that turbulence within fishway pools is kept to an acceptable level, thus promoting successful fish passage. The recommended maximum EDF values for American Shad is 3.15 ft-lb/s/ft^3. The NLF flow regime changes as flows increase at the site, with downstream weirs being drowned out and at the 5% exceedance flows the fishway behaves more like a continuous run than individual step pools where EDF is typically calculated. For the low-flow design flow, model results will be reviewed to indicate if the proposed design meets the EDF guidelines for American Shad. However, under the high-flow design flow, it is anticipated that there will be no defined pools and the weir will be fully passable as a continuous run.

5.1.3 FISHWAY BOULDER AND FOUNDATION MATERIAL SIZING

There is general guidance from Aadland (2010) that suggests 3-foot to 6-ft boulders be used for the boulders on top of the rock foundation in each weir, but the Guidelines did not have substantial guidance on sizing of these boulders beyond the USFWS (2019) Rock Weir Hydraulics Reference Plate 10-1. Based on experience, Kleinschmidt will utilize a force-balance equation that accounts for lift, drag, buoyancy, and particle weight to confirm the selected size of the boulders once the hydraulic modeling is finalized.

For the foundation stone in the arches, the USACE Unit discharge (USACE, 1991) and tractive force method (Newbury and Gaboury, 1993) will be used, per the guidance from the MNDNDR (Aadland, 2010) to confirm the selected size of the boulders once the hydraulic modeling is finalized. Additionally, the USACE steep slope riprap method (USACE, 1991) will be used as a third method. The stability of the structure is increased with more stones near the D_{50} stone size, so care should be taken to minimize the inclusion of small stone and the use of smaller gravel to "seal" the voids in the foundation stone to the extent practically feasible.

As noted in the design criteria, the fishway will be designed to resist major structural failures during a reasonably anticipated 100-year return period flood event. While we will use the 100-year return period hydraulic criterion when performing the stone sizing calculations listed above, there are other factors such as debris and ice, that cannot easily be quantified, yet can impact the stability of individual stones. Therefore, Kleinschmidt cannot guarantee that all stones will remain precisely in the location they are placed throughout the lifetime of the fishway. However, we anticipate that the fishway, as designed, will resist major structural failures based on technical guidance documents and observations of other similar fishways.

To increase flow over the weirs and minimize flow through the foundation fill, Kleinschmidt recommends placing a non-woven geotextile liner or coir fiber mat in the core of the weir. Although limited flow through the rock weirs is anticipated, the addition of a geotextile liner or coir fiber mat is anticipated to help reduce this leakage. Therefore, the flow over the weirs in the model will not be reduced to account for this leakage. Additionally, with time, the amount of leaking through the weirs will decrease as the porosity is reduced by settling of sediments (sand, silt, organic material) on the face of the weir.

5.1.4 CONTROL STRUCTURES

In accordance with the design criteria described above, the existing crest of the Brandywine Dam 2 needs to be modified to provide acceptable fish passage over the dam. As part the construction for this fishway, three ZOP notches are proposed in Dam 2 and the former dam just upstream of Dam 2, with each notch being approximately 6 feet wide and 2.5 feet deep. These notches will have constant elevations along the bottom of the ZOP, which may require some substrate removal above the dam. The ZOP notches are anticipated to be installed by over-demolishing the concrete and fill of the dam as necessary to install the stop log slots (Dam 2) and reinforcement of the sides of the notch. The exact methods for reinforcement and confirmation of dimensions will be part of further design.

5.1.5 TEMPORARY STRUCTURES

Several temporary structures will be necessary to support this Project, potentially including an upstream and downstream cofferdam, erosion and sediment controls, access roads, access bridge, staging area, and potentially a channel partition to direct higher river flows around the project site. The Contractor will be responsible to design these features, but the general cofferdam approach and layout is shown in the NLF Permit Drawings (Appendix A).

5.2 WATER MANAGEMENT DURING CONSTRUCTION

It is anticipated that the Contractor will install temporary cofferdams to isolate the southern and then the northern sections of the proposed NLF, in order to work mostly in the dry, with flow bypassed around the active work area in the non-active portion of the NLF footprint. Temporary access roads, potentially including large culverts, may be required to access the south half of the NLF during construction. The approach for management of low and moderate flows to be reasonably anticipated during construction will be developed as the design of the NLF is finalized. Final cofferdam locations, cofferdam design, water management plan development, and recommended safe work conditions under various discharge scenarios will be developed by the selected Contractor.

This water management plan will need to be evaluated in accordance with the City's water withdrawal operations so that the existing infrastructure can be used to maintain adequate water intake and minimize any disruption. The selected Contractor should plan to prepare a dewatering plan that describes in detail the water management sequence for DSPC's review and approval. The exact flow management will need to be worked out as part of final design and based on flow conditions at the time of construction, but the conceptual water management sequence is included in the Construction Sequence below.

5.3 PRELIMINARY CONSTRUCTION SEQUENCE

The construction sequence is anticipated to progress as indicated below but may be modified by the Contractor and updated as the design of the NLF is finalized. Kleinschmidt has assumed that construction will occur during periods of low flow, which can be adequately managed by the proposed temporary cofferdams. The low flow could be during the late summer or fall months (e.g., mid-August through early November) when typical lower flow conditions prevail along this river reach.

Preliminary Proposed Construction Sequence

1. Layout site and establish staging areas.
2. Mobilize equipment and materials to project site.
3. Construct temporary access road(s) into the river by installing temporary fill to access river channel.
4. Install upstream (at/above dam) and downstream cofferdams to divert river flow into the northern half of the NLF footprint. Manage headpond elevations per water management agreement with the City and DSPC.
5. Construct rock weirs from upstream to downstream (working on the southern half of the NLF first, then moving cofferdams to isolate the northern half of the NLF footprint while building the northern portion of the NLF):
    a. Install Zone of Passage notch(es) in Dam 2 and older dam just upstream;
    b. place foundation fill stone to base elevation for boulders (excavate soft soils if present), including geotextile or coir fiber matting for reducing flow-through;
    c. set footer boulder (as required);

d. set weir boulder at proposed grade, ensuring geotextile/ coir faber matting and face boulder are in place; and

e. place foundation stone to design elevation.

6. Remove upstream and downstream cofferdams while managing headpond elevations per water management agreement with the City and DSPC.

7. Remove remaining temporary structures, equipment, and materials from the project site.

8. Perform final site grading, revegetation, and stabilize staging area (as required).

9. Perform post-construction as-built survey and hydraulic verification in accordance with the Brandywine NLF Monitoring Plan for this fishway.

6.0 REFERENCES

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APPENDIX A

BRANDYWINE DAM 2 NLF PERMIT DRAWINGS

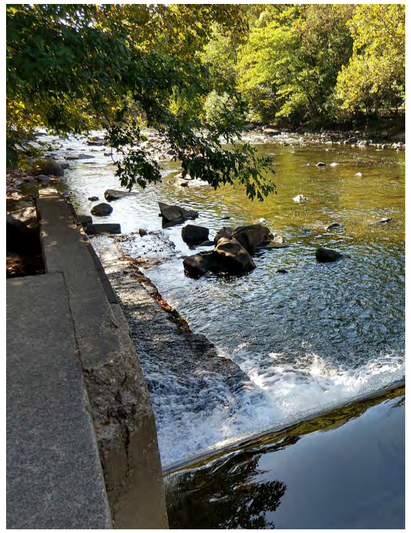
24x36 = FULL SCALE 0 1" 2" 3"

DIAMOND STATE PORT CORPORATION

WILMINGTON, DELAWARE

BRANDYWINE DAM 2: NATURE-LIKE FISHWAY

PERMIT DRAWING SET



DRAWING LIST				
SHEET NO.	SHEET DESCRIPTION	DATE	REVISION	STATUS
000-00	COVERSHEET	03-07-22		PERMIT SUBMISSION
100-01	GENERAL NOTES	03-07-22		PERMIT SUBMISSION
200-01	EXISTING CONDITIONS PLAN WITH AERIAL	03-07-22		PERMIT SUBMISSION
400-01	PROPOSED CONDITIONS PLAN WITH AERIAL	03-07-22		PERMIT SUBMISSION
400-02	PROPOSED CONDITIONS PLAN	03-07-22		PERMIT SUBMISSION
400-03	PROPOSED CONDITIONS PROFILE	03-07-22		PERMIT SUBMISSION
400-04	PROPOSED WEIR DETAILS	03-07-22		PERMIT SUBMISSION
900-01	PERMIT IMPACTS	03-07-22		PERMIT SUBMISSION

FOR PERMITTING
NOT FOR CONSTRUCTION

DIAMOND STATE PORT CORPORATION
WILMINGTON, DE (NEW CASTLE COUNTY)

WILMINGTON HARBOR-EDGEMOOR EXPANSION
BRANDYWINE DAM 2 NATURE-LIKE FISHWAY

COVERSHEET

No.	Revision	Date	Drawn	Checked

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
GSM	RL	TAK	5023001	03-07-22	000-00

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24x36 = FULL SCALE

GENERAL NOTES

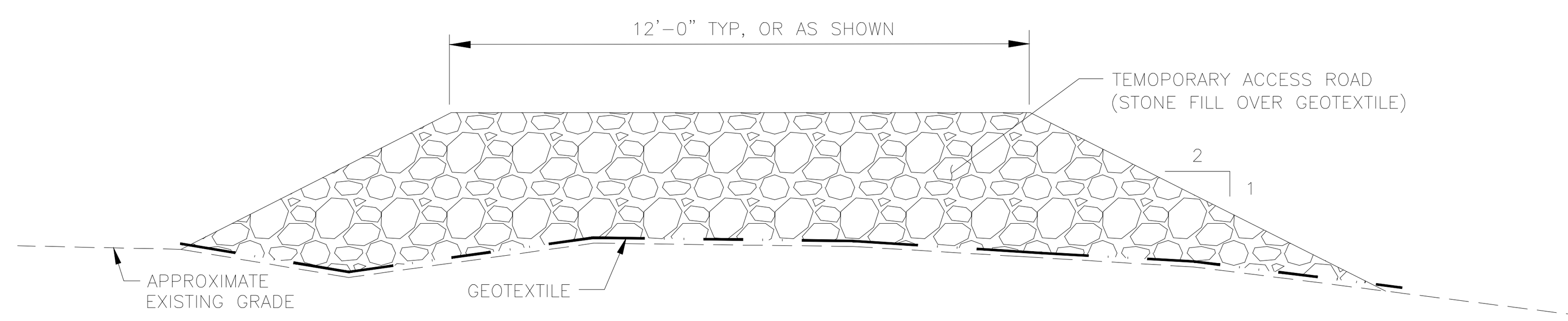
1. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REVIEW ALL OF THE DRAWINGS, SPECIFICATIONS, AND REFERENCED DOCUMENTS ASSOCIATED WITH THE PROJECT WORK SCOPE PRIOR TO THE INITIATION OF CONSTRUCTION. SHOULD THE CONTRACTOR FIND A CONFLICT WITH THE DOCUMENTS RELATIVE TO THE SPECIFICATIONS OR APPLICABLE CODES, IT IS THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE PROJECT ENGINEER OF RECORD IN WRITING PRIOR TO THE START OF CONSTRUCTION. FAILURE BY THE CONTRACTOR TO NOTIFY THE PROJECT ENGINEER SHALL CONSTITUTE ACCEPTANCE OF FULL RESPONSIBILITY BY THE CONTRACTOR TO COMPLETE THE SCOPE OF WORK AS DEFINED BY THE DRAWINGS AND IN FULL COMPLIANCE WITH NATIONAL, STATE, AND LOCAL REGULATIONS AND CODES.
2. SEE PROJECT TECHNICAL SPECIFICATIONS, TO BE DEVELOPED DURING FINAL DESIGN, FOR COMPLETE DETAILS.
3. SURVEY DATA, COLLECTED BY S.T. HUDSON ENGINEERS, INC., WAS PROVIDE BY VERDANTAS IN FEBRUARY 2022. KLEINSCHMIDT UTILIZED ADDITIONAL SURVEY DATA FROM ASH ASSOCIATES, COLLECTED IN 2010, AS WELL AS KLEINSCHMIDT'S FIELD OBSERVATIONS TO DEVELOP THE EXISTING CONDITIONS PLAN. THE TOPOGRAPHIC AND BATHYMETRIC SURVEY WAS MAPPED IN THE NAD 83 (2011) DELAWARE STATE PLANE COORDINATE SYSTEM, IN THE NAVD88 VERTICAL DATUM, AND IN UNITED STATES SURVEY FEET.
4. THESE DRAWINGS HAVE BEEN PREPARED BASED ON SURVEY INFORMATION PROVIDED BY OTHERS. THE DESIGN PROFESSIONAL HAS NOT VERIFIED THE ACCURACY AND/OR COMPLETENESS OF THIS INFORMATION AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS THAT MAY BE INCORPORATED AS A RESULT OF ERRONEOUS INFORMATION PROVIDED BY OTHERS. THE CONTRACTOR SHALL VERIFY ALL FIELD CONDITIONS AND REPORT ANY DEVIATIONS FROM THESE DRAWINGS TO THE OWNER PRIOR TO COMMENCING ANY WORK.
5. WETLANDS AND ORDINARY HIGH WATER LINES WERE DELINEATED BY KLEINSCHMIDT ASSOCIATES IN MARCH 2021 AND FEBRUARY 2022.
6. THESE ARE STANDARD NOTES APPLYING TO ALL WORK. SPECIFIC NOTES SHOWN ON OTHER DRAWINGS OR STATED IN THE TECHNICAL SPECIFICATIONS WILL TAKE PRECEDENCE. UNLESS NOTED OTHERWISE, ALL WORK SHALL BE DONE IN ACCORDANCE WITH DELAWARE DEPARTMENT OF TRANSPORTATION (DELDOT) "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", JUNE 2021 EDITION.
7. ALL MATERIALS SHALL BE PROVIDED AND WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE DELAWARE EROSION & SEDIMENT CONTROL HANDBOOK (CURRENT VERSION), UNLESS NOTED OTHERWISE. ALL WORK SHALL BE CONDUCTED PER THE EROSION AND SEDIMENT CONTROL PLAN FOR THIS PROJECT, TO BE DEVELOPED DURING FINAL DESIGN.
8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH ALL PERMITS ISSUED FOR THIS PROJECT AND THE RULES AND REGULATIONS OF THE DNREC.
9. CONTRACTOR SHALL SCHEDULE WORK IN COOPERATION WITH THE OWNER.
10. THE CONTRACTOR SHALL ASSUME ALL RESPONSIBILITY FOR ANY DEVIATION FROM THESE PLANS UNLESS WRITTEN APPROVAL IS OBTAINED FROM THE ENGINEER OR OWNER.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR AND PROVIDE ALL CONSTRUCTION STAKEOUT AND SURVEY WORK. ANY DISCREPANCIES FOUND DURING THE COURSE OF THE SURVEY WORK SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE OWNER/ENGINEER.
12. DETERMINE LOCATIONS, EXISTING CONDITIONS AND DIMENSIONS BY VISITING THE SITE. VERIFY ALL DIMENSIONS IN THE FIELD BEFORE ORDERING OR FABRICATING MATERIAL. WHERE DIMENSIONS ARE NOT SHOWN, CONTACT ENGINEER FOR CLARIFICATION.
13. THE CONTRACTOR WILL BE RESPONSIBLE FOR CONDUCTING UNDERGROUND UTILITY CHECKS, IN ACCORDANCE WITH STATE REGULATIONS. CONTRACTOR WILL BE RESPONSIBLE FOR COORDINATING WITH MISS UTILITY OF DELMARVA (811 OR 1-800-375-7117) A MINIMUM OF THREE FULL WORKING DAYS IN ADVANCE OF ANY DIGGING ACTIVITY. IF UTILITIES ARE ENCOUNTERED OR DETERMINED TO OCCUR IN THE PROJECT WORK AREA, THE CONTRACTOR SHALL REPORT SUCH FINDINGS IMMEDIATELY IN WRITING TO THE ENGINEER.
14. THE LOCATION OF ALL EXISTING UTILITIES ARE APPROXIMATE AND MUST BE CONFIRMED BY THE CONTRACTOR. THE CONTRACTOR SHALL DEFINE AND LOCATE VERTICALLY AND HORIZONTALLY ALL ACTIVE UTILITY SYSTEMS. THE CONTRACTOR IS RESPONSIBLE TO PROTECT AND MAINTAIN ALL ACTIVE SYSTEMS DURING SITE ACTIVITY, UNLESS APPROVED IN WRITING BY THE OWNER.
15. CONTRACTOR SHALL BE RESPONSIBLE FOR HAVING, MAINTAINING, AND SUBMITTING TO THE OWNER ALL REQUIRED DOCUMENTS, INCLUDING, BUT NOT LIMITED TO, A SPILL PREVENTION AND CONTROL PLAN, CONSTRUCTION SCHEDULE, AND SAFETY PLAN.
16. IT IS ANTICIPATED THAT MOST OF THE CONSTRUCTION FOR THE FISHWAY WILL BE DONE BEHIND COFFERDAMS, BUT MAY NOT BE ENTIRELY DRY. IF APPROVED BY THE PERMITTING AGENCIES, WORK MAY BE COMPLETED "IN THE WET". CONTRACTOR SHALL BE RESPONSIBLE FOR WATER CONTROL AND EROSION AND SEDIMENTATION CONTROL BEST MANAGEMENT PRACTICES.
17. THE CONTRACTOR SHALL BE ADVISED THAT THE PROJECT IS LOCATED IN AN AREA PRONE TO FLOODING AND SEVERE WEATHER IS KNOWN TO OCCUR AT THIS LOCATION. THE CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO PROTECT THE PROJECT WHILE UNDER CONSTRUCTION, WHICH MAY INCLUDE SEQUENCING THE PROJECT TO PROTECT TEMPORARY AND PERMANENT STRUCTURES. THIS INCLUDES, BUT IS NOT LIMITED TO, PROTECTION FROM STORMS, FLOODS, CURRENT, WIND, AND RECREATIONAL USERS. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE PROTECTION OF THE PROJECT SITE, TEMPORARY FACILITIES, FALSEWORK, COFFERDAMS, EQUIPMENT, PERSONNEL, WORK, MATERIALS, AND OTHER PROPERTIES, THE PUBLIC, OR INDUSTRY. FALSEWORK (AFTER APPROVAL BY OWNER) SHALL BE REMOVED IF WEATHER IS ANTICIPATED TO THREATEN THE PROJECT, THE RIVER, OR OTHER PROPERTY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MONITOR THE WEATHER AND INFORM THE OWNER OF ANY ANTICIPATED WEATHER THAT MAY COMPROMISE THE PROJECT SITE OR TEMPORARY FACILITIES AS SOON AS THE CONTRACTOR BECOMES AWARE OF SUCH CONDITIONS. ANY MATERIALS CAPABLE OF BEING DISLODGED SHALL BE ADEQUATELY SECURED, IF THREATENED BY INCLEMENT WEATHER.
18. WATER SURFACE ELEVATIONS ARE CALCULATED AVERAGES. THE CONTRACTOR MUST MAKE ALLOWANCES FOR WATER SURFACE ELEVATIONS THAT VARY FROM THOSE SHOWN ON THE DRAWINGS. NO ADDITIONAL PAYMENT WILL BE MADE FOR MORE DIFFICULT ACCESS TO SITE DUE TO CHANGING WATER SURFACE ELEVATIONS. NO ADDITIONAL PAYMENT WILL BE MADE FOR INCREASED POLLUTION PREVENTION, FALSEWORK, OR TEMPORARY FACILITIES REQUIRED DUE TO FLUCTUATIONS IN THE WATER SURFACE ELEVATION. .
19. CONTRACTOR IS RESPONSIBLE TO, REMOVE, AND PROPERLY DISPOSE OF WASTE MATERIAL IN ACCORDANCE WITH ALL TOWN, COUNTY, STATE AND FEDERAL LAWS AND APPLICABLE CODES. CONTRACTOR SHALL PROPERLY REMOVE & DISPOSE OF HAZARDOUS/UNSUITABLE MATERIAL OFF-SITE IN ACCORDANCE WITH ALL APPLICABLE CODES, ORDINANCES & LAWS.
20. CONTRACTOR SHALL REPAIR ANY PORTIONS OF THE SITE THAT ARE DAMAGED DURING CONSTRUCTION AND PERFORM LANDSCAPING AND SITE RESTORATION AS NECESSARY TO LEAVE THE WORK AREA AS CLOSE TO ORIGINAL CONDITION AS POSSIBLE.
21. CONTRACTOR SHALL PROVIDE SECURITY FOR EQUIPMENT AND MATERIALS. THE OWNER SHALL NOT BE RESPONSIBLE FOR THEFT OR VANDALISM OF CONTRACTOR'S PROPERTY.
22. ESTABLISH AND MAINTAIN AREAS FOR TEMPORARY PARKING AND CONTRACTOR EQUIPMENT AND MATERIALS LAYDOWN, WHERE DESIGNATED BY OWNER, TO ACCOMMODATE USE OF CONSTRUCTION PERSONNEL.
23. CONTRACTOR SHALL TAKE CARE TO ASSURE THAT ALL EQUIPMENT IS CLEAN AND FREE FROM INVASIVE PLANT MATERIAL PRIOR TO ACCESSING THE SITE. CONTRACTOR SHALL TAKE CARE NOT TO SPREAD INVASIVE SPECIES WITH EQUIPMENT. ALL EQUIPMENT SHALL BE DECONTAMINATED AFTER HANDLING ANY MATERIAL POTENTIALLY CONTAINING INVASIVE SPECIES PLANT MATERIAL.

WEIR AND FOOTER BOULDER NOTES:

1. STONES SHALL CONSIST OF SOUND, DURABLE ROCK, RESISTANT TO THE ACTION OF AIR AND WATER. EITHER FIELD STONE OR ROUGH, UNHEWN QUARRY STONE MAY BE USED. STONES SHALL BE SUBJECT TO APPROVAL OF ENGINEER PRIOR TO PLACEMENT.
2. WEIR BOULDERS PLACED ON FOUNDATION FILL SHALL HAVE APPROXIMATE DIMENSIONS OF 4'X4'X4' AND A MINIMUM WEIGHT OF APPROXIMATELY 3.5 TONS.
3. WEIR BOULDERS RESTING ON BEDROCK SHALL HAVE APPROXIMATE DIMENSIONS OF 4'X4'X3' AND A MINIMUM WEIGHT OF 3 TONS.
4. FOOTER BOULDERS SHALL HAVE APPROXIMATE DIMENSIONS OF 2.5'X2.5'X4' AND A MINIMUM WEIGHT OF 2 TONS.
5. STONES SHALL BE SEMI-ANGULAR WITH THE USE OF ROUND STONES SUBJECT TO ENGINEER APPROVAL.
6. STONE DENSITY SHALL BE AT LEAST 164 LBS PER CUBIC FOOT.
7. WEIR BOULDERS SHALL BE EMBEDDED INTO FOUNDATION FILL AT A MINIMUM DEPTH OF 40% OF THE BOULDER DIAMETER. IN AREAS WHERE WEIR BOULDERS INTERSECT EXISTING ROCK SUBSTRATE, CONFIRM SELECTED ANCHORING OPTION (FROM OPTIONS IN THIS PLAN SET) WITH THE ENGINEER.

FOUNDATION FILL NOTES:

1. STONES SHALL CONSIST OF SOUND DURABLE ROCK WHICH WILL NOT DESINTEGRATE BY EXPOSURE TO WATER OR WEATHER. EITHER FIELD STONE OR ROUGH, UNHEWN QUARRY STONE MAY BE USED.
2. STONE SIZE SHALL BE MEASURED ON INTERMEDIATE AXIS.
3. FOUNDATION FILL SHALL HAVE THE GRADATION SPECIFIED DURING FINAL DESIGN. FILL SHALL BE INSPECTED AND APPROVED BY ENGINEER PRIOR TO PLACEMENT.
4. ROCK FILL FOR WEIRS AND INTERSTITIAL FILL SHALL BE PLACED IN A MINIMUM OF TWO LIFTS FOR DEPTHS GREATER THAN TWICE THE D50 ROCK SIZE.

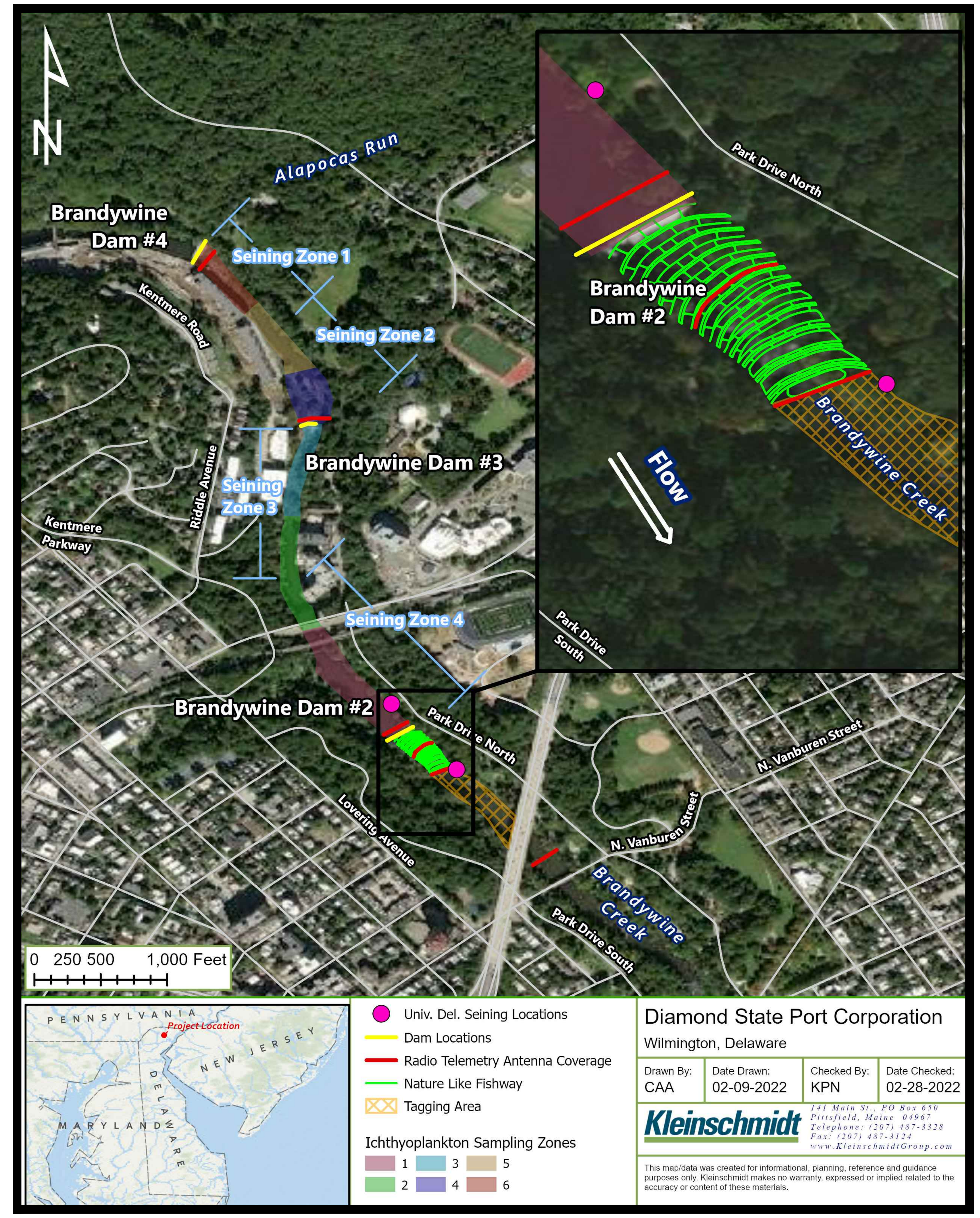


TEMPORARY ROAD DETAIL

N.T.S.

NOTES

1. TEMPORARY ROAD DETAIL APPLIES TO AREAS BELOW ORDINARY HIGH WATER LINE; AREAS IN UPLAND SHALL BE GRAVELED AS NEEDED TO PROVIDE A FIRM, SUITEABLE DRIVING SURFACE.
2. STONE FILL AND GEOTEXTILE SHALL BE REMOVED PRIOR TO PROJECT COMPLETION.



PROPOSED POST-CONSTRUCTION MONITORING LOCATIONS

NOTES

1. SEE BIOLOGICAL MONITORING PLAN FOR THE PROPOSED BRANDYWINE DAM 2 NATURE-LIKE FISHWAY (MARCH 2022), INCLUDED AS PART OF THE EDGEMOOR PROJECT FINAL MITIGATION PLAN FOR DETAILS OF PROPOSED MONITORING.

FOR PERMITTING
NOT FOR CONSTRUCTION

DIAMOND STATE PORT CORPORATION
WILMINGTON, DE (NEW CASTLE COUNTY)

WILMINGTON HARBOR-EDGEMOOR EXPANSION
BRANDYWINE DAM 2 NATURE-LIKE FISHWAY

GENERAL NOTES

No.	Revision	Date	Drawn	Checked
-	-	-	-	-

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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
GSM	GSM	TAK	5023-001	03-07-22	100-01

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N:640690.76
E:617342.75
CP1

NORTH PARK DRIVE

EXISTING SIDEWALK

EXISTING BOLLARDS

EXISTING WATER UTILITY LINE

CITY OF WILMINGTON-MAYOR & C
PARCEL ID: 26-014.10-006

EXISTING CONCRETE SLAB

EXISTING STONE RETAINING WALL

EXISTING RC SANITARY SEWER LINE

EXISTING RIP-RAP

EXISTING CONCRETE ABUTMENT

N:640621.60
E:617320.26
CP2

EXISTING CONCRETE DAM 2
CREST EL. 23.1

REMNANT DAM CREST
(APPROXIMATE)

EXISTING CONCRETE ABUTMENT

EXISTING CANAL HEADGATES

EXISTING DEBRIS BOOM

STEPS

STEPS

EXISTING CANAL OVERFLOW WEIR

COMBINED SEWER OVERFLOW SPILLWAY

SOUTH MILL RACE CANAL

EXISTING RIPRAP AND TREES

CITY OF WILMINGTON-MAYOR & C
PARCEL ID: 26-013.40-075

N:640509.05
E:617146.46
CP3

EXISTING TC SANITARY SEWER PIPE

EXISTING RC SANITARY SEWER LINE

N:640475.37
E:617219.42
CP4

COMBINED SEWER OVERFLOW

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- NEW MAJOR CONTOUR
- NEW MINOR CONTOUR
- ORDINARY HIGH WATER
- SEWER LINE OR COMBINED SEWER OVERFLOW
- WATER UTILITY LINE
- PROPERTY BOUNDARY
- VEGETATION LINE
- SIGNAGE
- INDIVIDUAL TREE

NOTES:
1. ALL ELEVATIONS IN NAV'D 1988 DATUM. HORIZONTAL CONTROL BASED ON DELAWARE STATE PLANE NAD 1983, US SURVEY FEET.

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SCALE IN FEET

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WILMINGTON, DE (NEW CASTLE COUNTY)

WILMINGTON HARBOR-EDGEMOOR EXPANSION
BRANDYWINE DAM 2 NATURE-LIKE FISHWAY

EXISTING CONDITIONS PLAN WITH AERIAL

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NORTH PARK DRIVE
N:640690.76
E:617342.75
CP1
EXISTING SIDEWALK
CITY OF WILMINGTON-MAYOR & C
PARCEL ID: 26-014.10-006
EXISTING WATER UTILITY LINE
EXISTING STONE RETAINING WALL
DEMOLISH REMAINS OF PREVIOUS FISHWAY AS REQUIRED FOR NEW FISHWAY
EXISTING RC SANITARY SEWER LINE
EXISTING RIP-RAP
EXISTING DAM WEIR 1
EXISTING CONCRETE ABUTMENT
WEIR 2
WEIR 3
WEIR 4
WEIR 5
WEIR 6
WEIR 7
WEIR 8
WEIR 9
WEIR 10
WEIR 11
WEIR 12
WEIR 13
WEIR 14
EXISTING CONCRETE DAM 2 CREST EL. 23.1
N:640621.60
E:617320.26
CP2
PROPOSED NORTH ZONE OF PASSAGE
PROPOSED FISHWAY ENTRANCE POOL
PROPOSED THAWLEG ZONE OF PASSAGE
3 PROPOSED NOTCHES: APPRX. 2.50 FEET DEEP, 6 FEET WIDE THROUGH EXISTING DAMS WITH STOPLOG SLOTS IN THE LEFT AND RIGHT NOTCHES FOR CLOSURE DURING DROUGHT CONDITIONS. GRADE UPSTREAM TO MAINTAIN NOTCH INVERT ELEVATION.
PROPOSED SOUTH ZONE OF PASSAGE
REMNANT DAM CREST (APPROXIMATE)
EXISTING CONCRETE ABUTMENT
EXISTING CANAL HEADGATES
EXISTING DEBRIS BOOM
COMBINED SEWER OVERFLOW SPILLWAY
MIDDLE OF POOL TO BE MINIMUM 4' DEEP WHERE NOT LOCATED WITHIN 10' OF EXISTING SEWER LINE (TYP)
DIVIDER ON OVERFLOW WEIR (PENDING FINAL HYDRAULICS)
EXISTING CANAL OVERFLOW WEIR
SOUTH MILL RACE CANAL
EXISTING RIPRAP AND TREES
CITY OF WILMINGTON-MAYOR & C
PARCEL ID: 26-013.40-075
EXISTING TC SANITARY SEWER PIPE
N:640509.05
E:617146.46
CP3
N:640475.37
E:617219.42
CP4
EXISTING RC SANITARY SEWER LINE
COMBINED SEWER OVERFLOW

24x36 = FULL SCALE

LEGEND

###	EXISTING MAJOR CONTOUR
###	EXISTING MINOR CONTOUR
###	NEW MAJOR CONTOUR
###	NEW MINOR CONTOUR
	ORDINARY HIGH WATER
S	SEWER LINE OR COMBINED OVERFLOW
W	WATER UTILITY LINE
	PROPERTY BOUNDARY
	VEGETATION LINE
	RIPRAP FOUNDATION FOR WEIRS
	SIGNAGE
	INDIVIDUAL TREE

NOTES:
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WILMINGTON HARBOR-EDGEMOOR EXPANSION
BRANDYWINE DAM 2 NATURE-LIKE FISHWAY

PROPOSED CONDITIONS PLAN WITH AERIAL

No.	Revision	Date	Drawn	Checked
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Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
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NORTH PARK DRIVE

N:640690.76
E:617342.75
CP1

EXISTING SIDEWALK

EXISTING STONE RETAINING WALL

EXISTING WATER UTILITY LINE

CITY OF WILMINGTON–MAYOR & C
PARCEL ID: 26–014.10–006

DEMOLISH REMAINS OF PREVIOUS FISHWAY AS REQUIRED FOR NEW FISHWAY

EXISTING RC SANITARY SEWER LINE

EXISTING RIP–RAP

EXISTING CONCRETE ABUTMENT

EXISTING DAM
WEIR 1

WEIR 2

WEIR 3

WEIR 4

WEIR 5

WEIR 6

WEIR 7

WEIR 8

WEIR 9

WEIR 10

WEIR 11

WEIR 12

WEIR 13

WEIR 14

EXISTING CONCRETE DAM 2
CREST EL. 23.1

N:640621.60
E:617320.26
CP2

PROPOSED NORTH ZONE OF PASSAGE

PROPOSED FISHWAY ENTRANCE POOL

PROPOSED THALWEG ZONE OF PASSAGE

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PROPOSED SOUTH ZONE OF PASSAGE

REMNANT DAM CREST (APPROXIMATE)

EXISTING CONCRETE ABUTMENT

EXISTING CANAL HEADGATES

EXISTING DEBRIS BOOM

COMBINED SEWER OVERFLOW SPILLWAY

MIDDLE OF POOL TO BE MINIMUM 4' DEEP WHERE NOT LOCATED WITHIN 10' OF EXISTING SEWER LINE (TYP)

DIVIDER ON OVERFLOW WEIR (PENDING FINAL HYDRAULICS)

EXISTING CANAL OVERFLOW WEIR

SOUTH MILL RACE CANAL

EXISTING RIPRAP AND TREES

CITY OF WILMINGTON–MAYOR & C
PARCEL ID: 26–013.40–075

N:640509.05
E:617146.46
CP3

EXISTING TC SANITARY SEWER PIPE

N:640475.37
E:617219.42
CP4

EXISTING RC SANITARY SEWER LINE

COMBINED SEWER OVERFLOW

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- NEW MAJOR CONTOUR
- NEW MINOR CONTOUR
- ORDINARY HIGH WATER
- SEWER LINE OR COMBINED OVERFLOW
- WATER UTILITY LINE
- PROPERTY BOUNDARY
- VEGETATION LINE
- RIPRAP FOUNDATION FOR WEIRS
- SIGNAGE
- INDIVIDUAL TREE

NOTES:
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SCALE IN FEET

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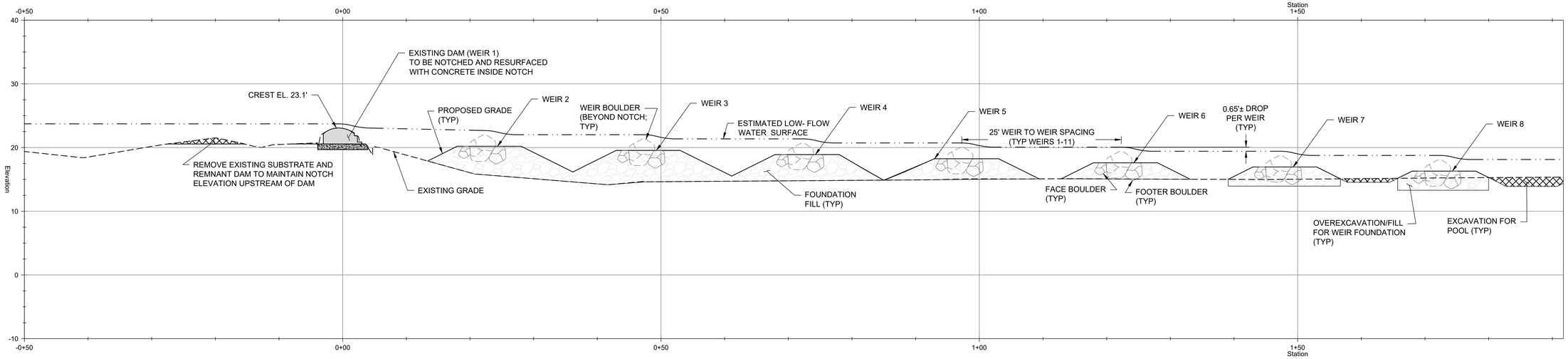

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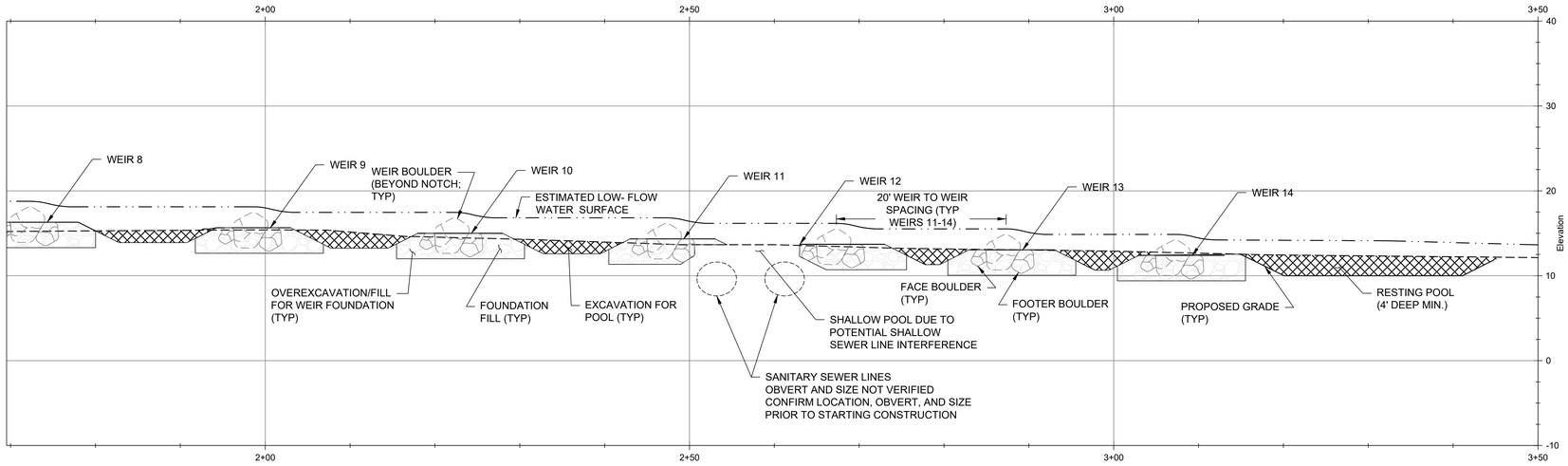

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SCALE IN FEET

NOTES:
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2. FINAL DESIGN AND HYDRAULIC MODELING WILL INFORM WEIR AND NOTCH SPACING, ELEVATIONS, AND FILL EXTENT, BUT FINAL CONDITIONS WILL BE IN GENERAL AGREEMENT WITH THE PROPOSED DESIGN IN THIS DRAWING SET.

No.	Revision	Date	Drawn	Checked
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DIAMOND STATE PORT CORPORATION
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PROPOSED CONDITIONS PROFILE

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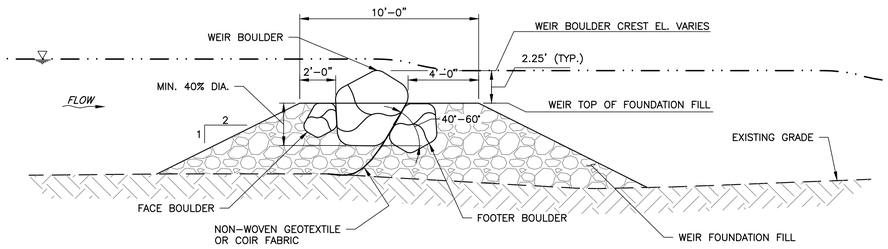

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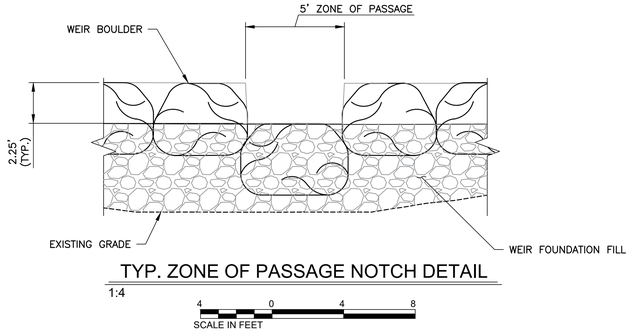

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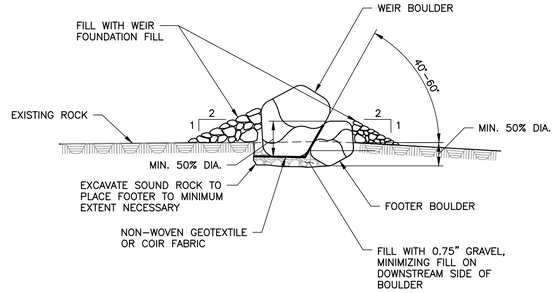

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WEIR BOULDER AND FOOTER BOULDER
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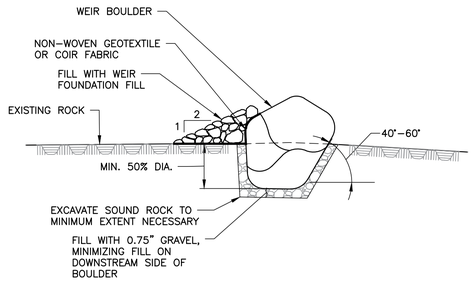

WEIR BOULDER SET IN BEDROCK OPTION 2
WEIR BOULDER ONLY
1:4

WEIR BOULDER SET IN BEDROCK NOTES:

1. CONTRACTOR SHALL UTILIZE ONE OF THESE OPTIONS TO ANCHOR BOULDERS WHERE BEDROCK PROHIBITS THE PLACEMENT OF FILL AND FOOTER BOULDERS AS IS INDICATED IN THE TYPICAL WEIR SECTION. OPTIONS LISTED IN ENGINEER'S ORDER OF PREFERENCE.
2. SUBMIT PREFERRED OPTION AND MATERIAL DETAILS TO OWNERS ENGINEER FOR REVIEW.
3. OWNER'S ENGINEER TO APPROVE SELECTED OPTION PRIOR TO IMPLEMENTATION BASED ON INTERPRETATION OF FIELD CONDITIONS WITH THE CONTRACTOR.
4. TOP OF BOULDERS SHALL MEET DESIGN GRADES. EXCAVATE AS NECESSARY TO ACHIEVE GRADES AND MAINTAIN MINIMUM BOULDER SIZE.
5. BOULDERS SHALL BE STABLE AND FOOTER ROCK/BOULDERS SHALL SUPPORT THE CREST BOULDER ALONG THE MAJORITY OF THE BOULDER.
6. LONGEST AXIS OF BOULDER SHOULD BE PERPENDICULAR TO FLOW TO MINIMIZE GAPS BETWEEN BOULDERS
7. CONTRACTOR TO PLACE CREST BOULDERS TO MINIMIZE GAPS BETWEEN CREST BOULDERS, INCLUDING CHINKING WITH SMALLER STONE AND CONTINUING GEOTEXTILE IN STONE WEIR FOUNDATION BETWEEN THE FOOTER BOULDER AND THE CREST BOULDER.

NOTES:
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WILMINGTON HARBOR-EDGEMOOR EXPANSION
BRANDYWINE DAM 2 NATURE-LIKE FISHWAY

PROPOSED WEIR DETAILS

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WATERWAY IMPACT KEY

TEMPORARY IMPACTS | PERMANENT IMPACTS

Impact Type	Temporary Impact Below OHWL	Permanent Impact Below OHWL	Total
Area (SF)	16,100	54,500	70,600
Volume (CY)	2,200	4,600	6,800

24X36 = FULL SCALE

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- NEW MAJOR CONTOUR
- NEW MINOR CONTOUR
- ORDINARY HIGH WATER LINE
- SEWER LINE OR COMBINED SEWER OVERFLOW
- WATER UTILITY LINE
- PROPERTY BOUNDARY
- VEGETATION LINE
- LIMITS OF DISTURBANCE (3.23 AC, 2.1 AC BELOW OHWL)
- TEMPORARY ACCESS ROAD
- TEMPORARY COFFERDAM

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DIAMOND STATE PORT CORPORATION
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WILMINGTON HARBOR-EDGEMOOR EXPANSION
BRANDYWINE DAM 2 NATURE-LIKE FISHWAY

PERMIT IMPACTS

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APPENDIX B

DAM 2 WETLAND DELINEATION REPORT

Wetland Boundary Identification

Diamond State Port Corporation

Dam 2 Nature-Like Fishway

Wilmington, Delaware

Prepared for:

Brandywine Shad 2020

Prepared by:

Kleinschmidt Associates

March 2022

Kleinschmidt

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1.0 INTRODUCTION

As part of the United States Army Corp of Engineers (USACE) Mitigation for the Wilmington Harbor – Edgemoor Expansion, Diamond State Port Corporation (DSPC) is proposing to install a nature-like fishway (NLF) to improve migratory fish passage at Dam 2 on the Brandywine River. Dam 2 is also known as the Brandywine Park Dam or Broome Street Dam and is located on the Brandywine River in Brandywine Park (River Mile [RM] 2.9), in Wilmington, Delaware. The latitude and longitude coordinates for the Dam 2 are 39.75142, -75.55502. Dam 2 serves to impound water into upriver water intakes operated by the City of Wilmington. This report has been prepared by Kleinschmidt Associates (Kleinschmidt) as part of their contract with Diamond State Port Corporation (DSPC) to develop the design for fish passage enhancements at the project site.

To ensure compliance with federal and state wetland regulations and support the project's permitting efforts, Kleinschmidt Associates (Kleinschmidt) completed a delineation of federal wetlands and watercourses in the proposed limit of disturbance (LOD) of Dam 2. This report details the methodology and results of the field work completed on March 23 and March 24, 2021, and February 28, 2022.

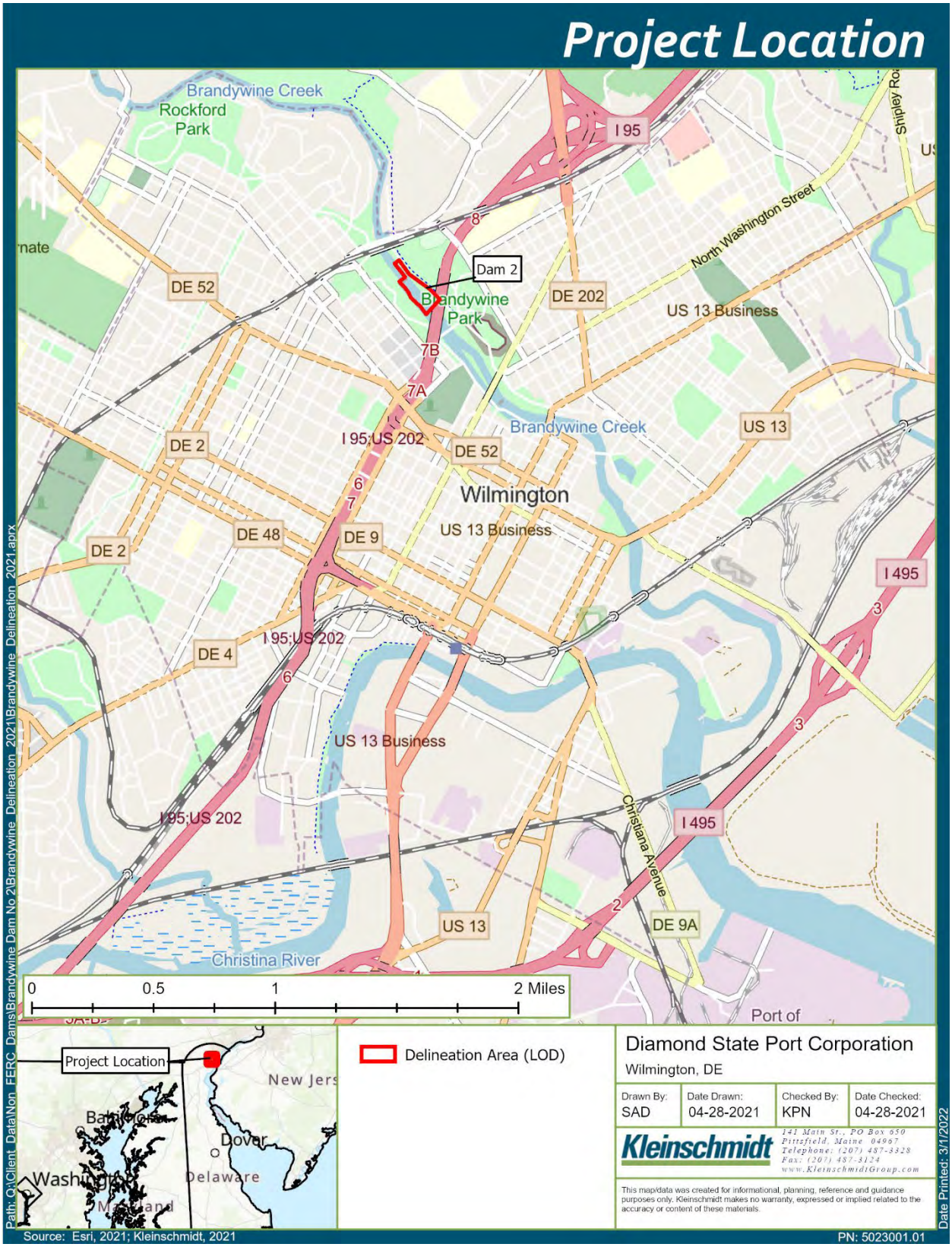

Figure 1. Project Location Map

2.0 METHODOLOGY

Wetlands were delineated using standard methods described in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual and the Atlantic and Gulf Coastal Plain supplement which relies on a three-factor approach requiring wetland vegetation, hydrology, and soils. Soils were classified using hydric soil indicators as outlined in the regional supplement, along with the Munsell Soil Color Chart. Kleinschmidt also located the regulatory Ordinary High-Water Line (OHWL) within the Dam 2 LOD. Spatial data was collected using a Trimble® GEO-7X receiver data logger capable of sub-meter accuracy was differentially corrected using Trimble Pathfinder Office Ver. 5.70.

3.0 SUMMARY

One palustrine emergent wetland (~620 sq. ft.) was identified in the survey area (Cowardin, 1979). Dam 2 occurs primarily in areas of commercial and residential development, specifically Brandywine Park. The wetland occurs within areas of Delanco-Codorus-Hatboro complex, formed in alluvium washed from areas of micaceous crystalline rocks, and Neshaminy-Montalto silt loams (USDA, 2021). A total of three features were mapped including one wetland, one intermittent stream, and one river (Brandywine). Figure 2 shows identified features mapped within the survey area at Dam 2.

Figure 2. Dam 2 Delineated Natural Resources

3.1 Emergent Wetlands

One palustrine wetland was observed in the delineation survey areas (Figure 2). Wetland A is a small emergent wetland associated with the Brandywine River (Photo 1). The wetland is in a public park area and appears to be regularly mowed. Dominant species include fig buttercup (*Ranunculus ficaria*) and stinging nettle (*Urtica dioica*). In addition to the Brandywine River, this wetland receives hydrologic input from a culvert that drains underneath N. Park Drive. Wetland hydrology indicators include saturated soils and geomorphic position.

Photo 1. View of Wetland A Facing West at Dam 2

3.2 Rivers and Streams

The ordinary high-water line was delineated for the Brandywine River at Dam 2 (Figure 2, Photo 2) based on vegetation type and condition, elevation, substrate, and debris lines. In addition to the river, one intermittent stream was observed in the delineation survey area (Photo 3). Stream A is an intermittent stream that flows southwest through a box culvert to the Brandywine River

(Photo 2). The average width of the stream is approximately 20 feet and the substrate is boulder-dominated.

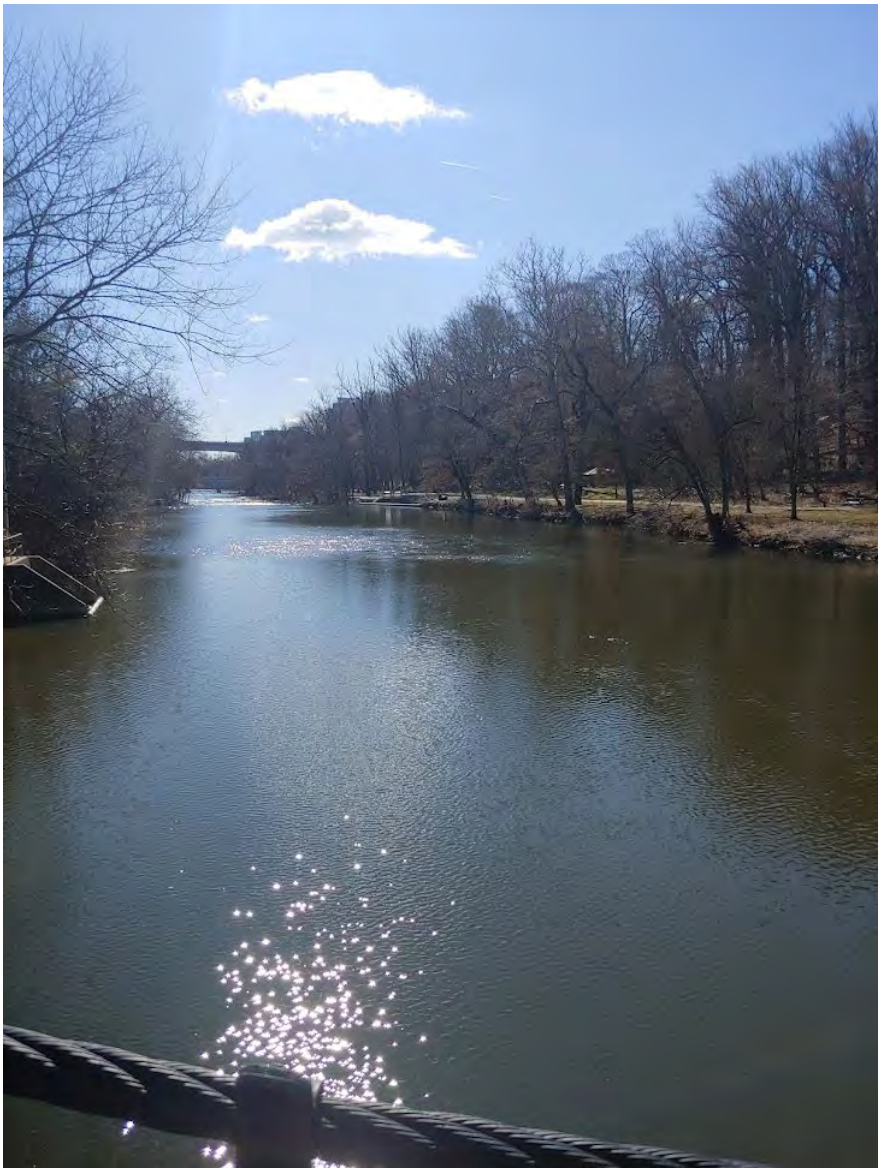

Photo 2. Downstream View of Brandywine River

Photo 3. View of Stream A (A) Upstream (B) Downstream

3.3 USACE Paired Sample Plots

A USACE paired wetland sample plot was completed for wetland A. USACE data sheets are included in Appendix A. Table 1 contains the latitude and longitude for the paired plot, as well as the wetland habitat type associated with the sample location. Palustrine emergent communities were the only wetland type observed within the delineation survey area.

Table 1. USACE Paired Wetland Sample Plot Descriptions and Locations

Site	Plot ID	Habitat	Latitude[1]	Longitude[1]
Wet A	Wet A-Up	Emergent Wetland	39.75919513	-75.55510657
	Wet A-Wet		39.75919224	-75.5551310

[1]NAD 1983 StatePlane Delaware FIPS 0700 (US Feet)

3.4 Vernal Pools

While the wetland survey was completed outside of the vernal pool survey season, no potential vernal pools were observed in the project area.

4.0 LITERATURE CITED

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C.

U.S. Army Corps of Engineers. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-20. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

U.S. Department of Agriculture (USDA). 2021. Web Soil Survey. [Online] URL: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed April 27, 2021.

APPENDIX A

USACE DATA FORMS

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Brandywine Dam 2 City/County: Willmington Sampling Date: 3/23/2021

Applicant/Owner: DSPC State: DE Sampling Point: Wet A-up

Investigator(s): Sarah Drahovzal Section, Township, Range: Willmington

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 1-2

Subregion (LRR or MLRA): MLRA 149A Lat: 39.75919513 Long: -75.55510657 Datum: NAD 83

Soil Map Unit Name: DcB Delanco-Codorus-Hatboro complex, 0 to 8 percent slopes, NWI classification: none

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

Are Vegetation [✓] Soil [ ] or Hydrology [ ] significantly disturbed? [ ] Are "Normal Circumstances" present? Yes [✓] No [ ]

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

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

Hydrophytic Vegetation Present?	Yes [ ]	No [✓]	**Is the Sampled Area within a Wetland?**	Yes [ ] No [✓]
Hydric Soil Present?	Yes [ ]	No [✓]		
Wetland Hydrology Present?	Yes [ ]	No [✓]		

Remarks:
Vegetation is in a public park and is disturbed (regularly mowed).

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)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along 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)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

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 [✓]

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

Remarks:
No wetland hydrology indicators observed

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wet A-up

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Sapling Stratum (Plot size: _____)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Shrub Stratum (Plot size: _____)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Herb Stratum (Plot size: 5 ft)			
1. Poa sp.	100	Y	
2. Allium schoenoprasum	T	N	FACU
3. Viola sp.	T	N	
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30 = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Woody Vine Stratum (Plot size: _____)			
1. N/A			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (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
- [ ] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes [ ] No [✓]

Remarks: (If observed, list morphological adaptations below).

Upland plot is in a open, lawn area in the park

SOIL

Sampling Point: Wet A-up

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10 YR 3/4	100					Sandy Loam	
8+	resistance							

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

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

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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): 8

Hydric Soil Present? Yes _____ No X

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Brandywine Dam 2 City/County: Willmington Sampling Date: 3/23/2021

Applicant/Owner: DSPC State: DE Sampling Point: Wet A-wet

Investigator(s): Sarah Drahovzal Section, Township, Range: Willmington

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 1-2

Subregion (LRR or MLRA): MLRA 149A Lat: 39.75919224 Long: -75.55513106 Datum: NAD 83

Soil Map Unit Name: DcB Delanco-Codorus-Hatboro complex, 0 to 8 percent slopes, NWI classification: PEM

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

Are Vegetation [✓] Soil [ ] or Hydrology [ ] significantly disturbed? [ ] Are "Normal Circumstances" present? Yes [✓] No [ ]

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

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

Hydrophytic Vegetation Present?	Yes [✓]	No [ ]	**Is the Sampled Area within a Wetland?** Yes [✓] No [ ]
Hydric Soil Present?	Yes [✓]	No [ ]	
Wetland Hydrology Present?	Yes [✓]	No [ ]	

Remarks:
Vegetation is in a public park and is disturbed (regularly mowed).

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)
- [✓] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along 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)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [✓] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [✓] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

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): 0

Wetland Hydrology Present? Yes [✓] No [ ]

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

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wet A-wet

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Sapling Stratum (Plot size: _____)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Shrub Stratum (Plot size: _____)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Herb Stratum (Plot size: 5 ft)			
1. Ranunculus ficaria	20	Y	FAC
2. Urtica dioica	10	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30 = Total Cover		
50% of total cover: _____	20% of total cover: _____		
Woody Vine Stratum (Plot size: _____)			
1. N/A			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
50% of total cover: _____	20% of 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 (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
- [ ] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes [✓] No [ ]

Remarks: (If observed, list morphological adaptations below).

Vegetation is disturbed

SOIL

Sampling Point: Wet A-wet

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10 YR 3/2	100					Sandy loa	
10-18	10 YR 3/2	85	10YR 3/4	15			Loamy sa	

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

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

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☑ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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 ☐

Remarks:

APPENDIX G

US Fish and Wildlife Service Certification

United States Department of the Interior

U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4575

Online Certification Letter

Today's date: March 4, 2022

Project: Construction of Nature-Like Fishway - Brandywine Creek Dam 2
Fox Point State Park Wetland Restoration

Dear Applicant for online certification:

Thank you for using the U.S. Fish and Wildlife Service (Service) Chesapeake Bay Field Office online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the referenced project in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

Based on this information and in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), we certify that except for occasional transient individuals, no federally listed endangered or threatened species are known to exist within the project area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For additional information on threatened or endangered species in Maryland, you should contact the Maryland Wildlife and Heritage Division at (410) 260-8573. For information in Delaware you should contact the Delaware Division of Fish and Wildlife, Wildlife Species Conservation and Research Program at (302) 735-8658. For information in the District of Columbia, you should contact the National Park Service at (202) 339-8309.

The U.S. Fish and Wildlife Service also works with other Federal agencies and states to minimize loss of wetlands, reduce impacts to fish and migratory birds, including bald eagles, and restore habitat for wildlife. Information on these conservation issues and how development projects can avoid affecting these resources can be found on our website (www.fws.gov/chesapeakebay)

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interest in these resources. If you have any questions or need further assistance, please contact Chesapeake Bay Field Office Threatened and Endangered Species program at (410) 573-4527.

Sincerely,

Genevieve LaRouche
Field Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127
http://www.fws.gov/chesapeakebay/
http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html

In Reply Refer To: November 15, 2021
Consultation Code: 05E2CB00-2022-SLI-0310
Event Code: 05E2CB00-2022-E-00826
Project Name: Fox Point State Park Wetland Restoration

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. This species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
(410) 573-4599

Project Summary

Consultation Code: 05E2CB00-2022-SLI-0310
Event Code: Some(05E2CB00-2022-E-00826)
Project Name: Fox Point State Park Wetland Restoration
Project Type: SHORELINE / BEACH PROTECTION / RENOURISHMENT
Project Description: Fox Point State Park is contiguous with, and immediately upriver of, the Proposed Port of Wilmington Edgemoor Expansion project (Edgemoor project) site. Wetland restoration at Fox Point State Park is being proposed as a proposed compensatory mitigation project for the Edgemoor project.

The Park was created through filling activities performed along the Delaware River shoreline that began circa 1955. Along the upriver end of the park, a low-lying area overgrown with phragmites and having elevations ranging from approximately 6 to 8 feet mean lower low water (MLLW) datum is separated from the Delaware River by a constructed revetment. The area has been identified as having potential for fill removal to restore the intertidal habitat that existed prior to the historic filling event. The site, approximately 1.1 acre in size, is located near the upriver end of Fox Point Park along the Delaware River.

The wetland construction work will occur in an existing upland area that currently is disconnected from the Delaware River. The excavation through the revetment near the end of the project will establish tidal flow and allow the wetland area to become part of Delaware River when finished. While in-water work for this project is minimal, no work will be performed during the spring spawning and migration period for anadromous fish within the Delaware River.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.76852465,-75.48273611513751,14z

Counties: New Castle County, Delaware

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis*	Threatened

No critical habitat has been designated for this species.

This species only needs to be considered under the following conditions:

- Projects with a federal nexus that have tree clearing = to or > 15 acres: 1. REQUEST A SPECIES LIST 2. NEXT STEP: EVALUATE DETERMINATION KEYS 3. SELECT EVALUATE under the Northern Long-Eared Bat (NLEB) Consultation and 4(d) Rule Consistency key

Species profile: https://ecos.fws.gov/ecp/species/9045

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus*	Candidate

No critical habitat has been designated for this species.

This species only needs to be considered under the following conditions:

- The monarch is a candidate species and not yet listed or proposed for listing. There are generally no section 7 requirements for candidate species (FAQ found here: https://www.fws.gov/savethemonarch/FAQ-Section7.html).

Species profile: https://ecos.fws.gov/ecp/species/9743

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER EMERGENT WETLAND

- PEM5R

ESTUARINE AND MARINE WETLAND

- M2US2P

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127
http://www.fws.gov/chesapeakebay/
http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html

In Reply Refer To: November 15, 2021
Consultation Code: 05E2CB00-2022-SLI-0309
Event Code: 05E2CB00-2022-E-00824
Project Name: Construction of Nature-Like Fishway - Brandywine Creek Dam 2

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. This species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
(410) 573-4599

Project Summary

Consultation Code: 05E2CB00-2022-SLI-0309
Event Code: Some(05E2CB00-2022-E-00824)
Project Name: Construction of Nature-Like Fishway - Brandywine Creek Dam 2
Project Type: ** OTHER **
Project Description: Dam 2 is located at river mile (rm) 2.9 of the Brandywine Creek within the City of Wilmington, Delaware, above the fall line in Brandywine Creek. It is approximately 4.7 miles upstream of the Delaware River. As such, it is a shallow, non-tidal, fluvial body of fresh water. Water depths in the vicinity of Dam 2 range from a few inches to several feet.

Complete or partial removal of Dam 2 is not practical at this time as it is critical to the City of Wilmington providing potable water to the population served by the public water system. As a result, construction of a rock, nature-like fishway (NLF) at the dam (i.e, immediately downstream) is proposed to re-establish anadromous fish passage to habitats within Brandywine Creek upstream of the dam. The fish passage is intended to primarily support passage of river herring, including shad.

The scope of the project does not include tree-clearing nor are there any buildings within the project footprint. The proposed construction of a NLF at Dam 2 is being considered as a compensatory mitigation project for the Proposed Port of Wilmington Edgemoor Expansion Project (previously certified via letter dated November 5, 2019).

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.75821555,-75.55460122564585,14z

Counties: New Castle County, Delaware

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis*	Threatened

No critical habitat has been designated for this species.

This species only needs to be considered under the following conditions:

- Projects with a federal nexus that have tree clearing = to or > 15 acres: 1. REQUEST A SPECIES LIST 2. NEXT STEP: EVALUATE DETERMINATION KEYS 3. SELECT EVALUATE under the Northern Long-Eared Bat (NLEB) Consultation and 4(d) Rule Consistency key

Species profile: https://ecos.fws.gov/ecp/species/9045

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus*	Candidate

No critical habitat has been designated for this species.

This species only needs to be considered under the following conditions:

- The monarch is a candidate species and not yet listed or proposed for listing. There are generally no section 7 requirements for candidate species (FAQ found here: https://www.fws.gov/savethemonarch/FAQ-Section7.html).

Species profile: https://ecos.fws.gov/ecp/species/9743

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

RIVERINE

- R2UBFx
- R2UBH

APPENDIX H

State of Delaware Fish Certification

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF FISH & WILDLIFE
RICHARDSON & ROBBINS BUILDING
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

DIRECTOR'S OFFICE

PHONE
(302) 739-9910

December 8, 2021

Rebecca Harris
Duffield Associates
5400 Limestone Road
Wilmington, DE 19808

Re: DUFF 2021 Port of Wilmington Expansion Mitigation, Fox Point State Park & Brandywine Creek Dam 2

Dear Rebecca:

Thank you for contacting the Species Conservation and Research Program (SCRP) about information on rare, threatened and endangered species, unique natural communities, and other significant natural resources as they relate to the above referenced project.

Fox Point State Park – Wetlands Restoration

State Rare and Federally Listed Species
A review of our database indicates that the following state rare or federally listed plants, animals or natural communities occur at or adjacent to the project site:

Scientific Name	Common Name	Taxon	State Rank	State Status	Global Status	Federal Status
Acipenser brevirostrum	Shortnose sturgeon	Fish	S3N	E	G3	E
Acipenser oxyrinchus	Atlantic sturgeon	Fish	S2	E	G3	E
Bidens bidentoides	Estuary tick-seed	Plant	SH		G3	
Eleocharis aestuum	Tidal spikerush	Plant	SH		G3	
Eleocharis erythropoda	Bald spikerush	Plant	S1		G5	
Sagittaria calycina	Spongy arrowhead	Plant	S1		G5	
Sagittaria spatulata	Tidal arrowhead	Plant	S1		G5	
Sagittaria subulata	Strap-leaf arrowhead	Plant	S2		G5	

State Rank: **S1** – Extremely rare within the state (typically 5 or fewer occurrences); **S2** – Very rare within the state (6 to 20 occurrences); **S3** – Rare to uncommon in Delaware; **B** – Breeding; **N** – Nonbreeding; **S4** – Apparently secure, at fairly low risk of extinction or extirpation due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors; **S5** – Demonstrably secure, at very low risk of extinction or extirpation due to a very extensive range, abundant populations or occurrences, or little to no concern from declines or threats.; **SX** – Extirpated or presumed extirpated from the state. All historical locations and/or potential habitat have been surveyed; **SH** – Historically known, but not verified for an extended period (usually 15+ years); there are expectations that the species may be rediscovered; **SE** – Non-native

in the state (introduced through human influence); not a part of the native flora or fauna; **SNR** – Not yet ranked in Delaware, **SN** – Occurrences in DE of limited conservation value, **of concern due to a restricted range; **SU** – Status uncertain within the state. Usually an uncommon species which is believed to be of conservation concern, but there is inadequate data to determine the degree of rarity.

State Status: E – Endangered, i.e. designated by the Delaware Division of Fish and Wildlife as seriously threatened with extinction in the state pursuant to State of Delaware Code (7 Del. §601 *et seq.*) and implementing regulation (Title 7, 3900, 16.0 Endangered Species) ; **NA** – plants are not included in Title 7.

Federal Status: E – Endangered, i.e. designated by the U.S. Fish and Wildlife Service as being in danger of extinction throughout its range; **T** – Threatened, i.e. designated by USFWS as being likely to become endangered in the foreseeable future throughout all or a significant portion of its range; **C** – candidate - Taxa for which the U.S. Fish and Wildlife Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. NOAA Managed Candidate: **SC** – Species of Concern **-** species about which NOAA's National Marine Fisheries Service (NMFS) has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the ESA.

Global Rank: G1 – Imperiled globally because of extreme rarity (5 or fewer occurrences worldwide); **G2** – Imperiled globally because of great rarity (6 to 20 occurrences); **G3** – Either very rare and local throughout its range (21 to 100 occurrences) or found only locally in a restricted range; **G4** – Apparently secure globally but uncommon in parts of its range; **G5** – Secure on a global basis but may be uncommon locally; T – Variety or subspecies rank; Q – Questionable taxonomy.

Bellevue Cove was visited by state botanist Bill McAvoy on September 14, 2015 and September 14, 2017 to access critical habitat and vegetation. A copy of his report is enclosed with this letter. Although the rare plants listed above occur approximately 200 feet north of the mitigation site, and then continue north along the Delaware River shoreline, caution should still be applied. Because this is a sensitive site with several rare plant species occurring along the shoreline and in the marshes, Bill requests the opportunity to be involved in all aspects of the project to ensure protection of critical resources. In addition, Bill requests phragmites control be added to the project goals. Specifically, phragmites control to the north of the proposed mitigation site. You may contact Bill directly at William.McAvoy@delaware.gov or (302) 735-8668.

State Natural Heritage Site

Because rare species are present, this project is within a State Natural Heritage Site. State Natural Heritage Sites are identified as "Designated Critical Resource Waters" by the Army Corps of Engineers (ACOE), and as such are subject to the restrictions and limitations imposed through Nationwide Permit General Condition No. 22. A copy of this letter shall be included in any permit application or pre-construction notification submitted to the Army Corps of Engineers for activities on this property.

If you propose to use Nationwide Permit No. 3, 13, 18, 57, or 58 the State of Delaware has denied 401 Water Quality Certification (WQC) and Federal Consistency Concurrence for these Nationwide Permits (NMPs) in Designated Critical Resource Waters. In order to use any of these five Nationwide Permits at this site you must apply for a project-specific WQC and Federal Consistency Determination from the appropriate offices at DNREC. The State of Delaware has denied 401 WQC for NWPs 12, 29, 39, 40, 42, 43, 44 and 51 in Designated Critical Resource Waters. The State of Delaware has denied the Federal Consistency Concurrence for all of these NWPs regardless of location. The State of Delaware has denied Federal Consistency Concurrence for NWPs 48, 55 and 56 in Designated Critical Resource Waters. To obtain the application materials and for all information regarding WQC, contact DNREC's Wetlands and Subaqueous Lands Section at (302) 739-9943. For information pertaining to Federal Consistency, contact DNREC's Coastal Programs at (302) 739-9283.

If you propose to use Nationwide Permit No. 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43,44, 49, 50, 51, or 52, this Designated Critical Resource Water designation may require you to

obtain authorization through some other nationwide or general permit, or an individual permit from the Army Corps of Engineers. You should review the Nationwide Permit General Conditions and Regional Conditions for Delaware (see, in particular, Nationwide Permit General Condition No. 22) to determine what notification requirements or restrictions might be applicable for your activity. Please contact the Army Corps of Engineers at (215) 656-6728 if you have questions or require additional information regarding the Nationwide Permit Program.

Fisheries
This area of the Delaware River is utilized by the federally endangered shortnose sturgeon (*Acipenser brevirostrum*) and federally endangered Atlantic Sturgeon (*Acipenser oxyrinchus*). Spawning is believed to be upriver, but as evidenced by telemetry and other survey methods, juveniles of both species can be found in the deep water adjacent to this project site. This area of the Delaware River has been identified by NOAA as Critical Habitat for Atlantic Sturgeon. Because these sturgeons are federally protected under the U.S. Endangered Species Act, please note that if this project requires a federal permit, a Section 7 consultation by the federal agency responsible for permitting the action may be required.

In addition, the Delaware River is utilized by Striped Bass (*Morone saxatilis*) for spawning during April to June and are routinely caught in the project area. Large numbers of American Shad (*Alosa sapidissima*) pass through this area from April to June during upstream migration. Although these two species are not listed as endangered or threatened, they are an important resource in terms of recreational and commercial fisheries. To protect spawning activities, we request that no in-water work (placing riprap, pile driving, etc.) occur during **March 15th to June 30th**.

Brandywine Creek Dam 2 – Construction of Rock Fishway

State Natural Heritage Site
A review of our database indicates that there are currently no records of state-rare or federally listed plants, animals or natural communities at this project site. As a result, at present, this project does not lie within a State Natural Heritage Site, nor does it lie within a Delaware National Estuarine Research Reserve which are two criteria used to identify “Designated Critical Resource Waters” in the Army Corps of Engineers (ACOE) Nationwide Permit General Condition No. 22. A copy of this letter shall be included in any permit application or pre-construction notification submitted to the Army Corps of Engineers for activities on this property.

Fisheries
This area is utilized by Striped Bass (*Morone saxatilis*) for spawning during April to June and are routinely caught in the project area. Large numbers of American Shad (*Alosa sapidissima*) also occupy and spawn in this area from April to June. Although these two species are not listed as endangered or threatened, they are an important resource in terms of recreational and commercial fisheries. To protect spawning activities, we request that no in-water work (placing riprap, pile driving, etc.) occur during **March 15th to June 30th**.

According to our records and recent sampling occurrences, a population of Smallmouth Bass (*Micropterus dolomieu*) inhabits the Brandywine River within the project impact areas. Smallmouth Bass are recreationally valuable species as they are targeted by local anglers. To avoid impacts to this species, our Fisheries section biologists request that no in-water work occurs between **April 1st and June 30th** to protect nesting Smallmouth Bass during their spawning season.

In addition, Delaware River tributaries and northern tributaries are used by fairly large numbers of American Eel (*Anguilla rostrata*). We request that in-stream work not take place from **March 1st to May 15th** to allow upstream passage of elvers (young eels).

Collectively, we request that no in-water work occur between **March 1st and June 30th**.

Invasive fish species, most notably Northern Snakehead, Blue Catfish, and Flathead Catfish, have been documented below Dam 2. While the benefit of upstream passage for anadromous fish species is a priority, it should be noted that invasive fish species may also utilize the upstream passage provided by this project.

We are continually updating our records on Delaware's rare, threatened and endangered species, unique natural communities and other significant natural resources. If the start of the project is delayed more than a year past the date of this letter, please contact us again for the latest information.

Please feel free to contact me with any questions or if you require additional information.

Sincerely,

Danielle Ellis
Environmental Review Coordinator
Phone: (302) 223-2446
6180 Hay Point Landing Road
Smyrna, DE 19977

(See invoice on next page)

INVOICE - PAYMENT DUE

It is our policy to charge a fee for this environmental review service. This letter constitutes an invoice for $70.00 ($35.00/hour for a minimum of one hour). Please make your check payable to “Delaware Division of Fish and Wildlife” and submit to:

DE Division of Fish and Wildlife
97 Commerce Way
Suite 106
Dover, DE 19901
ATTN: DFW Fiscal

In order for us to properly process your payment, you must reference “DUFF 2021 Port of Wilmington Expansion Mitigation**” on your check.**

cc: Division of Fish and Wildlife Fiscal (dnrec_dfw_payroll@delaware.gov); Code to 72900

APPENDIX I

Memorandum of Understanding Between City of Wilmington And DSPC

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE DIAMOND STATE PORT CORPORATION
AND
THE CITY OF WILMINGTON – DEPARTMENT OF PUBLIC WORKS

1.0 PURPOSE

This Memorandum of Understanding ("MOU") is newly adopted between the Diamond State Port Corporation ("DSPC") and the City of Wilmington – Department of Public Works ("DPW") (collectively the "Parties" and each individually, a "Party") to outline the Parties' intentions for constructing, funding, and maintaining a nature-like fishway ("NLF") at Dam 2 along the Brandywine Creek. The Parties intend the NLF to allow resident and migratory fish upstream access to portions of the Brandywine Creek otherwise prohibited by Dam 2's current construction (the "Fish Passage Project"). DSPC proposes the Fish Passage Project as part of DSPC's proposed Final Mitigation Plan for the US Army Corps of Engineers (the "Federal Mitigation Plan") to offset possible environmental impacts of DSPC's project to construct a primary harbor access channel and ship berth in the Delaware River at DSPC's Edgemoor property.

Dam 2 is located along the Brandywine Creek in the City of Wilmington (the "City). The City owns Dam 2 and the adjoining lands on both the north and south banks of the Brandywine Creek. Brandywine Park, owned by the City and managed by the Division of Parks and Recreation ("Division of Parks") within the Department of Natural Resources and Environmental Control, is located on the north side of the Creek. Dam 2 represents critical infrastructure for the City's potable water supply, and is in close proximity to City sewer utilities. Given the importance of this infrastructure and the involvement of several key stakeholders, the Fish Passage Project requires collaboration regarding several factors, including: (i) the City allowing DSPC to access Dam 2; (ii) construction of the fish passage by DSPC in collaboration with the City to ensure that all infrastructure is handled appropriately; and (iii) limited ongoing maintenance following construction. This MOU outlines the Parties' intentions to undertake necessary steps to advance the Fish Passage Project but the Parties understand and agree that it will be necessary to negotiate and execute certain mutually beneficial future agreements ("Future Agreements").

2.0 SCOPE OF SERVICES

Future Agreements of the Parties will cover the following actions and/or provide the following services to each other:

2.1 DSPC:

2.1.1 Being permitted to access Dam 2 and the area downstream of Dam 2 for purposes of constructing the NLF;

2.1.2 Being permitted to modify Dam 2 to provide fish passage, provided that Dam 2 operations are not impacted in accordance with regulatory submissions;

2.1.3 Funding and conduct all construction-related activities for the NLF;

2.1.4 Ensuring that construction efforts do not impair the City's nearby water and sewer utilities;

2.1.5 Coordinating with the City to conduct condition assessments of subsurface utilities before and after construction of the NLF;

2.1.6 Following construction, confirming that all lands adjacent to the NLF are returned as nearly as practicable to the same condition as existed when the work commenced;

2.1.7 Coordinating with the City to seek available grant funding to support the infrastructure in the vicinity of the NLF; and

2.1.8 Accepting ultimate responsibility for maintenance of the NLF either directly or by confirming that designees complete inspection and maintenance appropriately.

2.2 The City:

2.2.1 Allowing DSPC to access Dam 2 and the area downstream of Dam 2 to construct the NLF;

2.2.2 Being responsible for all continuing maintenance of Dam 2, but will not be responsible for maintenance of the NLF;

2.2.3 Not interfering with operations of the NLF;

2.2.4 Collaborating in good faith with DSPC to seek all available grant funding to support infrastructure in the vicinity of the NLF; and

2.2.5 Being responsible for future maintenance, repair or replacement of existing or future utilities within the NLF footprint, including regulatory approvals.

Services under this MOU may be provided by agents, consultants, and contractors. It is expressly understood this MOU is non-binding on the parties but each Party agrees to negotiate any Future Agreements in good faith. Each Party further agrees to cooperate and use commercially reasonable efforts to advance the Fish Passage Project. This MOU also does not document, provide for, or commit to exchanging funds or personnel between the Parties. The Parties expressly agree and recognize that any approvals required for any of the actions contemplated in this MOU, including but not limited to the requirements of Sec. 8-205 of the Charter of the City of Wilmington, will need to be secured in the context of this MOU as well as any Future Agreements.

3.0 COMMUNICATIONS

To provide consistent and effective communication between DSPC and the City, each Party appoints the following primary and alternate Person of Contact ("POC") to serve as its central point of contact on matters relating to this MOU. The postal and email addresses noted below should serve as the address for any notifications/correspondence between the Parties.

3.1 DSPC

3.1.1 Primary POC
Eugene R. Bailey
Executive Director
Diamond State Port Corporation
Port of Wilmington
c/o Office of the Secretary Department of State
820 North French Street, 4th Floor
Wilmington, Delaware 19801
302- 577 - 8959
gbailey@port.state.de.us

3.1.2 Alternate POC
Sean McNeely
Treasurer
Diamond State Port Corporation
Port of Wilmington
820 North French Street, 8th Floor
Wilmington, Delaware 19801
302- 577 - 8988
Sean.McNeeley@delaware.gov

3.2 City of Wilmington

3.2.1 Primary POC
Kelly Williams
Commissioner
City of Wilmington
Department of Public Works
Louis L. Redding City/County Building
800 N. French Street, 6th Floor
Wilmington, Delaware 19801
302 - 571 - 4579
kwilliams@wilmingtonde.gov

3.2.2 Alternate POC
Vincent R. Carroccia
Deputy Commissioner
City of Wilmington

Department of Public Works
Louis L. Redding City/County Building
800 N. French Street, 6th Floor
Wilmington, Delaware 19801
302 - 576 - 3081
vcarroccia@wilmingtonde.gov

4.0 APPLICABLE LAWS

This MOU and all documents and actions under it shall be governed by the applicable statutes, regulations, directives, policies, and procedures of the State of Delaware, and County of New Castle.

5.0 DISPUTE RESOLUTION

The Parties agree that if a dispute arises, the Parties shall use their best efforts to resolve the dispute informally through consultation and communication or other forms of mutually acceptable non-binding alternative dispute resolution. If such measures fail to resolve the conflict, the Parties shall elevate the issue through their respective leaderships.

6.0 PUBLIC INFORMATION

DSPC is responsible for explaining its programs before other agencies, departments, and offices of the State of Delaware; federal agencies, departments, and offices; or any other governing body. Each Party shall give the other Party advance written notice before making any public statement, or in the event of a Freedom of Information Act request regarding the work contemplated, undertaken, or completed under this MOU.

7.0 MISCELLANEOUS

7.1 Other Relationships or Obligations: This MOU shall not affect any pre-existing or independent relationships or obligations between the Parties.

7.2 Severability: If any provision of this MOU is determined to be invalid or unenforceable, the remaining provisions shall remain in force and unaffected to the fullest extent permitted by law and regulation.

7.3 Transferability: This MOU is not transferable except with the Parties' written consent.

8.0 REQUIRED REVIEWS

The Parties will review this MOU annually, on or around the anniversary of the Effective Date.

9.0 AMENDMENT, MODIFICATION, AND TERMINATION

This MOU may be modified or amended only by written, mutual agreement of the Parties. Either Party may terminate this MOU by providing at least 60 days written notice to the other Party.

10.0 EFFECTIVE DATE

This MOU takes effect on the day after the last Party signs (the "Effective Date") Portions of this MOU that may provide to DSPC a license or other interest in the real estate of the City shall be effective upon approval by resolution of Wilmington City Council.

11.0 EXPIRATION AND RENEWAL

This MOU shall automatically renew on the tenth anniversary of the Effective Date (the "Renewal Date") unless terminated earlier. Notwithstanding the preceding, the Parties intend that the Future Agreements will supersede this MOU.

12.0 INDEMNIFICATION

Notwithstanding the process of dispute resolution described in 5.0 of this MOU, DSPC shall accept all responsibility for and agrees to defend, indemnify, and save harmless the City, its elected and appointed officials, officers, members, employees, directors, contractors, and agents from and against any and all claims, actions, suits, liabilities, losses, arising from or in connection this MOU that result from the negligence or willful misconduct of DSPC, its officials, employees, contractors, and agents in connection with this MOU.

[Signature page follows]

The Diamond State Port Corporation

Eugene R. Bailey 3/7/2022
Eugene R. Bailey Date
Executive Director

The City of Wilmington
Department of Public Works

3/7/22
Kelly Williams Date
Commissioner

APPENDIX J

Memorandum of Understanding Between DNREC And DSPC

MEMORANDUM OF UNDERSTANDING
FOR
eDNA MONITORING PROGRAM
BETWEEN
THE DIAMOND STATE PORT CORPORATION
AND
THE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

1.0 PURPOSE

This Memorandum of Understanding ("MOU") is newly adopted by and between the Diamond State Port Corporation ("DSPC") and the State of Delaware Department of Natural Resources and Environmental Control ("DNREC") (collectively the "Parties" and each individually, a "Party") to outline the Parties' understanding regarding responsibilities for funding, sampling, and data sharing related to environmental DNA monitoring and research activities performed by DNREC as more fully described herein (the "eDNA Monitoring Program"). DSPC has proposed three years of support for the eDNA Monitoring Program as part of DSPC's proposed Final Mitigation Plan ("Federal Mitigation Plan") for the US Army Corps of Engineers ("USACE") and the State of Delaware Compensatory Mitigation Plan dated September 24, 2021, and approved by DNREC on September 29, 2021 (the "State Mitigation Plan" and collectively the "Mitigation Plans"). DSPC prepared the Mitigation Plans to offset possible environmental impacts of DSPC's project to construct a primary harbor access channel and ship berth in the Delaware River at DSPC's Edgemoor property (the "Port Expansion Project").

The eDNA Monitoring Program is intended to assist with DNREC's evaluation and understanding of resident and transient fish species in the area most likely impacted by the construction at DSPC's Edgemoor property. Also, the Parties anticipate the eDNA Monitoring Program will expand sampling activities in the Delaware River to monitor state and federal public trust species. The eDNA Monitoring Program will be conducted by DNREC's Division of Fish and Wildlife, Fisheries Section and/or by DNREC's Division of Water, Environmental Laboratory Section. Given the involvement of several key stakeholders, the eDNA Monitoring Program requires collaboration, including: (i) coordination regarding the funding previously appropriated by the Delaware General Assembly and entrusted to the discretion of the Chair of DSPC; (ii) memorialization of the purchase of relevant technical equipment for conducting eDNA sampling; (iii) coordination of fisheries sampling, including co-sampling during current regularly occurring fisheries surveys; and (iv) coordination regarding the sharing of data and reports generated by DNREC with DSPC and USACE. This MOU outlines the Parties' commitment to undertake the necessary steps to establish and execute the eDNA Monitoring Program.

2.0 SCOPE OF SERVICES

The Parties agree to undertake the following actions and/or provide the following services to each other:

2.1 DSPC Shall:

2.1.1 Within three days after the Effective Date, authorize disbursement of $750,000 of the appropriation in Section 102 of the Fiscal Year 2022 Bond and Capital Improvements Act to DNREC to be used to offset costs associated with DNREC's purchase of necessary laboratory and sampling equipment and the establishment, administration and execution of the eDNA Monitoring Program; and

2.1.2 Promptly forward a copy of all documentation received from DNREC under Sections 2.2.1 through 2.2.5 to USACE in support of the Federal Mitigation Plan.

2.2 DNREC shall:

2.2.1 Provide proof of purchase of necessary laboratory equipment and sampling equipment once items are received by DNREC;

2.2.2 Develop Standard Operating Procedures (SOPs) and a Quality Assurance Plan for sampling and laboratory analytical activities;

2.2.3 Develop a general Sampling and Analysis Plan (SAP) for the three year duration of the program development. The general plan will specify sample locations and frequencies for primary purposes of monitoring during and around the Port Expansion Project, in coordination with any dredging-related activity near the Edgemoor site. Additional studies in other parts of the watershed/throughout the state will occur as personnel and funding for sample analysis remains;

2.2.4 Provide an annual eDNA Data Summary Report at the end of each calendar year during the three year program development period. The report will summarize yearly activities and present the eDNA data collected during those activities; and

2.2.5 Upon conclusion of the three year program, provide a final summary memorandum reviewing the results and efficacy of the eDNA Monitoring Program, including DNREC's plans for potentially continuing the program beyond the requirements of the Mitigation Plans.

Services under this MOU may be provided by agents, consultants, and contractors. The Parties understand and agree that it may be necessary to negotiate and execute certain mutually beneficial future agreements ("Future Agreements"). Each Party agrees to negotiate any Future Agreements in good faith. Each Party further agrees to cooperate and use commercially reasonable efforts to advance the eDNA Monitoring Program. Other than memorializing the funding process described more fully in Section 2.1.1 above, this MOU does not document, provide for, or commit to additional funds or exchange of personnel between the Parties.

3.0 COMMUNICATIONS

To provide consistent and effective communication between DSPC and DNREC, each Party appoints the following primary and alternate Person of Contact ("POC") to serve as its central point of contact on matters relating to this MOU. The email or postal addresses noted below should serve as the address for any notifications/correspondence between the Parties. Either Party may change its primary and/or alternate POC at any time by providing written notice of such change(s) to the Other Party's POC.

3.1 DSPC

3.1.1 Primary POC

Eugene R. Bailey
Executive Director
Diamond State Port Corporation
Port of Wilmington
c/o Office of the Secretary Department of State
820 North French Street, 4th Floor
Wilmington, Delaware 19801
302-577-8959
gbailey@port.state.de.us

3.1.2 Alternate POC

Sean McNeely
Treasurer
Diamond State Port Corporation
Port of Wilmington
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Wilmington, Delaware 19801
302-577-8988
Sean.McNeely@delaware.gov

3.2 DNREC

3.2.1 Primary POC

John G. Cargill IV
Hydrologist V
Delaware Department of Natural Resources and Environmental Control
The Richardson and Robbins Building
89 Kings Highway
Dover, Delaware 19901
302-395-2622
John.Gargill@delaware.gov

3.2.2 Alternate POC

Christopher Main

Environmental Scientist IV
The Richardson and Robbins Building
89 Kings Highway
Dover, Delaware 19901
302-739-9298
Christopher.Main@delaware.gov

4.0 APPLICABLE LAWS

This MOU and all documents and actions under it shall be governed by the applicable statutes, regulations, directives, policies, and procedures of the State of Delaware and County of New Castle.

5.0 DISPUTE RESOLUTION

The Parties agree that if a dispute arises, the Parties shall use their best efforts to resolve the dispute informally through consultation and communication or other forms of mutually acceptable non-binding alternative dispute resolution. If such measures fail to resolve the conflict, the Parties shall elevate the issue through their respective leaderships, and, if needed, the Parties shall refer the matter to a court with appropriate jurisdiction for resolution.

6.0 PUBLIC INFORMATION

DSPC is responsible for explaining its programs before other agencies, departments, and offices of the State of Delaware; federal agencies, departments, and offices; or any other governing body. Each Party shall give the other Party advance written notice in the event of a Freedom of Information Act request regarding the eDNA Monitoring Program, and before making any public statement regarding the work contemplated, undertaken, or completed pursuant to this MOU.

7.0 MISCELLANEOUS

7.1 Other Relationships or Obligations: This MOU shall not affect any pre-existing or independent relationships or obligations between the Parties.

7.2 Severability: If any provision of this MOU is determined to be invalid or unenforceable, the remaining provisions shall remain in force and unaffected to the fullest extent permitted by law and regulation.

7.3 Transferability: This MOU is not transferable except with the Parties' written consent.

8.0 REQUIRED REVIEWS

The Parties will review this MOU annually to determine if any amendments are necessary, on or around the anniversary of the Effective Date.

9.0 AMENDMENT, MODIFICATION, AND TERMINATION

This MOU may be modified or amended only by written, mutual agreement of the Parties. Through the Effective Date, either Party may terminate this agreement without cause by providing written notice to the other Party. After the Effective Date, if the other Party materially breaches any provisions of this MOU, either Party may terminate this MOU by providing at least 60 days written notice to the other Party.

10.0 AUTOMATIC TERMINATION

If USACE denies DSPC's permit application or otherwise rescinds the permit (by appeal or otherwise) this MOU will automatically terminate.

11.0 EFFECTIVE DATE

This MOU takes effect on April 1, 2022 (the "Effective Date").

12.0 EXPIRATION DATE

This MOU expires upon DNREC's delivery of the final summary memorandum contemplated in Section 2.2.5 above, unless terminated earlier. Notwithstanding the preceding, the Parties anticipate that any Future Agreements will supersede this MOU.

[Signature page follows]

The Diamond State Port Corporation

Eugene R. Bailey
Executive Director

3/02/2022
Date

State of Delaware
Department of Natural Resources and Environmental Control

Shawn M. Garvin
Secretary

Date

The Diamond State Port Corporation		**State of Delaware** **Department of Natural Resources and Environmental Control**	
Eugene R. Bailey Executive Director	Date	Shawn M. Garvin Secretary	3/02/22 Date

APPENDIX K

Brandywine Dam 2 Ecological Performance Standards

Ecological Performance Criteria for the Proposed Brandywine Dam 2 Nature-Like Fishway

Associated with the Edgemoor Port Mitigation

Prepared for:

Diamond State Port Corporation

Prepared by:

Kleinschmidt Associates

March 2022

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1. INTRODUCTION

The success of any upstream fishway is dependent on local hydrology, target species, life stage, dam orientation, and numerous other site-specific considerations that are incorporated into the design of the fishway. An important component of fishway design is defining the level at which the fishway is required to perform. The first step in any fishway design is to establish the fish passage objectives, which inform the design criteria for that particular project. After these are established, the next step is to develop performance criteria that will define the success of the fishway. Performance criteria typically are developed in accordance with the fishway's intended function and relate to evaluating if design criteria are attained and assessing if the target species are utilizing the fishway as intended.

The Performance Criteria for the proposed Rock Weir Nature-Like Fishway (NLF) at Brandywine Dam 2 (Brandywine Park Dam) fall into three major categories outlined as follows:

1. NLF Design Criteria
2. Fish Passage Effectiveness
3. Demonstration of Spawning/Foraging Habitat Use

DSPC proposes to complete monitoring and field work[1] as necessary to document success in these three categories, after which the NLF will be accepted as successful for providing upstream passage over Dam 2 for the target species (American Shad, Alewife and Blueback Herring). Once any one criterion/metric is met, fishway performance is considered acceptable for that criteria/metric and no additional monitoring will be required to show compliance with that criteria/metric. DSPC understands that that once the fishway is accepted, no additional monitoring or inspection will be required, other than visual inspections, as dictated in the Brandywine NLF Maintenance Plan (Kleinschmidt, 2022a) Section 2 and Section 3.a (NLF Maintenance Plan is included in DSPC's Final Mitigation Plan for the project at Edgemoor).

[1] As identified in the Brandywine NLF Monitoring Plan (Kleinschmidt, 2022b) included in DSPC's Final Mitigation Plan for the project at Edgemoor.

2. NLF DESIGN CRITERIA

The following criteria will be used to guide the design of the NLF. The design process generally is iterative in nature, often with input from involved fisheries resource agencies and private fish passage professionals, non-governmental organizations, and the dam owners. As such, design criteria may be modified or "fine-tuned" as the design process progresses.

The NLF at Dam 2 is being designed to pass three primary target species:

1. American Shad,
2. Alewife, and
3. Blueback Herring

Depending on availability, Alewife and Blueback Herring may be combined into one category termed, "River Herring". In this case, test specimens used in monitoring studies to determine passage effectiveness for herring would consist mainly of the most abundant species, most likely Blueback Herring. Table 1 indicates these species design guidelines based on swimming performance are essentially the same. At the request of DNREC, the performance of Hickory Shad in the NLF may be evaluated, but Hickory Shad will not be a target species and the success of the Brandywine NLF in meeting the NLF Performance Criteria will in no way be tied to the results of any Hickory Shad monitoring performed as described in the NLF Monitoring Plan.

Additional migratory species such as American Eel, as well as many resident fish species, are expected to use the NLF, but the design of the fishway will focus on providing passage for American Shad and River Herring. Physical design criteria will follow the fish passage criteria for the target species as summarized below in Table 1 from the Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes (Turek et al., 2016) ensuring that adequate water depth, velocity, and resting habitat for target species are provided. The most restrictive criteria for each of the three target species will be used to develop the fishway, with multiple zones of passage established to provide variable flows and depths to accommodate the target species. This approach ensures passage for the weakest swimmers from the target species. The NLF is anticipated to have pools with depths of at least 4 feet, widths of at least 20 feet, and lengths as dictated by site constraints and hydraulics. Velocities in weir notches will target less than 6.0 feet per second (fps) for River Herring (Alewives and Blueback Herring) and less than 8.25 fps for American Shad. The slope will be set to 1:30 (or shallower) to minimize hydraulic drops and maintain the recommended hydraulics in the channel. The hydraulics will be modeled with a 2-D hydraulic model and validated in the field after the project is constructed (see the NLF Monitoring Plan included in DSPC's Final Mitigation Plan for the project at Edgemoor).

Table 1. Summary of Federal Interagency Nature-like Fishway Passage Design Guidelines for American Shad, Blueback Herring, and Alewife

	Minimum Pool/ Channel Width (ft)	Minimum Pool/ Channel Depth (ft)	Minimum Pool/ Channel Length (ft)	Minimum Weir Opening Width (ft)	Minimum Weir Opening Depth (ft)	Maximum Weir Opening Water Velocity (ft/second)	Maximum Fishway Channel Slope
Species	**W_p**	**d_p**	**L_p**	**W_N**	**d_N**	**V_{max}**	**S_O**
American Shad (*Alosa sapidissima*)	20.0	4.00	30.0	5.00	2.25	8.25	1:30
Blueback Herring (*Alosa aestivalis*)	5.0	2.00	10.0	2.25	1.0	6.00	1:20
Alewife (*Alosa pseudoharengus*)	5.0	2.25	10.0	2.50	1.0	6.00	1:20

Note: Blue shaded cells indicate most restrictive design guidelines for American Shad and river herring.

Additional design criteria proposed for this project include:

1. Fish passage type: full-width Rock Weir Nature-like Fishway
2. Location: immediately downstream of Brandywine River Dam 2
3. NLF Operational Range: The NLF will provide suitable passage from the 95% exceedance to the 5% exceedance flows during the fish passage season, as based on the USGS Gage 01481500 on the Brandywine River at Wilmington for the past 20 years of data and removing permitted water withdrawal flows as noted below to account for the City of Wilmington's water withdrawal above Dam 2 (19 MGD/29 cfs Average Day, 63 MGD/97 cfs maximum permitted withdrawal).

Percent Exceedance (passage season)	River Flow above Dam 2 and City Withdrawal (cfs)*	Allowance for City Withdrawal (cfs)**	NLF Design Flow at Dam 2 (cfs)
5	1,326	0	1,326
50	470	29	441
95	233	97	136

* *Flow is from USGS Gage 01481500. The flow was not adjusted due to the small difference in drainage areas from the gage to the project site.*

** *Most conservative assumption for fishway flow; to be evaluated as design progresses and may be modified to be less conservative if this drives design to include an additional weir or other major cost implications to address these conservative design parameters, as it is understood that the City rarely, if ever, utilizes their maximum permitted withdrawal.*

4. Design Flood/Stability Event: The structure will be designed to resist major structural failures during a reasonably anticipated 100-year return period flood event.
5. There will be no substantial impact to Wilmington's water withdrawal operations at the Dam or at their intake facility upstream of the Dam.
6. The fishway will have three "Zone of Passage" (ZOP) notches at varying elevations along each of the rock weirs below the concrete dam. At least two ZOP notches (3 if hydraulically feasible and approved by cultural resources staff) will be included in the crest of Dam 2.
7. The fish passage season is considered as March 15 through June 15 annually.
8. The 2019 USFWS Region 5 Fish Passage Engineering Design Criteria (USFWS, 2019) will be used to guide the design, but given the infrastructure constraints at the site, the design will be in accordance with the guidelines as much as practical and agreed to by the regulatory agencies.
9. To preserve the City of Wilmington's ability to a provide potable water supply, provisions for gates will be provided that allow the City of Wilmington to close the east and west notches in Dam 2 during periods of extremely low flow (<150 cfs at USGS Gage 01481500).
10. The ZOP notches will be suitable for downstream passage.

3. FISH PASSAGE EFFECTIVENESS

Biological performance criteria for the fishway will focus on: 1) passage effectiveness (i.e., how many fish that encounter the fishway successfully exit upstream). Additionally, the number of forays/attempts at passage into the lowest pool of the NLF and fishway ascendance rate will be monitored and reported annually to inform any adaptive management decisions relative to the need for modifications of the fishway.

Although NLFs are currently considered a preferred option when fish passage is required at low-head dams, there is limited data available on their effectiveness. A study conducted in 2013-2015 by Raabe et al., (2019) to determine passage effectiveness of American Shad in a large rock weir NLF constructed on the Cape Fear River in 2012, reported 53% to 65% of tagged shad passed upstream. This facility was the first NLF constructed on the East Coast for American Shad. Since that time, design standards have been modified to better emulate natural river conditions and provide hydraulic conditions commensurate with target species' swimming abilities. Also, it should be noted that the fisheries biologists who led the monitoring studies for the Cape Fear River NLF noted their concern that the collection and tagging methods used for that study may have had an impact on the migratory motivation (fallback) of the fish used in the study, which likely impacted the results of that study. Current professional opinion is that a properly designed and constructed Rock Weir NLF for American Shad and other Alosine species in relatively small rivers should be able obtain upstream passage efficiencies of 70 – 95% and with a minimal migration

delay of 4 – 5 days (Kleinschmidt, 2021). As such, the proposed target upstream passage efficiency for a Rock Weir NLF for American Shad, Alewife and Blueback Herring (River Herring) at Dam 2 is a 3-year running average or three out of four sequential years of 70%.

No downstream passage effectiveness monitoring is proposed because of the availability for downstream migration over the full 130-foot width of Dam 2, which is very large, relative to the small canal opening (~15 feet). Additionally, the three proposed zone of passage notches in Dam 2 (each ~6-foot wide and 2.5′ deep) and notches in each of the downstream rock weirs are anticipated to provide highly effective downstream passage. Finally, the debris boom across the raceway has an approximately 18″ deep continuous fin under the debris boom, which will further discourage fish from entering the raceway.

4. DEMONSTRATION OF SPAWNING AND FORAGING HABITAT USE

While passage of fish through the NLF achieves the objectives of removing the upstream migration barrier, additional documentation of successful use of spawning and foraging habitat upstream of Dam 2 is necessary. Approaches to document successful use of upstream habitat by Alosine species are detailed in the NLF Biological Monitoring Plan (included in DSPC's Final Mitigation Plan for the project at Edgemoor) and include haul seining, targeted surveys by skilled anglers, ichthyoplankton sampling, visual observations of adult spawning and young of the year foraging activities, and analysis of radio telemetry and PIT tag returns.

Spawning and foraging by the target species will be assessed up to Dam 4. Spawning and foraging habitat use shall be qualitatively documented for Alosines by at least two of the following methods:

1. Any of the methods detailed in Section 4 of the NLF Biological Monitoring Plan (Kleinschmidt, 2022b), including:
    a. PIT tagging/skilled angler survey
    b. Haul Seining
    c. ichthyoplankton sampling
2. By detection of target species by radio telemetry between Dams 3 and 4 for three consecutive years or four out of five consecutive years, sampling conditions permitted (e.g., an extremely high flow year that resulted in mass outmigration of juveniles could be removed and not counted toward the consecutive years of monitoring, if so agreed by the agencies). If this criterion is achieved in the first 3 years of monitoring, no further monitoring is required for this criterion.

5. REFERENCES

Kleinschmidt. 2021. Brandywine River Dams 2-6 Engineering Feasibility Assessment and Fish Passage Alternatives Analysis. 54 pp.

Kleinschmidt. 2022a. Maintenance Plan for the Proposed Brandywine Dam 2 Nature-Like Fishway. 5 pp. February, 2022.

Kleinschmidt. 2022b. Biological Monitoring Plan for the Proposed Brandywine Dam 2 Nature-Like Fishway. 14 pp. March, 2022.

USFWS (U.S. Fish and Wildlife Service). 2019. Fish Passage Engineering Design Criteria. USFWS, Northeast Region R5, Hadley, Massachusetts. 248 pp. Raabe, J.K., J.E. Hightower, T.A. Ellis, and J. J. Facendola. April 2019. Evaluation of Fish Passage at a Nature-Like Rock Ramp on a Large Coastal River. Trans. Am. Fish. Soc., 148, pp. 798-816.

APPENDIX L

Fox Point State Park Wetland Restoration Maintenance Report Template

WETLAND MONITORING REPORT

FOX POINT STATE PARK
WETLAND REHABILITATION

Wilmington Harbor – Edgemoor Expansion Compensatory Mitigation Project

US ARMY CORPS OF ENGINEERS INDIVIDUAL PERMIT
CENAP-OP-R-2019-278

PREPARED FOR:

Diamond State Port Corporation

PREPARED BY:

MONITORING YEAR: _____

DATE OF REVEIW: _____

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1.0 INTRODUCTION

Fox Point State Park is located adjacent to the proposed project location along the Delaware River and provides an opportunity to develop environmental improvements in the immediate area where impacts will occur from construction of the Port of Wilmington expansion. The design will restore intertidal habitat and wetland area including features to provide productive foraging habitat for native fish species as well as habitat for other aquatic species.

The design provides for the removal and treatment of the invasive plant phragmites from the one-acre site. The site is then excavated down to appropriate elevations to provide intertidal interaction and hydrology creating a range of habitat communities from deep to shallow and emergent intertidal wetlands.

The rehabilitation of an intertidal wetland serves as an in-kind, offsite mitigation project to compensate for the filling of intertidal areas as part of the construction of the proposed container port at Edgemoor.

1.1 Location (landscape, waterbodies, adjacent land use, etc.)

1.1.1 Landmarks

The mitigation area is at the up river end of the Fox Point State park Locate at the northern end of Lighthouse Road in Edgemoor, Delaware

Additional Information Provided Following Construction

1.1.2 Information to locate perimeter

Additional Information Provided Following Construction

1.1.3 Coordinates (lat/long)

The Project is located at latitude: 39.769505, Longitude -75.480340

1.1.4 Purpose, acreage, offset, dates for construction and plantings

Additional Information Provided Following Construction

1.1.5 Date of Site Inspections

Additional Information Provided Following Construction

1.1.6 Weather at Current Inspection

Additional Information Provided Following During Review

1.2 Existing site conditions

Additional Information Provided Following During Review

1.3 Recent corrective or maintenance activities since previous report submission

Additional Information Provided Following Construction and during Review

2.0 MONITORING METHODS

2.1 Monitoring Standards

Monitoring is conducted to document that the rehabilitation efforts provide:

- *Intertidal habitat.*
- *Tidal exchange of river flows.*
- *A stable habitat free of invasive species.*

2.2 Ecological Performance Standards

The ecological performance standards are focused on providing resilient intertidal wetland habitat, tidal exchange of river flows and a stable habitat free of invasive species. The standards include:

- *Wetland Vegetation Dominance.* Establish a wetland community within the vegetated area where more than 50 % of the dominant plant species are rated obligate, facultative wet, or facultative utilizing the USACE established vegetation sampling procedures.
- *Aerial Cover Standards.* Achieve long term stability of the wetland by establishing a 5-year aerial coverage of natural species consistent with the reference site of 75 percent of the vegetated area. To achieve this long - term goal, incremental aerial cover standards of 45 percent at 1 year and 60 percent at three years shall be considered.
- *Control of Invasive Species.* The design of the wetland has incorporated grade changes to minimize the extent of the wetland area that is at elevations prone to invasive species (primarily phragmites). The wetland shall be managed to not greater than 5 percent invasive species.
- *Wetland Hydrology.* The rehabilitated habitat is to consist of intertidal wetland with connectivity to the Delaware River. The Applicant shall survey the constructed wetland to document that the habitat provided includes the

proper tidal hydrology and substrate elevations, and that the wetland areas flood during typical tidal fluctuations.

2.3 Qualitative Monitoring (Visual)

The monitoring of the constructed habitat consisted of an initial period of monthly visits to perform the following qualitative assessments of the constructed wetlands:

2.3.1 Overall site conditions
2.3.2 Flow conditions
2.3.3 Plant survival
2.3.4 Cover
2.3.5 Species Composition
2.3.6 Additional assessments Delaware River flows reach 100-year flood or elevation
2.3.7 Photographic documentation
2.3.8 Inspection of inlet/outlet structures

2.4 Quantitative Monitoring (Vegetation Quadrants)

Quantitative assessments are conducted toward the end of each growing season at quadrants established in each habitat type, including a reference area in adjacent emergent wetlands. Each vegetation community/habitat type was monitored to assess performance of the mitigation areas and the potential need for institutional controls (e.g., management of invasive species). These assessments are also intended to verify the stability of the intertidal habitat and that habitat loss has not been experienced though sedimentation other means. The quantitative assessment will verify sufficient growth and survivability to meet the anticipated survivability rate of the plants for the establishment period, and direct sufficient supplemental plantings to achieve a stable wetland environment or engage other adaptive management measures.

For each assessment event, the area shall be visually reviewed and six discrete field cells were sampled. Each field cell is a randomly selected plot approximately four feet by four feet. The following data is to be documented:

- Dominant vegetation species
- Percent of ground cover
- Number of woody plants stems greater than 10 inches in height
- The percentage of dominant species facultative or greater.
- The percent survival by planted species; and
- The percent cover of invasive species.

2.5 Qualitative Monitoring (Hydrology/Exchange Flow)

The Assessment shall verify:

- Establishment and verification of proper tidal hydrology and substrate elevations relative to closest tidal datum. Tidal inundation appropriate to

the planned community type is present throughout the site.

- Tides must alternately flood and expose the land surface at least twice daily. The surface elevations of this wetland type will be between the mean high and mean low tide elevations.

2.6 Quantitative Monitoring (Hydrology/Exchange Flow) Years 1, 3 and 5

Site Review and Surveying shall be performed in years 1 3 and 5 and shall document:

- The field delineated High Tide Line
- Mean High Water elevation
- Size of the wetland area
- Elevation of the inlet/outlet structure
- Observed Vegetation Bear Spots

3.0 MONITORING RESULTS

Based on the monitoring results summarized below, the results indicate that the performance standards are trending toward success OR are being met (short statement required).

3.1 Qualitative Results (Visual)

Overall site conditions

Flow conditions

Plant survival

Vegetation Cover

Species Composition

Inlet/Outlet Structures

3.2 Quantitative Results (Vegetation Quadrants)

QUADRANT/ FIELD CELL	Dominant Species	Ground Cover (% in Plots)	Stem Count (greater than 10 inches in height)	Species Richness	Invasive Species (% in Plots	Survival (%)

3.3 Vegetation Density

3.4 Qualitative Results (Hydrology/Exchange Flow)

3.5 Quantitative Results (Hydrology/Exchange Survey)

4.0 ADAPTIVE MANAGEMENT

4.1 Identified Areas of Concern

4.2 Additional corrective or remedial actions

4.3 Additional monitoring

4.4 Regulatory Notifications

5.0 REFERENCES

APPENDIX M

Brandywine Dam 2 Preliminary Monitoring Plan

Biological Monitoring Plan for the Proposed Brandywine Dam 2 Nature-Like Fishway

Associated with the Edgemoor Port Mitigation

Prepared for:
Diamond State Port Corporation

Prepared by:
Kleinschmidt Associates

March 2022

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1.0 INTRODUCTION

Diadromous fish species require safe, timely, and effective access to high quality habitats at different life stages to successfully survive and reproduce. On Brandywine Creek, multiple low head dams currently prevent upstream migration of fish. These adverse impacts can be mitigated by dam removal and/or installing properly designed nature-like fishways (NLF) following criteria provided by the United States Fish and Wildlife Service (USFWS, 2019) and found in the Federal Interagency Nature-Like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes (Turek et al., 2016). After the fishway is installed, a monitoring program designed to document whether Performance Criteria for the fishway are achieved is essential to ensuring that the fishway is operating successfully. The following monitoring program identifies field study methodologies/approaches to determine if agreed upon Performance Criteria metrics for the Brandywine Dam 2 NLF are achieved (see corresponding Ecological Performance Criteria as included in Diamond State Port Corporation's (DSPC's) Final Mitigation Plan for the project at Edgemoor). The three Performance Criteria metrics make up the major sections below, with proposed monitoring method(s) included within each section.

1. NLF Design Criteria:
    a) As-Built Survey
    b) Hydraulics Verification
2. Upstream Fish Passage Effectiveness:
    a) Radio Telemetry Studies
3. Demonstration of Spawning and Foraging Habitat Use:
    a) PIT Tagging/Skilled Angler Survey
    b) Haul Seining
    c) Ichthyoplankton Sampling
    d) eDNA Sampling[1]

It should be noted that completion of the monitoring plan will be adaptive in nature, with subsequent studies building on experiences and lessoned learned in previous study efforts at the NLF and on the Brandywine Creek in general. Any substantial modifications to this plan will occur in consultation with natural resource agencies prior to implementation. All reporting generated as a result of the monitoring plan will be submitted to the following parties:

[1] In coordination with the Delaware State DNA Monitoring and Research Project conducted as part of the mitigation package for DSPC's proposed project at Edgemoor.

NLF Monitoring Plan Reporting Parties:

- Diamond State Port Corporation
- City of Wilmington, Delaware
- DNREC Fisheries
- USFWS
- NOAA NMFS

The DSPC proposes to complete monitoring and field work as necessary to document success in these three categories, after which the NLF will be accepted as successful for providing upstream passage over Dam 2 for the target species (American Shad, Alewife and Blueback Herring – combined as "River Herring" depending on availability). Once any one criterion/metric is met, fishway performance is considered acceptable for that criteria/metric and no additional monitoring will be required to show compliance with that criteria/metric. DSPC shall be responsible for monitoring activities identified in this plan during the evaluation period required to determine that the NLF meets the performance criteria (Kleinschmidt, 2022a) as outlined in the DSPC Final Mitigation Plan for the Port at Edgemoor. DSPC may complete the monitoring activities themselves or assign monitoring activities to agents, employees, contractors, or designee(s). DSPC understands that that once the fishway is accepted, no additional monitoring or inspection will be required, other than visual inspections, as dictated in the NLF Maintenance Plan (Kleinschmidt, 2022b) Section 2 and Section 3.a (NLF Maintenance Plan is included in DSPC's Final Mitigation Plan for the proposed project at Edgemoor).

2.0 NLF DESIGN CRITERIA

As described in the NLF Performance Criteria for this project (Kleinschmidt, 2022a), the design criteria will be evaluated against the as-built condition to ensure the constructed fishway and resultant hydraulics within the fishway generally meet the overall objectives for the target species. The following actions will be completed to document compliance with the design criteria for the proposed river-wide Rock Weir NLF at Brandywine Dam 2 (Brandywine Park Dam).

2.1 As-Built Survey

DSPC shall complete an as-built survey within 1 year of project completion. The survey will compare as-built dimensions and elevations to those in the final design drawings, including red-line markups of the design drawings. This survey shall capture the following components of the design at a minimum:

1. dam notch width and invert elevation
2. top of boulder locations and elevations across each weir

3. Zone of Passage notch widths and invert elevations
4. maximum pool depths
5. profile along each of the NLF Zones of Passage that captures the breadth of the weir (upstream to downstream dimension), pool depth, and distance between weirs at all weirs below the dam

The as-built survey shall be stamped by a Professional Surveyor licensed in Delaware and filed with the NLF Reporting Parties. Generally, the average notch and boulder elevations shall be within 0.25-feet of the design elevation, with trends in elevation change consistent with the NLF Design.

2.2 Hydraulics Verification

This phase is essential to developing proper hydraulics in the fishway, as this allows for field adjustments to achieve the desired geometry and hydraulic conditions. After the fishway is functionally complete[2], DSPC shall complete a survey of the average water levels in the pools, as well as water depths and average velocities in the zone of passages at low flow when the NLF is safe to access, along with performing observations of the overall hydraulics (especially at higher flows) for consistency with the design. DSPC will compare the hydraulic measurements with the design hydraulic model depths/velocities and evaluate the observed conditions relative to fish passage effectiveness to determine if modifications to the fishway should be recommended. The results of this hydraulic verification shall be presented in a short memo and filed with NLF Reporting Parties.

3.0 FISH PASSAGE EFFECTIVENESS

Biotelemetry will be used to assess upstream fish passage effectiveness for American Shad and River Herring. These technologies include radio telemetry, acoustic telemetry, and passive integrated transponders (PIT). Each technology has advantage and drawbacks and depending on study objectives and site conditions, any one or a combination of technologies could be appropriate for use.

Generally, radio telemetry to monitor fish behavior works well in shallow (> 15 m), freshwater systems, either fast flowing and turbulent or slow moving and calm. Signals from the transmitter are received through above water, directional antennas or in some cases, specially designed underwater antennas. Range from radio transmitters can be lowered to as low as 5 feet to examine passage through a gate or similar structure or increased to over 1,000 feet to cover the full width

[2] Ideally this would be before the contractor demobilizes, but this may not be feasible, depending on accessibility due to river flows.

of a large water body. Tracking of test specimens is done from stationary receiving locations and mobile receivers (boat, vehicle, airplane).

Acoustic telemetry to monitor fish behavior works well in deep freshwater, brackish water, and saltwater environments that have minimal turbulence. Air entrainment and water turbulence, commonly found in shallow rapids and riffles in freshwater river systems, boulders and bedrock outcroppings, as well as acoustic noise generated by machinery (boats, water intakes, etc.) often interfere with signal reception which is obtained by deployment of an underwater hydrophone. In a well-designed acoustic system in relatively deep water, a hydrophone array can provide very accurate three-dimensional location data, including the depth where a telemetered specimen is located. However, applicability of acoustic telemetry for evaluation of fish passage performance in a shallow turbulent NLF or in free-flowing riffle sections of the Brandywine Creek will be limited due to signal interference.

PIT tags are small transponders usually injected into the body cavity or musculature of a test specimen. The tag is "energized" and transmits its unique signal when the fish passes through an area energized by a wire antenna configured either in a loop or as a flat linear array. PIT tags are often used in evaluation of fish ladders, fish lifts, and downstream passage collection devices because of the confined nature of these structures enable deployment of antennas in constricted areas where fish are forced to pass through a small space easily energized with a wire loop or linear antenna. These structures also protect antennas from damage due to debris and high water. Monitoring large notches in dams or long expanses on dam crests or stream beds has been problematic in many locations. Based on experience and recommendations from PIT tag manufacturers, PIT tag technology was dropped from consideration as a method to monitor fishway effectiveness. PIT tagging will however be used in determination of target species' spawning and habitat use (Section 4.0).

Based on the advantages and drawbacks of each technology, the Brandywine NLF Technical Subcommittee (BNLFTS) concluded that relative to the objectives for evaluating fish passage effectiveness for American Shad and River Herring that radio telemetry is the most appropriate technology for use at the proposed rock weir NLF at Dam 2. A study approach is outlined below.

3.1 Radio Telemetry Studies

Starting in the first spring migration season after confirmation that the rock weir NLF was constructed according to design and is operating properly, a multi-year telemetry study will be conducted to determine fish passage effectiveness (i.e., successful upstream passage of fish through the NLF) for American Shad and River Herring. The BNLFTS also discussed the need for downstream passage studies and the potential concern for entrainment/diversion of outmigrating

adults and juvenile Alosines into the City of Wilmington's water supply system. As documented in the NLF Performance Criteria (Kleinschmidt, 2022a), the downstream passage rate of outmigrating Alosines (adults and juveniles) is anticipated to be high given the full-river width fishway, deep zone of passage notches, and the debris barrier and fin across the raceway, therefore no downstream passage monitoring is proposed.

The fish passage efficiency study will be iterative in nature, utilizing lessons learned from one year in subsequent years to modify study approaches and techniques to ensure study objectives are attained. The study approach determined most appropriate by the BNLFTS includes:

1. At least 10 months prior to the start of the first upstream migration season following completion of the NLF, DSPC shall prepare and submit to the NLF Reporting Parties for review a Dam 2 Fish Passage Monitoring Plan (the "Monitoring Plan") containing detailed protocols for the monitoring studies and target areas for receiver deployment/data collection.
2. American Shad, Alewife and Blueback Herring are the species of interest and the major design criteria for the NLF is focused on the swimming capabilities of these species (Turek et al., 2016). It is recognized that Alewife population numbers are declining and consequently, test specimens of this species may not be available in numbers required for appropriate sample size. Alternatively, Blueback Herring are abundant relative to Alewife and the NLF design criteria for both species is essentially the same (Turek et al., 2016). Attempts will be made to meet sample size requirements for both herring species, but in the likely event that Alewife are not readily available, a combination of Alewife and Blueback Herring (collectively referred to as River Herring) will be used to meet the sample size.
3. Sample size of test specimens will be determined with a simple numerical model developed in R, focusing on the number of test subjects needed to determine the 90% confidence limit around a passage estimate of 70% (the agreed upon performance criteria for upstream passage; Kleinschmidt, 2022a), as shown in Appendix A. The number of fish entering the fishway will be considered as the sample size for each year of study. During the first year of study, the sample size goal will be 50 American Shad and 50 River Herring (50 of each River Herring species if availability permits), as stated in Appendix A. Attaining this sample size will likely require the tagging of additional fish to account for drop-back and mortality. Accordingly, a total of 60 Shad and 60 River Herring be tagged in the first year of study, providing 10 additional fish of each species. Following an adaptive management approach, the sample size would be increased or decreased in subsequent years, if necessary.
4. DNREC also has an interest in the management of Hickory Shad on Brandywine Creek. This fish is closely related to American Shad, Alewife, and Blueback Herring and is a prized game fish known for their jumping and fighting ability on hook and line. They are relatively abundant in Brandywine Creek in Spring, arriving about the same time as Alewife. The Hickory Shad's life history and body morphology is very similar to American Shad and

River Herring; however, their swimming performance characteristics have not been widely studied and consequently, NLF fishway design criteria for this species based on empirical swim speed data is lacking (Turek et al., 2016). During the first year of study, Hickory Shad will be added as a species of interest on an experimental basis to collect empirical data on their ability to navigate an NLF. Because NLF design criteria for Hickory Shad based on empirical swim speed data is lacking, the results of passage efficiency studies with Hickory Shad will not be used as part of the NLF's performance criteria but is intended to add to the body of NLF/natural bypass design data for this species, as requested by DNREC. Hickory Shad specimens for tagging will be collected opportunistically (no additional sampling just for Hickory Shad) during sampling episodes targeted at American Shad and River Herring. Total Hickory Shad tagged in the first year will be based on availability of both Alewife and Hickory Shad with the total tagged specimens combined not to exceed 60 fish. Following an adaptive management approach, the sample size would be increased or decreased in subsequent years, if necessary, but will not exceed 60 combined Alewife and Hickory Shad tagged in any one year of effectiveness studies.

5. Test specimens will be collected in the Brandywine Creek by boat-mounted electrofishing, haul seining, and/or targeted angling by skilled/select anglers working in conjunction with fisheries technicians. Collection efforts will be in collaboration with DNREC.
6. Transmitter "attachment" will be gastric insertion though the esophagus.
7. Transmitter size and will be specific to species and study objectives relative to battery life required.
8. Transmitter frequency, antenna configuration, and receiver location will be determined after site-specific range and noise testing. At a minimum, receiver location will collect data to discern the entrance of individual fish into the fishway, residence time of fish within the fishway, exit of individual fish from the fishway, and identification of fish which have dropped back downstream beyond a specified location (Figure 3-1). In addition to the four monitoring locations aimed at evaluating fish passage effectiveness, two receiver locations will be established upstream of Dam 3 and downstream of Dam 4 to document upstream passage at Dam 3 and utilization of potential spawning and foraging habitat upstream of Dam 2 (Figure 3-1). Receiver and antenna configurations may change in subsequent years based on lessons learned and adaptive management considerations.
9. All radio-tagged test specimens will also be PIT tagged for additional study in upstream habitat and for potential recognition as return spawners in subsequent years.
10. Spring upstream migration season is considered as 15 March to 15 June. Three years of study (or as required to document the NLF meets the Performance Criteria) are anticipated to determine fishway performance over a range of river flow during this time. In general, the range defining typical high and low flows during the American Shad upstream passage season is:
    a) typical low flow range: 230 cfs to 470 cfs
    b) typical high flow range: 470 cfs to 1,330 cfs

11. Biological performance criteria for the fishway will focus on passage effectiveness. In addition to fish passage efficiency, the number of forays/attempts at passage and fishway ascendance rate will be determined and reported annually to inform any adaptive management decisions relative to the need for modifications of the fishway.
12. Studies may be modified/postponed/delayed, after consultation with the NLF Reporting Parties for extenuating circumstances such as:
    a) high water/flooding that necessitates the removal of monitoring equipment,
    b) repairs/physical adjustments to the fishway that require deployment of equipment (e.g., excavators, cranes, coffer dams) that would not make fish passage representative if monitored, or
    c) lack of test specimens available in the Brandywine Creek.
13. Study reporting and subsequent year study plan adjustments, if needed, shall be submitted for NLF Reporting Parties by November 30 of the calendar year in which the work occurred.

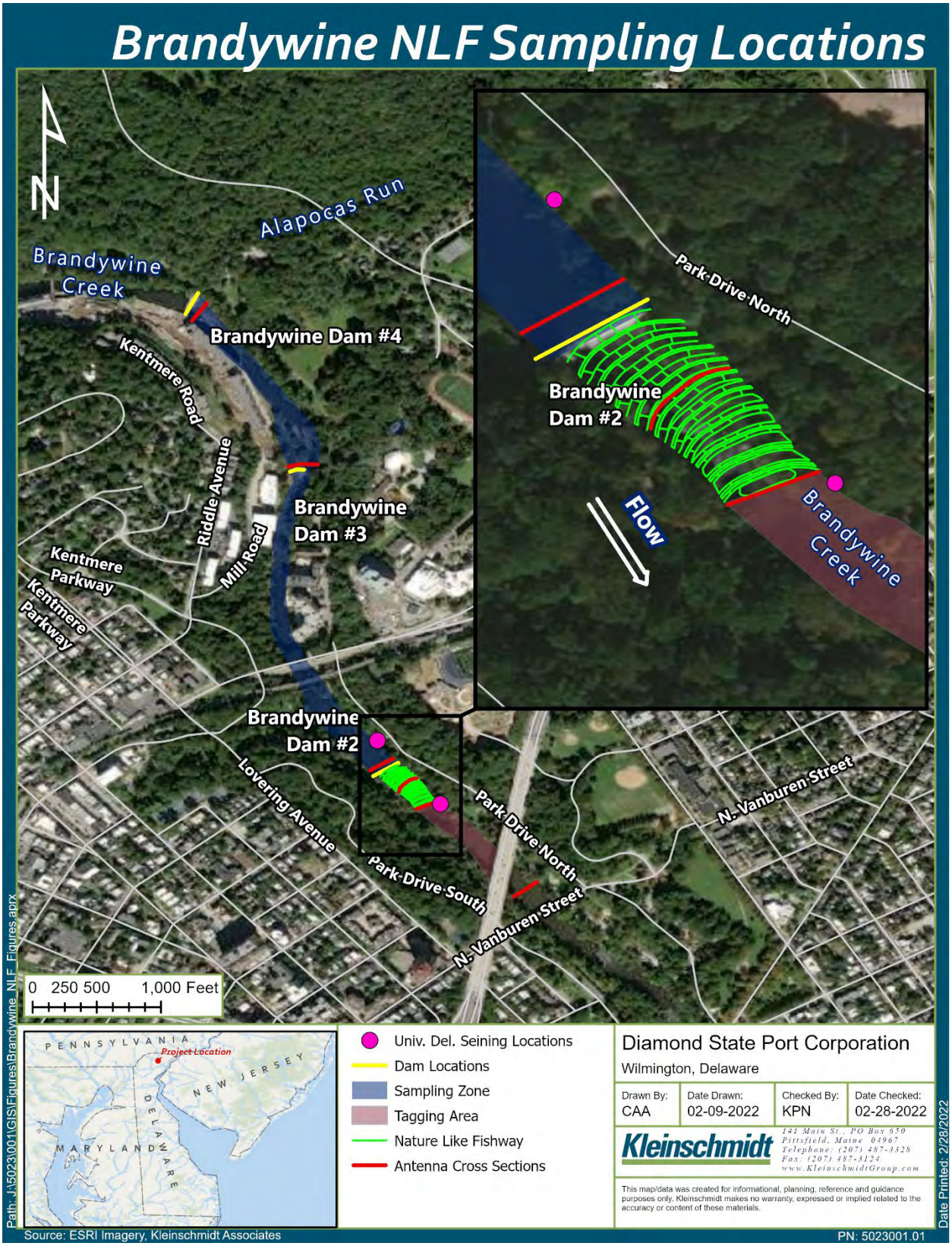

Figure 3-1. Brandywine NLF Radio Telemetry Receiver Locations

4.0 DEMONSTRATION OF SPAWNING AND FORAGING HABITAT USE

Ultimately the goal of fish passage is to provide access to suitable upstream habitats for adult spawning and rearing of juveniles to increase population abundance. The use of habitat upstream of Dam 2 by Alosine species (e.g., American Shad, River Herring) for spawning and foraging will be determined on a quantitative and qualitative basis as an additional measure of program success. Spawning and foraging habitat use by target species will be assessed up to Dam 4 and will be qualitatively documented for the target species as required by Section 4 of the Performance Criteria for this NLF included in DSPC's Final Mitigation Plan for the project at Edgemoor. If this criterion is achieved in the first 3 years of monitoring, no further monitoring will be required.

In addition to the methods described below, radio telemetry and visual observations of spawning activities by the target species will be used to qualitatively confirm use of the upstream river reaches between Dams 2 and 4. Most of this work will build upon existing programs or begin implementation of new approaches. A brief summary of the annual field efforts and qualitative results related to the NLF Performance Criteria (Kleinschmidt, 2022a) will be presented in a Study Report (including any suggested subsequent year study plan adjustments) that is submitted for NLF Reporting Party review by December 31 of the calendar year in which the work occurred.

4.1 PIT Tagging/Skilled Angler Survey

Targeted angling by skilled anglers will be used to help determine the distribution of Alosines upstream of Dam 2 after the passage season starts. A systematic sampling program will target specific areas of the river based on a statistically derived study design. Additionally, migration timing above Dam 2 will be determined through this study by recapture of Alosines PIT tagged downstream of Dam 2 during collection of test specimens for the radio telemetry study. In addition to the target species that will be both radio-tagged and PIT tagged, an additional 75 American Shad specimens and 75 River Herring specimens, (an additional total of 150 target fish, if available, with exact ratio/quantity dependent on study objectives and collection efforts below Dam 2) will be PIT tagged for potential recapture by anglers upstream of Dam 2. This study will last approximately 12 weeks over the migration season with collection of test specimens for tagging conducted by the same methods utilized to tag fish for radio telemetry below Dam 2. Anglers fishing above Dam 2 will be accompanied by a biological technician to collect morphometric data on captured fish and to scan specimens for the presence of a PIT tag.

In addition, PIT tagging will be utilized to help determine population estimates of American Shad and River Herring through a mark/recapture experiment. Collection for both tagging and recapture will be electrofishing, angling, and seining (if river conditions permit) as described above. Ideally, if the timing of permit issuance for construction allows, a baseline population

estimate based on PIT tagging prior to construction of the fishway would provide the best overall data for understanding population fluctuations and redistribution in Brandywine Creek after installation of the NLF. DNREC and other parties are interested in obtaining population estimates for American Shad and River Herring, and a partial-width PIT-tag antenna downstream of Dam 2 may be considered in pursuit of this data.

4.2 Haul Seining for Juvenile Alosine Abundance

Haul seining is currently being conducted at one location downstream and one location upstream of Dam 2 (Brandywine, 2020 YOY Report) and is being used to help examine the recovery of diadromous fish to the Brandywine Creek. Seining will be expanded to suitable locations upstream of Dam 2 and will be conducted by DSPC twice monthly from July through October after installation of the NLF. Sampling via haul seining will be conducted at the two existing locations and a minimum of two additional locations upstream of Dam 2 and Dam 3. Based on field reconnaissance, seining sampling locations will be selected in each of the zones identified in Figure 4-1. Haul seining will be conducted annually following installation of the NLF to document successful reproduction of Alosines between Dams 2 and 4.

Seine samples will be conducted using a modified Swingle Method (Park & Stangl 2020; Swingle 1956) which includes anchoring one end of the net and then conducting a single arc through the water column. All fish collected will be enumerated and identified to the lowest taxonomic level possible and released alive. Length data will be obtained from a random subsample (e.g., n = 20) of each Alosine species collected.

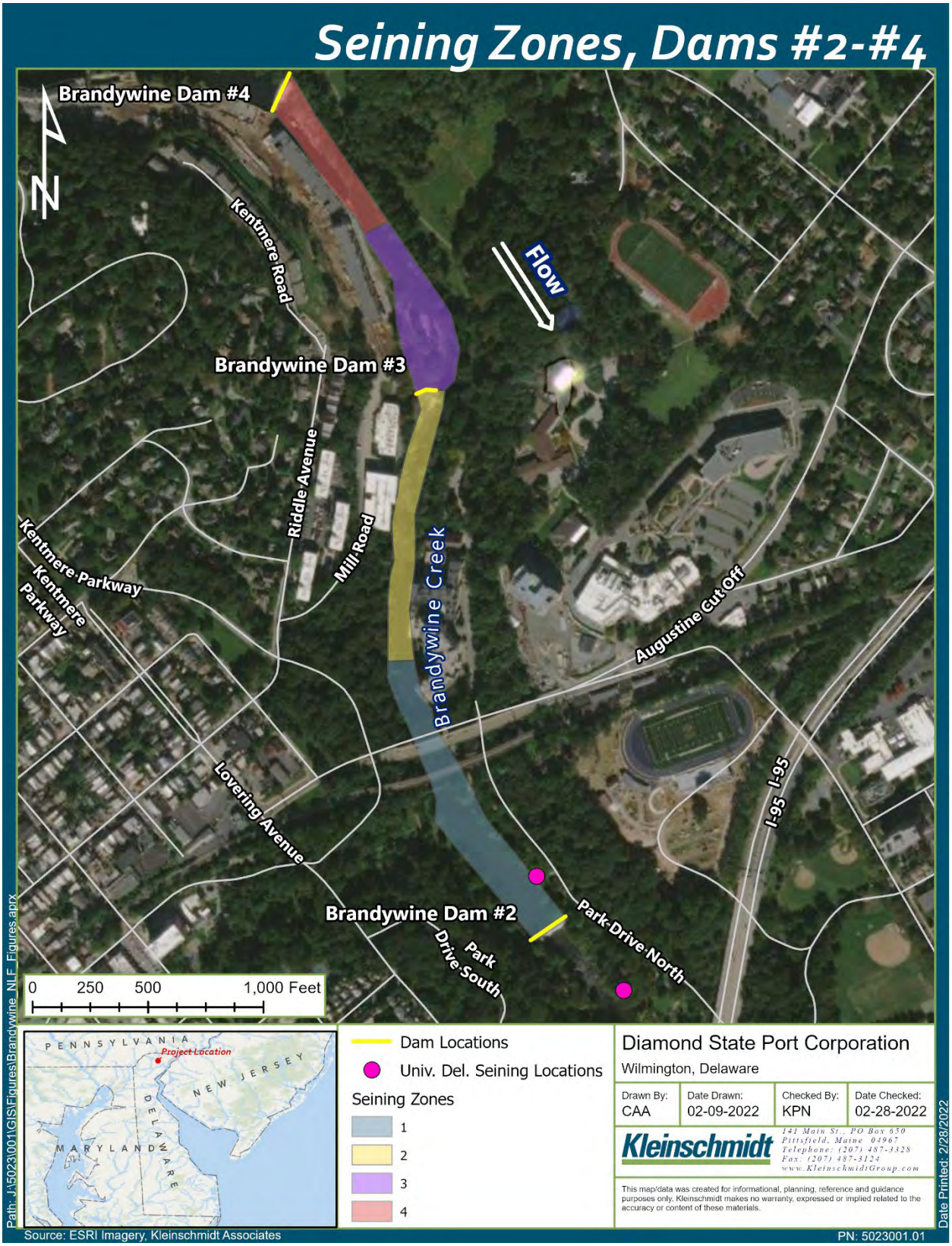

Figure 4-1. Proposed Haul Seining Zones for Brandywine Creek

4.3 Ichthyoplankton Sampling

During the spring season migratory fish passage is provided at Dam 2, qualitative ichthyoplankton samples will be collected upstream of Dams 2 and 3 to verify target fishes are spawning within the Dam 2 to Dam 4 reach. The intent of this work is not to quantify egg deposition but to confirm spawning is occurring in several locations where Alosines would be expected to spawn. Ichthyoplankton samples will be collected at a minimum of three locations upstream of Dam 2 and Dam 3 during three sampling events between April 15 and May 30. Based on field reconnaissance, sampling locations will be selected in each of the zones identified in Figure 4-2.

Samples will be collected at dusk/nighttime by anchoring a half or full meter net just below the water surface for 10 minutes in areas identified as a likely spawning location either by visual observation of spawning behavior or a concentration of fish identified by the skilled anglers participating in the distribution study. All samples will be preserved in 95% ethanol after collection. Samples will be sorted and eggs and ichthyofauna will be identified to species.

Figure 4-2. Proposed Ichthyoplankton Sampling Locations on the Brandywine Creek

4.4 eDNA Sampling

In collaboration with State of Delaware's eDNA Monitoring and Research Project, eDNA samples will be collected by DSPC annually during the 3-5 years of evaluating NLF performance criteria to determine species distribution and potentially abundance in relation to operation of the NLF. Species of interest, sampling protocols, timing, and frequency of sampling will be determined by the DNREC with the main focus on redistribution of fish from below Dam 2 to upstream of Dam 2 after installation of the NLF. The BNLFTS agreed that eDNA is not the primary method to document Alosine habitat use of the area above Dam 2 but could be very helpful and provide baseline data for other efforts aimed at restoring fish passage on Brandywine Creek.

5.0 REFERENCES

Hale, Edward A. 2020. An Annual Report Examining the Recovery of Diadromous Fishes in the Brandywine Creek, DE. 11 pg.

Kleinschmidt. 2021. Brandywine River Dams 2-6 Engineering Feasibility Assessment and Fish Passage Alternatives Analysis. 54 pp.

Kleinschmidt. 2022a. Ecological Performance Criteria for the Proposed Brandywine Dam 2 Nature-Like Fishway. 6 pp. March, 2022.

Kleinschmidt. 2022b. Maintenance Plan for the Proposed Brandywine Dam 2 Nature-Like Fishway. 5 pp. February, 2022.

Raabe, J.K., J.E. Hightower, T.A. Ellis and J. J. Facendola. April 2019. Evaluation of Fish Passage at a Nature-Like Rock Ramp on a Large Coastal River. Trans. Am. Fish. Soc., 148, pp. 798-816.

Turek, J., A. Haro, and B. Towler. 2016. Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes. Interagency Technical Memorandum. 47 pp.

U.S. Fish and Wildlife Service. 2019. Fish Passage Engineering Design Criteria. 248 pp.

APPENDIX A

SAMPLE SIZE AND STATISTICAL ANALYSIS OF RADIO-TAGGED AMERICAN SHAD AND RIVER HERRING TO ASSESS FISH PASSAGE EFFECTIVENESS AT BRANDYWINE DAM 2 NLF MEMORANDUM

MEMORANDUM

To: Gene Bailey - Diamond State Port Corporation

From: Tyler Kreider, P.E., Scott Ault, Chris Frese, Kevin Nebiolo - Kleinschmidt

Cc: Tom McGonigle - Barnes & Thornburg LLP

Date: January 26, 2022

Re: Sample Size and Statistical Analysis of Radio-tagged American Shad and River Herring to Assess Fish Passage Effectiveness at Brandywine Dam 2 NLF

Radiotelemetry will be used to assess American Shad and River Herring (Alewife and Blueback Herring) fish passage effectiveness through the proposed Nature-Like Fishway (NLF). Starting in the first spring migration season after confirmation that the rock weir NLF was constructed according to design and is operating properly, a 3-year telemetry study will be conducted for American Shad and River Herring to determine fish passage effectiveness. The study will be iterative in nature, utilizing lessons learned from one year in subsequent years to modify study approaches and techniques to ensure study objectives are attained. Modifications during the study could include increases or reductions in sample size; adjustments in seasonal timing of tagging; modifications to capture and tagging techniques; and adjustments to receiver and antenna location and configuration.

Test specimens will be collected in the Brandywine River by boat-mounted electrofishing, haul seining, and/or targeted angling by skilled/select anglers working in conjunction with DNREC. It is anticipated that tagging of Shad and River Herring would begin in late March or early April and continue weekly until water temperatures reach 68.0°F for four consecutive days. Tagging will be suspended when river flow exceeds approximately 1,200 cfs (DE USGS Gage #01481500) and resume when river flow recedes to safe working conditions.

Each year up to six groups of pre-spawned Shad and River Herring each will be tagged during a 6 to 8-week period encompassing the expected migration season. Shad and River Herring will be tagged immediately after capture. Test specimens will be placed in a water-filled tagging cooler and immobilized with a piece of fine mesh netting or a hinged PVC foam-padded tube to reduce stress. Fish will be measured, sexed (visual inspection only), and a radio transmitter will be inserted orally through the esophagus into the stomach. Radio-tagged specimens will also receive a unique PIT tag (passive integrated transponder) in conjunction with additional studies being conducted on distribution and habitat use.

To determine an appropriate sample size for fish passage effectiveness studies, Kleinschmidt conducted a simple numerical experiment in R to calculate the interquartile range about an effectiveness estimate of 70% (i.e., 70% performance criteria for the NLF). For the radio telemetry study, we consider sample size to be the number of fish entering the fishway. Fish in addition to this number will need to be tagged to account for potential dropback and/or mortality of tagged specimens.

Table 1 contains the model output of the statistical experiment with sample sizes from 5 to 70 individuals. Alpha and beta are the shape parameters for the beta distribution, where alpha is the number of successful migrants needed to reach the 70% passage criteria for a given sample size and beta is the number of fish that failed to pass. The interquartile range, or IQR, is equivalent to the 90% confidence interval about the 70% mean. Note, as sample sizes increase, the interquartile range decreases, and the precision of the estimate of fish passage effectiveness increases.

The value of this statistical experiment is that results highlight the point at which increases in sample size reach diminishing returns in terms of statistical robustness of the passage effectiveness estimate. The point of diminishing returns for statistical robustness around a 70% effectiveness estimate appears to be a sample size of 50. Beyond a sample size of 50 fish, there is little gain in precision of the estimate. For example, with a sample size of 50 fish, the 90% confidence interval will be +/- 11%, whereas, at 70 fish the 90% will be confidence interval will be +/- approximately 9%, an increase in precision of only 2% on either side of the estimate. Given the results of this model, we propose a sample size of 50 tagged fish need to reach the entrance of the NLF. This sample size will likely require the tagging of additional fish to account for drop-back and mortality. Accordingly, a total of 60 Shad and 60 River Herring be tagged in the first year of study. This would provide 10 additional fish of each species to provide at least the 50 fish sample size needed to attain precision at the 90% confidence interval. Following an adaptive management approach, the sample size would be increased or decreased in subsequent years, if necessary.

This approach was reviewed in detail with the Brandywine NLF Technical Subcommittee on January 24, 2022, and was approved by those that attended (USFWS, NMFS, DNREC).

Table 1. Sample size and confidence limits around a 70% fish passage estimate at the 90% confidence interval.

Sample Size # of Fish Entering the NLF	**Alpha** # of Fish Successfully Passing NLF to Reach 70%	**Beta** # of Fish that Failed to Pass	**LL** (90%) Lower Confidence	**UL** (90%) Upper Confidence Limit	**IQR** (90%) Interquartile Range
5	3.5	1.5	34.93%	95.40%	60.47%
10	7.0	3.0	45.04%	90.23%	45.19%
15	10.5	4.5	49.65%	87.23%	37.57%
20	14.0	6.0	52.42%	85.25%	32.83%
25	17.5	7.5	54.31%	83.84%	29.52%
30	21.0	9.0	55.71%	82.75%	27.05%
35	24.5	10.5	56.79%	81.89%	25.10%
40	28.0	12.0	57.66%	81.19%	23.53%
45	31.5	13.5	58.38%	80.60%	22.21%
50	35.0	15.0	58.99%	80.09%	21.10%
55	38.5	16.5	59.51%	79.65%	20.14%
60	42.0	18.0	59.97%	79.26%	19.29%
65	45.5	19.5	60.37%	78.92%	18.55%
70	49.0	21.0	60.73%	78.62%	17.89%

APPENDIX N

Brandywine Dam 2 Preliminary Maintenance Plan

Maintenance Plan for the Proposed Brandywine Dam 2 Nature-Like Fishway

Associated with the Edgemoor Port Mitigation

Prepared for:
Diamond State Port Corporation

Prepared by:
Kleinschmidt Associates

April 2022

Nature-like fishways (NLFs) are considered to have low maintenance requirements after construction because they replicate natural river systems. The proposed Rock Weir NLF design for Dam 2 on the Brandywine Creek is intended to be self-flushing, which reduces, if not eliminates, the need to remove debris from the fishway. This self-flushing may take time and will depend upon water level fluctuations to dislodge and carry away debris. One case example is the Midtown Rapids NLF, on the Red River in Minnesota, which required no maintenance in the 10-year period following construction despite the first, fourth, and sixth largest floods of a 125-year period of record (Aadland, 2010). Similarly, no maintenance has been required at the United States Army Corps of Engineer (USACE) Cape Fear NLF in at least the first seven years after construction was completed in 2012 and accordingly, the USACE has not found the need to prepare a Maintenance Plan (Yelverton, 2019). While logs and woody debris accumulate from time to time, they are generally flushed through on the next high flow event. Overall, a minimal amount of maintenance is anticipated, for a Rock Weir NLF at Dam 2 with most activity focused primarily around ensuring the initial stability of the structure post-construction.

Regardless that minimal maintenance of the NLF is anticipated, the Diamond State Port Corporation (DSPC) will assume responsibility for all maintenance activities for the foreseeable future. DSPC may complete the maintenance activities themselves or assign maintenance activities to agents, employees, contractors, or designee(s).

The maintenance activities anticipated for the Brandywine Dam 2 NLF are detailed below and include Pre-NLF Acceptance Tasks, Post-Flood Inspections, Post-NLF Acceptance Inspection and Maintenance Tasks, and NLF Repairs.

1. **Pre-NLF Acceptance Tasks**

   DSPC shall be responsible for the inspection and maintenance of the Dam 2 Rock Weir NLF during the evaluation period required to determine that the NLF meets the Brandywine NLF Performance Criteria (Kleinschmidt, 2022) as outlined in the DSPC Final Mitigation Plan for the Port at Edgemoor. Once it is determined that the NLF meets the performance criteria the NLF will be "accepted" and the fishway will enter the Post-NLF Acceptance period (detailed below). The following tasks shall be part of the Pre-NLF Acceptance tasks:

   a. Visual Inspection – Visual inspections shall occur four times per year during the Pre-NLF Acceptance period as follows:

      1) The first inspection shall be conducted prior to the start of fish passage season (target March 1),

      2) Second inspection shall occur during the fish passage season (target April 15),

      3) Third inspection shall occur during the fish passage season (target May 15), and

4) Fourth inspection during the seasonal low-flow period (target September).

The upstream fish passage season is generally considered to be March 15th to June 15th for American Shad, Alewife, and Blueback Herring (the three target species for this fishway). The seasonal low-flow period is generally considered August to November. Visual inspections shall be done to qualitatively observe the condition of the fishway for comparison to past observations. It is recommended that shore-based visual observations be supplemented by drone-based aerial observation, when feasible.

The qualified observer completing the Pre-NLF Acceptance Inspections, Post-Flood Inspections, and Post-NLF Acceptance Inspections shall be familiar with the construction of nature-like fishways and river hydraulics, as well as with the subject site. This could include a fish passage engineer, a fisheries biologist, trained maintenance staff member, or resource agency personnel who has reviewed the site design and prior monitoring efforts to familiarize themselves with the desired site conditions. The qualified observer needs to be familiar with the site enough to recognize differences in flow, depth, and NLF condition as compared to previous inspections based on visual observation.

The following shall be documented/observed during each visual inspection by a qualified observer, as described above:

i. River Flow:

   1) Record flow at USGS Gage No. 01481500 Brandywine Creek at Wilmington, Delaware.

   2) Request and record City of Wilmington combined water withdrawal from the Dam 2 Headrace and the Wills Raw Water Pumping Station to determine and document actual flow over the NLF.

   3) Record local staff gage water level (staff gage to be installed during construction).

ii. Weir Zone of Passage Notches

   The NLF consists of a series of rock weirs. Each of the rock weirs is created by stacking boulders side by side at a consistent elevation in an arched configuration. Each of the rock weirs will have a set of Zone of Passage Notches that consist of a series of boulders which are recessed at a lower height than the neighboring boulders. These notches are the primary flow path through the fishway and primary passage route for fish, particularly at lower flows. During visual inspection the following observations should be made regarding the Weir Zone of Passage Notches.

1) Are there blockages? If yes, indicate weir no. (numbering from upstream to downstream, with Dam 2 as weir no. 1), notch location (north, center, south), and cause of blockage.

2) What is flow type (streaming or plunging)? If plunging, indicate weir no. and notch location.

   As an example, in the below picture, the flow is from top to bottom, with streaming flow on the left and plunging flow on the right.

3) Is the flow turbulent? If yes, indicate weir no. and notch location.

4) Is the drop per pool consistent across the fishway? If no, indicate which pool is the outlier (pools numbered from upstream to downstream).

iii. Weir boulders

1) Are boulders dislodged or shifted? If yes, indicate weir no., boulder location, and cause (if it can be determined).

2) Are any boulders cracked or otherwise damaged? If yes, indicate weir no. and boulder location.

iv. Foundation stone

1) Is the foundation stone (below the boulders) dislodged or shifted, as observable during low flow periods or as evidenced by poor hydraulic conditions? If yes, indicate weir no. and location.

v. Dam 2 Flow Control Notches

1) Are there any blockages to the flow control notches in the dam? If yes, indicate which notch and the cause of the blockage.

2) Is there any visible damage to the notch and/or other flow control system components? If yes, indicate which notch and describe damage.

vi. Photo Documentation - Provide photographic documentation of any noted items above, along with general fishway photographs from photo monitoring points (minimum of eight photo monitoring points to be established immediately after construction).

vii. File a summary report from each inspection (including photos) within 30 days with the DSPC, City of Wilmington, Delaware's Department of Natural Resources and Environmental Control (DNREC), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), and U.S. Fish & Wildlife Service (USFWS).

b. Accumulated Debris Removal

In general, debris removal is not anticipated to be required regularly. In-river debris removal shall be triggered only if two or more zone of passage notches are more than 75% blocked on a single weir and safe access to remove the debris or to the river (as applicable) is feasible. Access to the NLF for debris removal will depend on river flows (safe access to the river likely required to perform debris removal), time of year (limited need for immediate debris removal in late summer, as higher fall flows will flush the NLF), and available equipment. No debris removal is anticipated for the weirs, as the zone of passage notches will be the primary routes of fish passage and the most critical component of the upstream fish passage. Anticipated means of debris mobilization from the zone of passage notches could include:

i. pushing debris loose with a pole from shore

ii. wading into the water with a saw to cut debris up to free it from the NLF

iii. using a shore-based winch to pull debris off of the NLF

iv. using an excavator (shore based or in-water) to pick up and remove or free the debris

c. Dam 2 Flow Control System Maintenance

The flow control structure(s) on the dam are anticipated to only require minimal maintenance, as the intent is that this is not utilized frequently. The maintenance is anticipated to include annual confirmation that stoplogs and a lifting device for the stoplogs are available if needed to close off the flow control notches equipped with stoplog slots. The exact Dam 2 zone of passage maintenance requirements may be further developed once the flow control notch design is finalized.

2. **Post Flood Inspection**

   This inspection by a qualified observer shall occur whenever flows at the USGS Gage on the Brandywine Creek at Wilmington, DE reach a 10-year return period flow of 17,300 cfs or more. Inspections may also be warranted after prolonged periods of drought, followed by moderate to large flow events; the necessity of such drought inspections shall be determined by DNREC fisheries staff and requested of DSPC within 30 days of the event. DSPC shall be responsible for completing these Post-Flood Inspections. The Post-Flood Inspections shall occur for the life of the fishway and include the following tasks:

   a. Visual Inspection (as detailed above) – Allow time following the storm for flows to recede to allow for effective visual observation. Inspections shall occur within 2 weeks of the return to baseflow conditions.

   b. Perform debris removal, as guided and required by the Accumulated Debris Removal guidance above.

3. **Post-NLF Acceptance Inspection and Maintenance Tasks** – After the evaluation period of the NLF to obtain the acceptance of the NLF as mitigation for the DSPC port project, DSPC shall be responsible for ensuring the fishway is inspected, maintained, and functional. This could be through execution of the inspections and maintenance themselves, in accordance with any established long-term agreement(s), or as performed by DSPC's agents, contractors, or designees. The following shall be performed on the schedule noted below, with task activities and reporting as detailed in Section 1 above:

   a. Visual Inspection – perform two visual inspections annually by a qualified observer in late winter (target February) and low flow period (target August), with the scope of the visual inspection as described in Section 1.a.i through 1.a.vii above.

   b. Accumulated Debris Removal – as needed based on criteria in Section 1.b above.

   c. Dam 2 Flow Control System Maintenance – annually as described in Section 1.c above.

4. **NLF Repairs** – If the hydraulics are substantially impaired due to damage to the fishway (e.g., due to highwater events, debris, or ice) in such a manner as to prohibit reasonable fish passage of the target species, repairs may be required after consultation with the City of Wilmington, USACE, DE SHPO (only for impacts to raceway or Dam 2), USFWS, NOAA NMFS, and DNREC. The critical components are the zone of passage notch depths, widths, and flow velocities; drop per pool; and pool depth. DSPC shall prepare a short proposal outlining the poor conditions and what is being proposed to remediate those conditions within 3 months of learning of the damage or poor performance. This proposal shall be submitted to and accepted by USACE, DE SHPO (only for impacts to raceway or Dam 2), USFWS, NOAA NMFS, and DNREC prior to initiating the work. All repairs shall be developed to restore the initial design that met the fish passage effectiveness criteria, unless determined otherwise in consultation with the resource agencies. The as-built drawings (to be attached to this plan post-construction) shall guide any repair efforts.

References

Aadland, Luther. 2010. Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage. Minnesota Department of Natural Resources, Ecological Resources Division. Fergus Falls, Minnesota.

Kleinschmidt. 2022. Ecological Performance Criteria for the Proposed Brandywine Dam 2 Nature-Like Fishway. 6 pp. February, 2022.

Yelverton, Frank. 2019. Personal Communication via email. August 16, 2019.

APPENDIX O

Memorandum of Understanding Between NCCD And DSPC

MEMORANDUM OF UNDERSTANDING
FOR
POST-ACCEPTANCE INSPECTION AND MAINTENANCE
OF THE BRANDYWINE DAM 2 NATURE-LIKE FISHWAY
BETWEEN
THE DIAMOND STATE PORT CORPORATION
AND
THE NEW CASTLE CONSERVATION DISTRICT.

1.0 PURPOSE

This Memorandum of Understanding ("MOU") is newly adopted by and between the Diamond State Port Corporation ("DSPC") and the New Castle Conservation District ("NCCD") (collectively the "Parties" and each individually, a "Party") to outline the Parties' understanding regarding responsibilities for post-acceptance inspection and maintenance of a nature-like fishway ("NLF") at Dam 2 along the Brandywine Creek. The Parties intend the NLF to allow resident and migratory fish upstream access to portions of the Brandywine Creek otherwise prohibited by Dam 2's current construction (the "Fish Passage Project"). DSPC is including the Fish Passage Project as part of a proposed final mitigation plan for the US Army Corps of Engineers ("Federal Mitigation Plan") to offset possible environmental impacts of DSPC's project to construct a primary harbor access channel and ship berth in the Delaware River at DSPC's Edgemoor property.

Dam 2 is located along the Brandywine Creek in the City of Wilmington (the "City). The City owns Dam 2 and the adjoining lands on both the north and south banks of the Brandywine Creek. Brandywine Park, owned by the City and managed by the State of Delaware's Department of Natural Resources and Environmental Control ("DNREC"), Division of Parks and Recreation is located on the north side of the Creek. Dam 2 represents critical infrastructure for the City's potable water supply, and is in close proximity to City sewer utilities.

DSPC expects resource agencies will evaluate the NLF's performance for a period until the NLF satisfies the Performance Criteria identified in the Federal Mitigation Plan. While the NLF is being reviewed by the resource agencies, DSPC is responsible for all maintenance and monitoring ("Pre-Acceptance Maintenance and Monitoring"). Once the NLF receives approval by the resource agencies, the NLF will require collaboration regarding ongoing maintenance and periodic inspection given the importance of the infrastructure, the involvement of several key stakeholders, and the desire to provide suitable fish passage. This MOU outlines the Parties' commitment to undertake all necessary steps to maintain the NLF following approval by the resource agencies ("Post-Acceptance Inspection and Maintenance").

2.0 SCOPE OF SERVICES

The Parties agree to undertake the following actions and/or provide the following services to each other:

2.1 DSPC:

2.1.1 Shall accept ultimate responsibility for providing fish passage for American shad, blueback herring, and alewife at Dam 2, according to the Federal Mitigation Plan;

2.1.2 Shall accept ultimate responsibility for Pre-Acceptance Maintenance and Monitoring and for confirming that NCCD completes Post-Acceptance Inspection and Maintenance appropriately;

2.1.3 Shall be responsible for any costs of repair necessary to maintain NLF operability as recommended by NCCD in coordination with DSPC, DNREC, the U.S. Fish & Wildlife Service ("USFWS"), and the National Oceanic and Atmospheric Administration ("NOAA") National Marine Fisheries Service ("NMFS") under 2.2.5 below;

2.1.4 Shall be responsible for coordinating any repair under 2.2.5 with NCCD, DNREC, the USFWS, NOAA NMFS;

2.1.5 Shall be responsible for any permit or lease renewals required by DNREC or the US Army Corps of Engineers; and

2.1.6 Shall provide prepayment, to NCCD, for all repairs and maintenance, in accordance with estimates provided by NCCD.

2.2 NCCD:

2.2.1 Shall provide Post-Acceptance Inspection and Maintenance, which shall include: visual inspection(s) of the NLF and reporting on the visual inspection(s), according to the timeline and procedures included in the Federal Mitigation Plan;

2.2.2 Shall remove accumulated debris from the NLF to ensure proper functioning according to the timeline and procedures included in the Federal Mitigation Plan;

2.2.3 Shall perform an additional visual inspection and remove accumulated debris according to procedures included in the Federal Mitigation Plan whenever flows at the USGS Gage on the Brandywine Creek reach or exceed the Post-Flood Inspection threshold (as stated in the Federal Mitigation Plan), within two weeks of the return to baseflow conditions;

2.2.4 Shall maintain records regarding the results of all inspections, maintenance, and debris removal, and shall provide copies of all records to DSPC annually;

2.2.5 Shall accept operational responsibility for NLF repairs if the hydraulics are substantially impaired from damage (e.g., highwater events, debris, or ice) that inhibits reasonable fish passage, in coordination with DSPC, DNREC, USFWS, NOAA NMFS according to the procedures outlined in the Federal Mitigation Plan. NCCD shall promptly notify DSPC of any costs related to maintaining operational responsibility under this paragraph; and

2.2.6 Shall provide estimates and change orders to DSPC, for acceptance, in advance of proceeding with any project or change to an active project.

If the US Army Corps of Engineers designates any permit condition(s) relevant to this MOU, the Parties agree to negotiate in good faith to accommodate the permit condition(s) under a new MOU. Services under this MOU may be provided by agents, consultants, and contractors. The Parties understand and agree that it may be necessary to negotiate and execute certain mutually beneficial future agreements ("Future Agreements"). Each Party agrees to negotiate any Future Agreements in good faith. Each Party further agrees to cooperate and use commercially reasonable efforts to efficiently maintain the Fish Passage Project.

3.0 NOTICE AND COMMUNICATIONS

To provide consistent and effective communication between DSPC and NCCD, each Party appoints the following primary and alternate Person of Contact ("POC") to serve as a central point of contact on matters relating to this MOU. The email or postal addresses noted below should serve as the address for any notifications/correspondence between the Parties.

3.1 DSPC

3.1.1 Primary POC
Eugene R. Bailey
Executive Director
Diamond State Port Corporation
Port of Wilmington
c/o Office of the Secretary Department of State
820 North French Street, 4th Floor
Wilmington, Delaware 19801
302-577- 8959
gbailey@port.state.de.us

3.1.2 Alternate POC
Sean McNeely
Treasurer
Diamond State Port Corporation
Port of Wilmington
820 North French Street, 8th Floor
Wilmington, Delaware 19801
302-577-8988

Sean.McNeely@delaware.gov

3.2 NCCD

3.2.1 Primary POC
Kevin C. Donnelly
District Coordinator
New Castle Conservation District
2430 Old County Road
Newark, Delaware 19702
302-832-3100
Kevin.Donnelly@delaware.gov

3.2.2 Alternate POC
Bruce Macolley
Business Manager
New Castle Conservation District
2430 Old County Road
Newark, Delaware 19702
302-365-8971
Bruce.Macolley@delaware.gov

4.0 APPLICABLE LAWS

This MOU and all documents and actions under it shall be governed by the applicable statutes, regulations, directives, policies, and procedures of the State of Delaware, and County of New Castle.

5.0 DISPUTE RESOLUTION

The Parties agree that if a dispute arises, the Parties shall use their best efforts to resolve the dispute informally through consultation and communication or other forms of mutually acceptable non-binding alternative dispute resolution. If such measures fail to resolve the conflict, the Parties shall elevate the issue through their respective leaderships, and, if needed, the Parties shall refer the matter to a court with appropriate jurisdiction for resolution.

6.0 PUBLIC INFORMATION

DSPC is responsible for explaining its programs before other agencies, departments, and offices of the State of Delaware; federal agencies, departments, and offices; or any other governing body; or in response to a properly submitted Freedom of Information Act request. In general, DSPC is responsible for all public information. DSPC shall make all public announcements and respond to all inquiries regarding the administration process.

7.0 MISCELLANEOUS

7.1 Other Relationships or Obligations: This MOU shall not affect any pre-existing or independent relationships or obligations between the Parties.

7.2 Severability: If any provision of this MOU is determined to be invalid or unenforceable, the remaining provisions shall remain in force and unaffected to the fullest extent permitted by law and regulation.

7.3 Transferability: This MOU is not transferable except with the Parties' written consent.

8.0 REQUIRED REVIEWS

The Parties will review this MOU annually, on or around the anniversary of the Effective Date.

9.0 AMENDMENT, MODIFICATION, AND TERMINATION

This MOU may be modified or amended only by written, mutual agreement of the Parties. Either Party may terminate this MOU by providing at least 60 days written notice to the other Party.

10.0 EFFECTIVE DATE

This MOU takes effect on the day after the last Party signs (the "Effective Date").

11.0 EXPIRATION AND RENEWAL

This MOU shall automatically renew on the tenth anniversary of the Effective Date (the "Renewal Date") unless terminated earlier. Notwithstanding the preceding, the Parties intend that the Future Agreements will supersede this MOU.

[Signature page follows]

The Diamond State Port Corporation

Gene Bailey — 03/07/2022

Eugene R. Bailey — Date
Executive Director

The New Castle Conservation District

Kevin Donnelly — 3/4/2022

Kevin Donnelly — Date
District Coordinator

APPENDIX P

Diamond State Port Corporation Financial Assurance Commitment

DIAMOND STATE PORT CORPORATION

Office of the Secretary, Department of State 4th Floor
820 N. French Street, Wilmington, DE 19801
Phone 302.354.2927| eMail: gbailey@port.state.de.us

March 7, 2022

Mr. Todd Schiable
Chief, Regulatory Division
U.S. Army Corps of Engineers
Philadelphia District
Wanamaker Building
Philadelphia, PA

RE: CENAP-OR-R-2019-278 – Financial Assurances

Dear Mr. Schiable:

We appreciate the continued collaboration with the U.S. Army Corps of Engineers ("USACE") regarding Diamond State Port Corporation's proposed expansion of the Port of Wilmington at the Edgemoor site in Delaware. Through this letter, the Diamond State Port Corporation ("DSPC") intends to memorialize its commitments to the proposed Final Compensatory Mitigation Plan, as part of the financial assurances requirement under 33 C.F.R. § 332.3(n).

As you know, DSPC is proposing a Final Compensatory Mitigation Plan that includes: (1) the construction of a nature-like fishway to allow fish passage at Dam 2 on the Brandywine Creek in Wilmington; (2) restoration of wetlands along the Delaware River at the Fox Point State Park adjacent to the Edgemoor site; and (3) support for an eDNA fishery monitoring and research program to be developed with and implemented by the Delaware Department of Natural Resources and Environmental Control (collectively, the "Mitigation Projects").

DSPC is a body corporate and politic established under 29 Del. C. § 8781 within the Department of State. Section 8781 provides that DSPC is governed by a Board of Directors that shall include certain members of the Delaware General Assembly and the Governor's cabinet. For example, the Board includes the co-chairs of the General Assembly's Joint Committee on Capital Improvement, which is the committee charged with overseeing and making appropriation decisions for the State's capital budget. The Board includes the Controller General, who provides nonpartisan fiscal analyses to the General Assembly and fiscal staff support for the Joint Committee on Capital Improvement. In addition, the Board includes the Secretary of State and the Secretary of Finance, which are the cabinet positions we hold. Our respective departments (the Department of State and Department of Finance) oversee most of the tax and fee revenue for the State. The Governor's Secretary of Transportation and Secretary of the Department of Safety and Homeland Security also serve on the Board. Their departments play important roles regarding the State's transportation infrastructure and security.

DSPC receives funding from various sources, including a concession agreement that provides annual payments as part of an agreement for the operation of the Port. DSPC also receives funding from various federal grants. Perhaps most importantly, DSPC has a long history of receiving appropriations from the State of Delaware to support its efforts. In fact, DSPC sought and received funding last year for some

of the Mitigation Projects, and the General Assembly appropriated $3 Million in the Fiscal Year 2022 Bond and Capital Improvements Act.

It is our understanding that 33 C.F.R. § 332.3(n)(1) provides that "[i]n cases where an alternate mechanism is available to ensure a high level of confidence that the compensatory mitigation will be provided and maintained (e.g., a formal, documented commitment from a government agency or public authority) the district engineer may determine that financial assurances are not necessary for that compensatory mitigation project." DSPC also understands the USACE Philadelphia District has accepted written assurances from state agency applicants as sufficient financial assurances for mitigation plans. To that end, DSPC accepts responsibility for the Mitigation Projects and understands that even if specific responsibilities are delegated to another governmental agency by agreement, DSPC is ultimately responsible for funding and ensuring the continued performance of the Mitigation Projects. In short, we respectfully suggest DSPC's commitment to construct and maintain the approved elements of the Final Compensatory Mitigation Plan, coupled with the significant demonstrated support for this project among elected and appointed officials in Delaware, constitutes adequate financial assurances without the need for any additional requirements.

DSPC looks forward to our continued collaboration and finalization of the Edgemoor expansion and the Final Compensatory Mitigation Plan. Please contact us if you have any questions.

Sincerely,

Jeffrey W. Bullock

Chair
Diamond State Port Corporation
Board of Directors

Sincerely,

Richard J Geisenberger

Rick J. Geisenberger

Vice-Chair
Diamond State Port Corporation
Board of Directors