New Jersey Sports and Exposition Authority

Meadowlands District 2019 – 2023 Wetland Program Plan

The overall program goal of the New Jersey Sports and Exposition Authority's (NJSEA) Meadowlands District 2019 – 2023 Wetland Program Plan (WPP) is to preserve, protect, monitor and restore the more than 4300 acres of wetlands and other natural habitat that lie within the Meadowlands District. Formerly known as the New Jersey Meadowlands Commission, NJSEA continues to undertake the founding mandates of the Commission which include protecting the delicate balance of nature under changing conditions within this urban environment.

The strategy for reaching this goal rests on five main initiatives:

1. Preserve existing wetland and other natural open space habitat owned and managed by the NJSEA within the Meadowlands District;

2. Monitor and assess the wetland and other natural habitats of the Meadowlands to better understand the complex urban ecosystem, and prepare for future changing conditions;

3. Restore and protect degraded wetland and other natural habitats within the District;

4. Acquire additional wetland and other natural habitats owned by others within the District for preservation, restoration and protection purposes; and,

5. Work in coordination with other land owners, land managers and non-profit organizations who work with or own land in the Meadowlands to assist them with preserving, restoring and protecting the wetlands and other natural habitats located within the District.

NJSEA's Master Plan, scheduled for completion in the spring of 2020, states that it is essential to understand the District's unique ecosystem to properly manage and maintain it. As such, NJSEA continues to monitor and assess its existing wetland habitats, target and prioritize potential preservation and restoration sites for acquisition, and pursue funding opportunities to further restore and protect degraded wetland habitat located within the District. Additionally, NJSEA seeks to increase public access to and education about the wetlands and waterways in the District.

To date, NJSEA has acquired or holds management rights to more than 2700 acres of wetland and adjacent habitat for preservation and protection. Additionally, approximately 1600 acres of wetlands and other natural habitats located within the Meadowlands but owned by others have been preserved and protected. All of these wetlands have been affected over time by changing conditions and, in general, the functions and services provided by these wetlands have been adversely affected. NJSEA and its partners are actively working to understand these changes while also working to preserve and protect existing wetland functions and services, document continued wetland stressors, and develop potential restoration opportunities to assist with the recovery of the Meadowlands.

The development of NJSEA's 2019-2023 WPP is based on NJSEA's previous WPP, developed and approved by the USEPA for the years 2012-2017. That initial plan documented the on-going monitoring and assessment efforts being undertaken by NJSEA and the Meadowlands Environmental Research Institute – Rutgers University (MERI). The 2019-2023 WPP builds on the earlier document, and includes new activities and collaborations.

In addition to these on-going efforts, NJSEA seeks to collaborate with statewide plans set forth by the New Jersey Department of Environmental Protection (NJDEP) toward a unified goal of:

> *Improving and protecting the significant ecosystem services and functions provided by wetlands including flood control, shoreline stabilization, coastal storm surge protection, water purification, nutrient cycling, sediment retention, provision of habitat for plants and wildlife, reservoirs of biological diversity supporting food webs, as well as providing meaningful recreation, sustainable economic benefits from tourism, and excellent opportunities for environmental education.*

As such, NJSEA's five-year plan includes two Core Elements, including:

1) monitoring and assessment, and
2) voluntary restoration and protection.

These core elements are described in more detail below, along with an additional element central to NJSEA's wetland efforts, public outreach and education.

Core Element 1: Monitoring and Assessment

One of NJSEA's long term goals is to protect the delicate balance of nature within the Meadowlands. To reach this goal, NJSEA regularly monitors and assesses the conditions of the wetlands located throughout the Meadowlands District. The monitoring and assessment data is used to document site conditions, assist with wetland restoration prioritization and implementation, track trends within the Meadowlands, compare baseline and trend data with

statewide data using the NJ Tidal Wetland Monitoring Network and, most recently, to inform the development of the NJSEA 2020 Master Plan. In addition, we will continue to collaborate with NJDEP and their statewide efforts.

NJSEA, in collaboration with MERI, continues to expand our monitoring and assessment efforts of the Meadowlands ecosystem functions to better understand the overall current condition of the wetlands, documenting changing conditions over time and evaluating the wetlands to assist in restoration prioritization decisions and management plans. The monitoring and assessment efforts that NJSEA and MERI regularly conduct and will continue to undertake over the next five years include:

- Landscape assessments using GIS and drone imagery data;

- Rapid assessments using such techniques as Floristic Quality Assessments for plant communities and surveys of flora and fauna populations; and,

- At some wetland sites, intensive site assessments to better document and understand tidal conditions, soil composition, site stressors, and changing populations.

Over the past thirty years, NJSEA has been developing a database of information on the wetlands and other natural areas located within the District. Information on which the Meadowlands' 2019-2023 WPP will build on includes the following:

- The MERI GIS database of the Meadowlands' wetlands and their characteristics

- Drone imaging and mapping of the wetlands

- Fish and benthic surveys and reports, previously conducted in 1987-1988, 2001-2003, and 2013-2015

- Diamondback terrapin surveys, conducted seasonally in the lower sections of the District

- Avian surveys conducted regularly at sites throughout the District

- Floristic quality assessments (FQAs) and habitat community mapping of the wetland sites

We will also continue to draw on the work conducted by MERI, including continuous water quality monitoring at three locations and the development of Surface Elevation Table data located at five sites throughout the Meadowlands.

The data collected and analyzed will assist NJSEA and its partners in managing invasive plant species, protecting and restoring habitat for species of concern, detailing site stressors and restoration opportunities, and re-establishing resilient habitat conditions and functions. In addition, NJSEA continues to participate in national and regional wetland monitoring and assessment forums including the Mid-Atlantic Wetland Work Group, the Mid-Atlantic Coastal Wetland Assessment, and the New Jersey Tidal Wetland Monitoring Network. NJSEA is also an active member of the New York-New Jersey Harbor Estuary Program and its Restoration Working Group, the Mid-Atlantic Chapter of the Society of Wetland Scientists, and the Mid-Atlantic Chapter of the Society of Ecological Restoration. NJSEA continues to look for collaborative projects and research efforts, using well-informed science to guide our actions.

Many reports and studies have been developed by NJSEA, MERI and its partners, cataloguing the data collected and describing the analysis of the information. Recent reports include:

- ➢ Report on the Three Fishery Resource Inventories of the Lower Hackensack River within the Hackensack Meadowlands District (March 2019)
- ➢ Measurements of Tidal Wetland Impairments for Acquisition and Enhancement in the New Jersey Meadowlands (June 2018)

➢ A Mark-Recapture Study of the Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*) in the Hackensack Meadowlands Sawmill Creek Wildlife Management Area (2012)

➢ New Jersey Meadowlands Vegetation Inventory (December 2010)

➢ Meadowlands Comprehensive Restoration Implementation Report (2010)

➢ Ecology of Colonial Wading Birds foraging in the Meadowlands District (2010)

Objectives: The objectives of the Meadowlands monitoring and assessment efforts are to document baseline conditions at each of the NJSEA-owned wetland sites within the District, including 17 preserved wetland sites and 10 restored wetland sites. In addition, NJSEA also visits and observes the 3 wetland mitigation banks and 10 wetlands sites owned by others within the District for comparative purposes. NJSEA's also strives to collaborate with other agencies, research institutions and universities, and NGOs in collecting and disseminating this information. To document baseline conditions at NJSEA-owned wetlands, NJSEA monitors and assesses the following conditions:

- Physical conditions – soil and water quality

- Habitat communities – flora and fauna

- Structural diversity – vegetation strata, trophic levels, and spatial mosaic

- Site stressors – invasives, contamination, and over-utilization

- External exchanges – habitat links and landscape flows

- Ecosystem function – productivity, habitat interactions and resilience/recruitment

In 2019, NJSEA began employing the Society of Ecological Restoration's International Standards for the Practice of Ecological Restoration in collecting this data for each wetland site owned by the NJSEA, so that our results developed within a framework that is comparable with data collected from around the world. In addition, NJSEA will be tracking our monitoring data using the newly established NJ Tidal Wetland Tracking Network that has been developed in coordination with NJDEP, so that all data collected will be tracked in a system that is accessible, updated on a timely basis, and integrated with other state water quality data.

Actions and Activities: Specific actions and activities that will be undertaken by NJSEA to meet its long term goals of increasing wetland habitat quantity and quality, and to meet our objectives of monitoring, assessing, and documenting these changes over time, are listed below.

Monitor and Assess Flora: NJSEA has performed floristic quality assessments for some of the preserved wetlands within the District, and will continue to undertake this effort at additional sites. In addition, NJSEA will field check drone images developed by MERI to develop habitat community maps for all NJSEA-owned wetlands sites within the District and add this information to the MERI GIS database. The information gathered will inform policy decisions regarding habitat management including the control of invasive plant species and restoration of breeding habitat for species of concern.

- Develop mapping for all wetland sites using drone technology
- Develop habitat community maps based on the drone mapping
- Detail site structural diversity, noting vegetation strata, trophic levels, spatial mosaic, and landscape connectivity

- Field check each habitat community map on site and develop corresponding soil maps

- Note site stressors including invasive plants species and over-utilization by wildlife and/or humans

- Develop recommendations regarding habitat management, including control of invasive plant species and potential restoration opportunities

- Provide annual summary reports

Survey Avian Fauna: The wetlands in the meadowlands region have long been recognized as a critical habitat for wildlife, especially birds. NJSEA will continue to monitor bird populations around the Meadowlands, determining the abundance and distribution of the bird species at the wetlands sites, to better understand how habitats are being utilized and to provide clear information to make policy decisions can be made on the preservation and restoration these wetland sites.

- Assess bird diversity

- Provide annual summary reports

- Develop recommendations and prioritizations for restoration of breeding habitat for species of concern

Survey Fish and Benthic Invertebrate Fauna: In 2015, NJSEA completed its third periodic two-year fishery resource inventory in the District, and the report documenting the monitoring and assessment methods and results was published in 2019. The benthic survey report will be released later in 2019. The next survey, which will commence in 2023 and continue for two

years, will inform NJSEA about both recent changes to the fish and benthic invertebrate community as well as changes that have taken place over the past 40 years.

- Assess fish and benthic invertebrate diversity

- Compare with past studies

- Provide annual summary reports

- Develop recommendations about water quality and fish habitat

- Conduct sampling of ichthyoplankton to better inform fish surveys

- Explore eDNA applications in the Meadowlands

Survey Diamondback Terrapin Populations: NJSEA continues to document the growing population of diamondback terrapin in the Meadowlands, and its expansion up the Hackensack River. NJSEA assesses population size and distribution in the River and its tributaries to better understand the recovery of the Meadowlands and its habitats.

- Seasonally assess terrapin population, distribution and nesting areas

- Provide annual summary reports

- Develop recommendations about terrapin habitat and nesting restoration

Collaborate with Partners around NJ and NY-NJ Harbor Estuary

- NJSEA will continue to work with MERI – Rutgers University in the undertaking of the Wetland Program Plan and its objectives and actions.

- NJSEA will also continue to collaborate with other organizations working and undertaking research in the Meadowlands to produce credible and salient science, which in the recent past has included the Rutgers University, Meadowlands Conservation Trust,

Hofstra University, Bergen County Audubon Society, New Jersey City University,

Ramapo College, Montclair State University, Hackensack Riverkeeper, NY/NJ

Baykeeper, NJ Conservation Foundation Harbor Herons, and Hudsonia.

- NJSEA will continue to coordinate our efforts with the USACE – NY District and
NJDEP, and other agencies that we meet with as part of the Meadowlands Interagency
Review Team.

- NJSEA will coordinate with the NJ Water Quality Monitoring Program to identify shared
goals and activities

- NJSEA will continue to work with the NY-NJ Harbor Estuary Program, particularly with
the Restoration Working Group and in keeping with their 2017-2022 Action Agenda

Core Element 2: Voluntary Restoration and Protection

The NJSEA 2020 Master Plan states that we will not only acquire and preserve wetland sites for
water quality, wildlife, and flood storage, but also assist with the recovery of these valuable
habitats and reestablish ecologic functions and services. NJSEA has active programs in place to
reach this goal of restoring and protecting the District's wetlands.

Restoration is accomplished primarily in partnership with NJSEA's partners, including the
multiyear cooperative effort with the US Army Corps of Engineers – NY District, documented in
the Meadowlands Comprehensive Restoration Plan (2010) and the Hudson Raritan Estuary
Comprehensive Restoration Plan (2016). NJSEA also works with MERI – Rutgers University,
NJDEP, Bergen County Audubon Society and other partners to protect wetland habitats, identify
potential restoration opportunities, and establish funding to undertake restoration projects.

NJSEA also seeks opportunities to acquire additional wetland and open space sites within the District, and continues to work with private landowners to provide education about protecting and restoring wetland resources.

Objectives: The objectives of NJSEA's efforts to restore and protect the Meadowlands' wetlands include increasing biodiversity, improving habitat particularly for species of concern, restoring ecological functions and services, promoting habitat connectivity, creating a more resilient shoreline throughout the District, and removing and attenuating contamination within aquatic habitats.

These objectives are consistent with actions under USEPA CEF Objective 1 to define restoration and protection goals. NJSEA has worked for several years on establishing restoration goals with a watershed approach consistent with the Master Plan and the means to achieve them. NJSEA worked with the USACE to develop the Meadowlands Environmental Site Investigation Compilation (MESIC) Report (2004) which documented existing wetland site data, reports and studies, and we continue to update the MESIC annually. The list of potential or candidate sites for restoration as originally appeared in MESIC and considered is updated as sites on that list are restored, other sites are acquired, and conditions at potential sites change.

NJSEA also cooperates with and funds other interagency, academic, and NGO efforts to perform comprehensive baseline studies, understand site stressors, determine prioritization strategies, and develop restoration plans. NJSEA is also an active member of the Meadowlands Interagency Review Team, which reviews all potential District wetland impacts and associated mitigation, and the NY/NJ Harbor Estuary Program Restoration Working Group.

One of NJSEA's mandates, to protect the delicate balance of nature, shares the intention of USEPA CEF Objective 2, to protect wetlands. To achieve this we have acquired and preserved approximately 2700 acres of wetlands and facilitated protection of about 1600 more acres. Our Master Plan calls for the continued acquisition of wetlands, which NJSEA continues to do as they become available.

To further protect the wetlands within the District, we established partnerships with Federal and State agencies as well as NGOs and colleagues at academic institutions to protect and study our resources. Recent studies in which we have teamed with others includes our benthic inventory and analysis with MERI, frog surveys with NJ Conservation Foundation and Montclair State, microplastics study with New Jersey City University, and a comprehensive study of restoration site successes with Rutgers University. We will continue to work with others to carry out our mission, documenting baseline conditions and site stressors, to better and protect the District's wetland resources into the future.

A lengthy and detailed assessment of the potential for restoration in the Meadowlands, the rationale for doing this, and how this can be accomplished has been the cooperative effort of the NJSEA and the USACE, as documented in the Meadowlands Comprehensive Ecosystem Restoration Study (2016). The actions of this program match USEPA CEF Objective 3 to restore wetlands, and we continue to use this document, particularly Chapter 7 – Lessons Learned, as we develop priorities and undertake restoration actions.

USEPA CEF Objective 4 calls for monitoring and tracking progress, which NJSEA continues to do. NJSEA collects its own data, gathers publications and studies conducted by others that occurs in or relates to the Meadowlands, and then catalogues these updates to the MESIC. In

addition, we have joined the NJ Tidal Monitoring Network and will be storing our data within the state-wide system.

Actions and Activities: Specific actions and activities that will be undertaken by NJSEA to meet its goals of restoring and protecting wetland habitats to increase biodiversity, improve habitat particularly for species of concern, restore ecological functions and services, promote habitat connectivity, and create a more resilient shoreline throughout the District, are listed below. These actions are in addition to the monitoring and assessment actions listed previously, which will also serve to reach NJSEA's goal of restoring and protecting wetland habitats.

Review past restoration efforts to inform future projects: Wetland mitigation and restoration efforts have been undertaken in the Meadowlands over the past 30 years. To inform restoration efforts in the future, NJSEA has begun a systematic review of past projects to understand what techniques have been successful and resilient, and actions that should be avoided.

- Literature and field review of past mitigation and restoration projects within the District
- Document findings and develop a peer-reviewed research paper
- Present at professional society meetings and workgroups for additional feedback
- Following the SER International Standards for Ecological Restoration, develop restoration standards specific to the Meadowlands
- Hold workshops within the Meadowlands to provide training

Create a Wildlife Management Plan for the Meadowlands: Building off of the NJ Wildlife Management Plan, NJSEA staff will develop a plan specific to the Meadowlands and its wetland habitats that protects habitat, minimizes fragmentation, and creates a path for restoring habitat.

- Continue to monitor flora and fauna populations, and document species of concern

- Create community habitat maps for the District

- Identify migratory corridors within the Meadowlands

- Develop species recovery plans for those species of concern

Develop a GIS map of Meadowlands District shoreline types: The Meadowlands miles of shoreline are incredibly diverse, and each one of these areas face different risks and management strategies as conditions change in the future. To better understand the challenges and begin to develop site specific strategies, NJSEA will develop a map of shoreline types for the District.

- Using existing GIS mapping, create a shoreline typology map

- Field check the GIS map

- Document potential future challenges and stressors for each shoreline type along with potential and restoration opportunities and strategies

Core Element 3: Public Outreach and Education

While aspects of public outreach and education are included within Core Elements 1 and 2, it is also a core element in itself since the outcomes of NJSEA's public outreach and education efforts help the agency in reaching its goals of protecting the delicate balance of nature, increasing wetland habitat quantity and quality, monitoring and assessing the District's wetlands, and restoring and preserving the wetland habitats within the Meadowlands. And NJSEA's

environmental revitalization efforts have transformed the District into a premier ecotourism and education destination. The District features 21 parks with eight miles of walking trails, seasonal pontoon boat cruises and canoe tours led by NJSEA staff, and the state-of-the-art William D. McDowell Observatory in DeKorte Park, which is open to the public Wednesday evenings year-round. Through its Meadowlands Environment Center, the NJSEA provides environmental science programs to schoolchildren through a contract with Ramapo College; approximately 15,000 students participate in field trips to DeKorte Park throughout the school year. In addition, the NJSEA works with the Bergen County Audubon Society, which leads twice-monthly guided nature walks throughout the District. The Authority maintains the Meadowlands Nature Blog (www.meadowblog.net) which includes great wildlife and landscape photos from area photographers, news about upcoming NJSEA events, and other Meadowlands-related nature and environment news.

Objectives: With an overall goal of providing educational and ecotourism opportunities to the public to increase awareness about wetlands in general and specifically the natural resources of the Meadowlands, NJSEA's primary objectives, in addition to continuing to provide education and tourism opportunities to the public, will be to incorporate innovative practices and technology into our programs.

Actions and Activities: Specific actions and activities that will be undertaken by NJSEA to meet its goals of providing education and tourism opportunities to the public and incorporating innovation and technology are listed below. These actions are in addition to those listed under Core Elements 1 and 2.

Highlight innovative ecological restoration projects and practices: NJSEA is looking to

implement innovative ecological restoration projects, including small pilot projects and large

wetland restoration projects, to increase the overall quantity and quality of the wetland habitats

in the Meadowlands. In undertaking these projects, NJSEA will work with Universities and

NGOs to educate other agencies, organizations and the general public on these nature-based

projects and how they work.

- Develop a small pilot project using regenerative stormwater conveyance techniques to improve the stormwater quality that flows from NJSEA's parking lot into the adjacent wetlands.

- Develop a wetland sand nourishment pilot and living shoreline project within DeKorte Park.

- Develop a floating island pilot project for use in the impoundment area of DeKorte Park.

- Develop a living shoreline pilot project along the shoreline at River Barge Park.

- For each project undertaken, develop public signage and hold a workshop/field trip for interested parties.

Work with other NGOs to begin to develop a citizen science data collection program:

Continue working with Bergen County Audubon Society on a citizen science collection program

for the Meadowlands.

- Develop an app specifically for the Meadowlands flora and fauna

- Begin a pilot program to introduce the app at the Bergen County Audubon Society Meadowlands field trips

MEADOWLANDS 2019-2023 WETLAND PROGRAM PLAN - SCHEDULE	2019	2020	2021	2022	2023
MONITORING & ASSESSMENT					
1. **Monitor & Assess Flora**					
Using drone imagery, create habitat maps for all NJSEA-owned sites	X	X	X	X	X
Field check baseline community habitat maps	X	X			
Update habitat maps each year based on new drone imagery		X	X	X	X
Develop annual habitat mapping report	X	X	X	X	X
2. **Survey Avian Fauna**					
Conduct daily point counts at various Meadowlands sites	X	X	X	X	X
Working with Kean University, conduct migratory banding at Harrier	X	X	X	X	X
Develop avian survey & banding annual report	X	X	X	X	X
3. **Survey Fish & Benthic Invertebrate Fauna**					
Assess fish diversity at various sites using dip nets		X	X	X	
Conduct fish and benthic invertebrate diversity sampling					X
Develop annual reports		X	X	X	
4. **Survey Diamond back Terrapin Populations**					
Seasonally, assess Diamondback Terrapin populations & distribution	X	X	X	X	X
Develop annual survey report	X	X	X	X	X
5. **Collaborate w/ Partners around NY/NJ Estuary**					
Continue to work with MERI, monitoring SET & water quality sites	X	X	X	X	X

With Ramapo College – develop regenerative stormwater management project to improve water quality from parking lot runoff that discharges to Kingsland Impoundment		X	X	X	
Continue to collaborate with Harbor Herons team Monitoring green herons and other shorebirds in Meadowlands	X	X	X	X	X
Continue to coordinate w/ Meadowlands Interagency Review Team	X	X	X	X	X
In partnership with Bergen County Audubon Society and Hackensack Riverkeeper, develop osprey nests throughout the Meadowlands		X	X		
Continue to work with NY/NJ Harbor Estuary Program	X	X	X	X	X
Maintain database with the NJ Tidal Wetland Monitoring Network	X	X	X	X	X
VOLUNTARY RESTORATION AND PROTECTION					
6. **Review Past Restoration Efforts to Inform Future Projects**					
Lit & field review of past projects	X	X			
Develop paper and presentations presenting results	X	X	X		
Develop SER standards for Meadowlands & provide training		X	X	X	X
7. **Create a Meadowlands Wildlife Management Plan**					
Continue to monitor focal species and habitats	X	X	X	X	X
Develop draft wildlife management plan	X	X			
Create GIS database/maps of focal species habitat	X	X			
Identify migratory corridors within the Meadowlands			X		
Develop species recovery plans for focal species		X	X	X	X
8. **Develop a GIS map of Meadowlands shoreline types**					
Using existing GIS mapping, create shoreline typology map	X				

Field check shoreline typology map	X				
Combine GIS layers of habitats and shorelines		X	X		
Document potential future challenges & stressors for each type		X	X	X	X
Document potential restoration opportunities & strategies		X	X	X	X
PUBLIC OUTREACH & EDUCATION					
9. **Highlight Innovative Eco Restoration Projects & Practices**					
Develop small pilot projects using regenerative stormwater management techniques to improve water quality around the Meadowlands	X	X	X	X	X
Develop sand nourishment, living shoreline and floating island pilot projects throughout the Meadowlands to improve breeding habitat for focal species of concern	X	X	X	X	X
For all projects, develop public signage and hold workshops and field trips for interested parties and education programs		X	X	X	X
10. **Work w other NGOs to develop Citizen Science Program**					
Develop an smart phone application specifically for Meadowlands flora and fauna		X	X		
Develop education programs to introduce app at Meadowlands' field trips and boat tours		X	X	X	X
11. **Harbor Boat Tours**					
In season, conduct boat tours throughout the Meadowlands for interested parties and education groups	X	X	X	X	X