GREAT BAY LIVING SHORELINE PROJECT

SCHANDA PARK – NEWMARKET, NEW HAMPSHIRE

DESIGN MEMO REPORT

Prepared for: Town of Newmarket
Great Bay Living Shoreline Project Grant
Great Bay National Estuarine Research Reserve
New Hampshire Department of Environmental Services – Coastal Program
University of New Hampshire

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TABLE OF CONTENTS

TABLES

APPENDICES

1.0 PROPOSED PROJECT LOCATION AND MOTIVATION

The Town of Newmarket (the Town) is proposing a waterfront improvement and living shoreline project within the existing footprint of Schanda Park, located on Water Street in downtown Newmarket and bisected by the Moonlight Brook outflow. Schanda Park is an urbanized/hardened, highly visible, and frequently utilized public park containing a developed plaza area with adjacent lawn areas, a widely used public boat launch, and provides access to a public floating dock.

As part of the greater effort to revitalize Newmarket's whole waterfront, the Town wishes to address existing concerns associated with the park's boat ramp and deteriorating shoreline revetment, as well as develop the park's overall resilience and aesthetic character.

2.0 EXISTING SITE CONDITIONS

The northern portion of Schanda Park centers around a landscaped plaza bound by the public boat launch to the north, the Lamprey River to the east, the Moonlight Brook outflow to the south, and the combined park and boat launch parking lot to the west. Below are descriptions of the points of interest comprising this portion of the park and the concerns and/or limitations associated with each.

2.1 Northern Section

Waterfront Plaza

The brick paved plaza is bound to the north by a vertical stone retaining wall associated with the adjacent boat ramp, which transitions to sloped bank stabilized with stone revetment that runs along the eastern and southern sides of the plaza below overgrown planting beds that are obstructing views of the river. Small patches of tidal marsh are perched in bare areas of the revetment off the southeastern corner of the plaza. The vertical retaining wall adjacent the boat ramp is in good condition, but discussions with Town representatives and assessment during the initial site visit reveal the revetment stabilizing the sloping bank is deteriorating due to action by water, particularly along the southern side of the plaza. Addressment of this deteriorating revetment has been highlighted as a primary item of concern for the Town and an interest in incorporating greener bank stabilization methods has also been expressed. However, the Town also indicated that due to the plaza's small size and high utilization for large community events, there is reluctance to losing accessible square footage of the plaza area.

Boat Ramp

The 40' wide boat ramp at the very northern end of the park is aligned to the centerline of Water Street, sloping from the private parking lot driveway to the north and down to the water line. The boat ramp is bound to the north and south by vertical stone retaining walls, both of which are in fair condition. However, the pavement of the ramp is broken near the high-water line and transitions to gravel upon entering the water. Discussion with the Town representatives revealed this gravel washes into the river and is regularly replaced by US Fish & Game, which manages the ramp. Additionally, the boat ramp is considered overly wide, and consideration has been given to renovating the ramp.

Parking Lot

West of the plaza area is the combined park and boat launch parking lot. There are 15 car parking spaces, one of which has a charging station and is reserved for electric vehicles, and another that is ADA accessible. There are also 4 boat trailer parking spaces located at the eastern end of the parking lot with easy access to the boat ramp and Water Street. Between the stone block wall along Moonlight Brook and the southern edge of the parking lot pavement, there is a narrow strip of grass, but this edge of the lot is not curbed. The parking lot slopes to the southeast corner, the eastern edge of which is curbed, which directs stormwater flow from the parking lot into Moonlight Brook.

2.2 Southern Section

The southern portion of Schanda Park centers around a grassy bluff flanked by the Moonlight Brook outflow to the north, the Lamprey River to the east, an unofficial kayak launch area to the south, and landscaped lawn to the west and southwest containing a paved walkway leading to a public floating dock at the southeastern corner of the park. Below are descriptions of the points of interest comprising this portion of the park and the concerns and/or limitations associated with each.

Bluff

Sandwiched between the Moonlight Brook outflow and the unofficial kayak launch, the upland lawn extends towards the river to form a bluff, which hosts a bench looking out on the river as well as a large tree. This bluff is bound by steep banks on all three sides stabilized by revetment, with the revetment on the northern side extending along the bank all the way to the Moonlight Brook culvert.

Existing Tidal Marsh Slope

At the southern end of the waterfront, the upland lawn slopes downward and transitions to a muddy slope approximately 12’ wide between the revetment off the southern side of the bluff and the revetment associated with the abutment for the floating public dock. At the bottom of the slope, within the intertidal zone, there is existing salt marsh vegetation including rare plant species extending approximately 6’ up the slope from the water line. A narrow path trampled through the plants was noted during the initial site visit, presumably due to the launching of kayaks which are available for rental upslope. Additionally, discussions with Town representatives indicate the historical fish weir installed in the Lamprey River just north of the Moonlight Brook outflow is removed from the water and stored above the high-water line on this slope, further impacting existing vegetation. Finally, during the October 18th site visit, it was noted there was evidence that Canada geese and other waterfowl had damaged the vegetation during foraging activities, a common issue in New England salt marsh systems.

Moonlight Brook

Moonlight Brook is an important tributary of the Lamprey River drainage basin for the Town of Newmarket, as it drains the center of town and outlets at the town landing in Schanda Park. The main channel of Moonlight Brook runs approximately 1.5 miles from its headwaters to its outlet into the Lamprey River. Within the Town of Newmarket, the brook is routed under several road crossings and through a series of culverts and pipes in the downtown area before emerging along the southern side of the Schanda Park parking lot. The brook then runs through three 24” diameter precast concrete pipes before flowing into the Lamprey River. These pipes are buried under an earthen walkway connecting the

northern and southern portions of Schanda Park. All three pipes are at slightly different elevations causing issues with the hydraulics of Moonlight Brook. Additionally, at high tide, all three pipes are several feet under water, running under pressure. The resultant hydraulic issues have hindered sediment transport through the culverts to the river, with a large sediment deposit upstream of the culverts on the southern side, further blocking the southern pipe. The banks of Moonlight Brook downstream of the culvert are steep and stabilized by revetment to the south and a stone block wall to the north. The revetment on the south side extends from the bluff, and the individual stones appear too large for the height of the bank and the relatively low energy of the brook system. Close to the culvert, the south revetment stones are missing, allowing the bank to erode back over time and creating a small eddy. The block wall to the north has failed in one location close to the culvert, and the remainder appears close to failure, with the top course of blocks displaced approximately 18' offshore relative to the rest of the wall. There are numerous plants growing through the northern revetment and on top of the wall.

3.0 PROPOSED IMPROVEMENTS

Our proposed improvements for Schanda Park focus on addressment of the deteriorating and/or failed revetment and development of natural stabilization of the banks bordering the park were possible through tidal marsh creation. We also provide additional recommendations for improving the boat ramp within its existing 40' footprint, stormwater management in the park, and overall park aesthetics. Per the suggestion of Town representatives and members of the Riverfront Advisory Committee, we present our proposed improvements in a phased format (Design Plans and Cross Sections in Appendix A).

3.1 Revetment Removal and Tidal Marsh Creation (Phases 1 and 2)

Southern Section (Phase 1)

In the southern half of the park there is existing tidal marsh vegetation present along the portion of bank not covered with revetment including water pimpernel (*Samolus parviflorus*), Virginia rye grass (*Elymus virginicus*), seaside crowfoot (*Ranunculus cymbalaria*), grass-leaved goldenrod (*Solidago graminifolia*), and blue vervain (*Verbena hastata*). We propose to expand this marsh area by establishing tidal marsh that will wrap around the current location of the bluff and along the southern bank of the Moonlight Brook outlet. This will be accomplished through removal of all stone revetment around the bluff and laying back to a 3% slope to better match the grade of the slope leading from the upland lawn area to the existing tidal vegetation. As there are existing patterns of behavior currently resulting in degradation of existing tidal marsh vegetation in this area (i.e., the launching of kayaks and the removal and storage of the fish weir), an important element of the project will be discouraging these conflicting uses. This will include installation of split-rail fencing along the upland edge of the created tidal marsh to discourage foot traffic on the marsh and designation of an alternative removal pathway and storage site for the fish weir in winter. Additionally, educational signage about the living shoreline could be installed along the split-rail fencing.

Northern Section (Phase 2)

In the northern half of the park our proposed design would remove most of the stone revetment along the waterfront surrounding the plaza except for the vertical retaining wall along the southern side of the boat ramp, which is good condition. Currently, there is no way to sufficiently reduce the vertical grade off the southern side of the plaza to allow for a green form of bank stabilization, as laying back the slope

to reduced grades would result in loss of plaza valuable area. Thus, we recommend an in-kind replacement of the deteriorating and failed stone revetment on the southern slope where the grade is currently nearly vertical.

Off the eastern and southeastern sides of the plaza, there is a possibility for tidal marsh establishment as an alternative to grey infrastructure for bank stabilization. However, while small patches of tidal marsh vegetation are currently perched in bare areas of the revetment, establishment of a healthy and sustainable tidal marsh requires a shallower slope than the current grades would allow. Again, the need to retain the upland plaza area in its entirety without any loss of square footage prevents the slope from being laid back in a manner similar to the Phase I work proposed south of Moonlight Brook. Thus, we suggest reducing the grade by extending the slope into the river through the installation of clean fill. We believe this a viable option because a review of the site in aerial imagery shows the bank off the southeast corner of the plaza does not align with the overall curvature of the river. The proposed slope extension would require infilling a portion of the river channel off the southeastern corner of the plaza. This would bring that portion of the bank in alignment with the rest of the riverbank along the Schanda Park waterfront and produce the shallower grades more suitable for tidal marsh creation.

General Grading and Planting Plans for Tidal Buffer and Marsh Creation

The regrading proposed is based on the Lidar dataset of the project area provided by the Town of Newmarket, supplemented with additional survey data collected by the project team during site visits on 9/2/21 and 10/11/21. Selection of the elevations for the tidal buffer-high marsh and high marsh-low marsh boundaries and the height of the stone sill at the marsh toe was made based on water levels calculated from pressure transducer data collected on site between 9/2/21 and 11/16/21. This water level data was analyzed to determine the tidal regime of the project area and is tied to the NAVD88 datum based on surveyed water surface elevation at 6:25 pm on 10/11/21 (Table 2).

Each proposed tidal marsh contains both high and low marsh environment, with a natural tidal buffer along the upland edge of each marsh. Following removal of the failing stone revetment, the eastern slope off the waterfront plaza and the slopes off the bluff will be regraded through a combination of extending the slope up to 20 ft into the mudflat beyond the current revetment (specific to the Phase 2 work), laying back slopes to the extent possible, terracing the slopes through placement of 12” diameter coir logs at the tidal buffer-high marsh and the high marsh-low marsh boundaries, and installation a 2.3 ft tall rock sill at the toe of the slope. We recommend the sill be constructed from rock salvaged from the revetment removal if possible and that the stone selected have a diameter of ±3 ft (see Cross Sections). Each portion of the tidal marsh (low marsh, high marsh, and tidal buffer) will be planted with species suitable for the hydroperiod characteristic of each area (Table 1; Planting and Maintenance Plan in Appendix B for further details). Construction of the tidal marshes should be timed to ensure installation of the tidal marsh plantings late spring to provide the maximum amount of growing/establishment time prior to the first winter. Irrigation of the constructed marshes may be required in the first couple growing seasons, particularly if conditions are dry. Supplemental planting may also be required should a significant proportion of the initial plantings not survive.

Table 1 - List of Suggested Plantings within the Low and High Marsh Areas and the Tidal Buffer.

Environment	Common Name	Scientific Name	Notes
Low Marsh	Smooth cordgrass	*Spartina alterniflora*	Main planting for the low marsh; consist of plugs "started" off-site and conditioned to the salinity conditions. Elevations between MSL and MHW (2.3' and 3.4 NAVD88).
	Sea-lavender American glasswort	*Limonium nashi* *Salicornia depressa*	Upper elevations of the low marsh; elevations ranging from 2.6' to 3.4' NAVD88). *S. depressa* will likely require some acquisition from natural growing locations and careful cultivation.
High Marsh	Saltgrass Saltmarsh rush Saltmarsh cordgrass	*Distichlis spicata* *Juncus gerardii* *Spartina patens*	Elevations between MHW and MHHW (3.4' to 6' NAVD88).
Tidal buffer	Switchgrass Prairie cordgrass	*Panicum virgatum* *Spartina pectinata*	Elevations above the highest observable tide (HOT) line (>5' NAVD88).

Considering the Impact of Sea Level Rise

Based on the *Living Shoreline New England: State of the Practice* (2017), tidal marsh should ideally be constructed with slopes 5:1 or flatter with the low marsh positioned between mean sea level (MSL) and mean high water (MHW), the high marsh between MHW and mean high water (MHHW), and the tidal buffer above highest observable tide (HOT). In terms of the placement of the tidal buffer-high marsh and high marsh-low marsh boundaries, the proposed Cross Sections conform with these guidelines with each positioned at elevations of 3.9 ft and 3.4 ft relatively to NAVD88, respectively.

However, when determining the elevation for the toe of the marsh, consideration was given to future impacts due to sea level rise, as planted marsh areas may have difficulty adapting to relatively rapid changes in sea level. Based on the *New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections* (2020), the project team has assumed an SLR projection of 1.6 ft by 2050 for Schanda Park, which would raise mean seal level (MSL) from the current elevation of 0.2 ft to an elevation of 1.8 ft NAVD88 by 2050. Thus, to enhance the proposed living shorelines' resiliency, the design team decided to set the elevation of the toe of the planted low marsh platform at an elevation of 2.3 ft NAVD88 through the installation of a backfilled rock sill, which would position the low marsh toe

at an elevation above the MSL elevation projected in 2050. Setting the toe of the tidal marsh at the raised elevation proposed will provide a longer window for establishment of the low marsh area and prolong the overall lifespan of the living shoreline.

Table 2 – Current and predicted tidal datum for Schanda Park. Based on analysis of pressure transducer data collected on site between 9/2/21 and 11/16/21 and projected sea level rise from *New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections* (2020).

	2022[1]	2050[2]
HOT[3]	3.9’	5.5’
MHHW	3.7’	5.3’
MHW	3.4’	5.0’
MSL	0.2’	1.8’
NAVD88[4]	0.0’	0.0’
MLW	-3.3’	-1.7’
MLLW	-3.4’	-1.8’

1. Water levels based on pressure transducer data gathered between 9/2/21 and 11/16/21.
2. Based on 1.6’ of sea level rise according to Intermediate-High scenario.
3. Highest Observable Tide Based on highest water level recorded during data collection period.
4. Water level data tied to NAVD88 by surveying water surface elevation at 6:25 PM on 10/11/21.

The design for both tidal marshes is targeted for a relatively short projection (30 years) due to the park’s small size and very urbanized setting, which limits the ability of the tidal marshes to naturally retreat upslope as sea level rises. For the Phase 2 tidal marsh, it is anticipated sea level rise will force the eventual loss of the tidal buffer and high marsh environments due to a currently complete lack of available area for marsh retreat upslope. For the Phase 1 tidal marsh, the open lawn upslope provides flexibility for some tidal marsh migration upslope with sea level rise, which could extend the lifespan of that tidal marsh.

3.2 Boat Ramp Upgrade (Phase 3)

As stated above, the boat ramp is currently wider than it needs to be. We propose to remove the existing paved and gravel surface of the existing boat ramp and install 18’ wide precast concrete planks, the standard for NH Fish & Game boat ramps. The concrete planks would be installed in the southern half of the boat ramp, leaving 24’ of extra width to be utilize for installation of a narrow floating dock alongside the boat ramp for utilization by kayakers and canoers.

3.3 Parking Lot Stormwater Management Upgrades (Phase 4)

Our proposed stormwater management improvements to the parking lot are relatively simple but can potentially provide a great benefit to Moonlight Brook and the park. The parking lot is already sloped to a single point, the southeast corner, so there is no need to regrade or repave the parking lot. The only required site work would be to install a curb along the southern edge of the parking lot to meet the curb that already exists along the eastern edge. At the corner, we propose a curb break to allow the parking lot runoff to be directed to a stormwater management best management practice designed according to New Hampshire Department of Environmental Services (NHDES) regulations. This would most likely be a subsurface sand filter, which would appear as a shallow depression in the lawn area, requiring minimal maintenance. An outlet pipe would need to be installed to Moonlight Brook, with care taken with regard

to the existing stone wall forming the channel bank. Alternatively, a rain garden could be established in place of the sand filter, providing additional stormwater management benefit as well aesthetic improvement. Some routine maintenance of rain garden vegetation would be required (see Planting and Maintenance Plan in Appendix B for more details regarding the rain garden option).

3.4 Existing Plantings and Invasive Species Management Plan

Currently, the landscaped areas of the Schanda Park are overgrown with many shrubs obscuring views of the river from within the waterfront plaza. Additionally, several invasive plant species have been observed in the park including Japanese knotweed (*Fallopia japonica),* bittersweet (*Celastrus scandens*), beach rose (*Rosa rugosa)*, purple loosestrife (*Lythrum salicaria)*, and Virginia creeper (*Parthenocissus quinquefolia*). We recommend coordinating with local groups involved with gardening/maintenance of Schanda Park's planting beds to discuss pruning shrubs back to enhance views of the river, as well as development of an invasive species management plan. When developing a management plan for the invasive species present in Schanda Park, regular cutting/pulling of new invasive plant growth will be vital. Cutting/pulling of invasives should be done before the plants go to seed, which typically occurs from July to August, and all invasive species plant material should be disposed of appropriately to reduce spreading of invasives to unaffected areas. See attached Planting Plan for more details regarding invasive species management.

3.5 Additional Recommendations

Moonlight Brook

While it is evident that the culverting of Moonlight Brook is causing hydraulic issues, addressment of these issues is beyond the scope of this project. However, some general suggestions include removal of the three existing concrete pipes to either be replaced with a larger right-sized Contech arch or a complete daylighting of this section of Moonlight Brook. Removal of the three existing culverts would for allow for easier wildlife and aquatic species transit, allow more flow through channel at flood stage, and would improve the overall aesthetic quality of the area.

Fish Weir

We recommend the fish weir not be seasonally removed from the river through the existing or proposed tidal marsh. The Town of Newmarket should incorporate feedback and opinions of all involved stakeholders regarding this proposed project.

4.0 RECOMMENDED NEXT STEPS

Based on this 50% design, creation of the proposed living shoreline and the additional improvements will necessitate acquiring multiple permits and coordination with several agencies. Should the Town choose to proceed with development of this design to 100%, there are several recommended steps for the Town to take. The design team specifically focused the following recommended next steps on what would be needed in relation to the tidal marsh construction.

1. Contract for a survey of the existing park to determine existing grades. This data will be needed for the development of engineering plans for the tidal marsh creation project.

2. Consult with an archaeological consultant to conduct a site walk and initiate state consultation. This information will be required during the permitting effort for any ground disturbing work. A Phase IA archeological/cultural survey may be required.

3. Conduct a longer tidal study to determine the local Highest Observable Tide (HOT) elevation. While the study conducted as part of this project provides a reasonable estimate, a longer study will provide a reliable database to work from.

4. Develop and distribute a Request for Proposals to select a contractor or team of contractors with whom the Town can work with to development of the 100% project design and coordinate the permitting effort.

5. Once the Town has selected a contractor, schedule a pre-application meeting(s) with NHDES and the U.S. Army Corps of Engineers (USACE) to begin discussing the permitting process. While the proposed filling of the river required for construction of the Phase 2 tidal marsh is permittable, it will likely be a challenging process and discussions regarding this element of the proposed work should begin earlier in the design process.

It is likely that the following permits will be required in order to complete the tidal marsh creation proposed (associated regulatory agency provided):

- Standard Dredge & Fill – Major Impact Permit (required by **NHDES** for the work below the HOT line)
    - Viable for a period of 5 years with an option to extend an additional 5 years. There are rules which prevent the acquisition of separate permits for the Phase 1 and 2 tidal marshes due to being on the same parcel; therefore, Phase 1 and Phase 2 should be considered simultaneously.
    - Important note: It is anticipated NHDES and USACE will require a five (5) years post-construction monitoring of the constructed tidal marshes to confirm successful establishment. This monitoring work must be conducted while the NHDES Standard Dredge & Fill – Major Impact Permit is active, so the project timeline should factor this in when acquiring the permits necessary for the work.
- Shoreland Permit (required by **NHDES** for work within 250 feet of lakes and ponds greater than 10 acres in size, rivers or streams which are fourth order or greater, rivers designated under RSA-483, and tidal waters)
    - Viable for a period of 5 years with an option for a time extension.
- **U.S. Army Corps**
    - Discharges of dredged or fill material into waters of the United States and work in navigable waters of the United States are regulated under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. Coordinate with a Regional USACE representative to determine if Section 404 permitting is required.
- Any local (**Town of Newmarket**) permitting requirements

5.0 POST-CONSTRUCTION TIDAL MARSH MONITORING RECOMMENDATIONS

It is anticipated NHDES and U.S. Army Corps will require development and implementation of a 5-year post-construction monitoring plan for the tidal marshes installed in the southern and northern portions of Schanda Park to confirm successful establishment. During this 5-year monitoring period, the tidal marsh(s) will need to be assessed annual and status reports submitted to NHDES, the USACE, and other interested parties regarding their establishment. The monitoring plan will need to include discussions of the following: pre-existing conditions at the project site(s); tidal marsh construction and as-built plans; performance standards the tidal marsh(s) must meet to be considered successful; the quantitative metrics to be measured during each annual assessment; and an adaptive management plan to be followed should the tidal marsh(s) show signs of failing to meet the performance standards.

Common performance standards include achieving a total areal vegetation coverage of ≥80% within the tidal marsh(s), development of a hydric soil profile, and the area not being infested by invasive species during the post-construction monitoring period. Monitoring of the tidal marsh(s) should be centered around an annual assessment conducted at the peak of the growing season prior to vegetation dieback (typically early September), supplemented by a brief site inspection each spring and after large storm events to check for any potential damage to the marsh(s). To ensure consistency between annual assessments, permanent photo stations should be selected during documentation of as-built conditions; photos documenting the marsh(s) should be collected from these stations at the same approximate angle and magnification during each site visit. We also recommend establishing a series of evenly distributed, permanent transects in the marsh(s), with the transects oriented perpendicular to the upland edge of each marsh and extending to the marsh toe. Data should be collected along each transect in consecutive 1-m^2 quadrat plots and include a list of the plant species observed, remarks on their apparent health, and percent coverage within each quadrat. Photos of each quadrat should be collected, as well as additional remarks such as any evidence of hydric soil development or incidence of negative impacts to the marsh such as erosion, excessive herbivory, or presence of invasive species.

It is recommended the adaptive management plan include potentially irrigating the tidal marsh plantings during the first growing season post-construction, particularly if conditions area drier than usual. Plantings that fail to thrive/survive the first winter should be supplemented with additional plantings at the start of the second growing season.

APPENDIX A

Design Plans & Cross Sections

SEE DESIGN PLANS LINK ON WEBPAGE

APPENDIX B

Planting and Maintenance Plan

Schanda Park

PLANTING AND MAINTENANCE PLAN

LIVING SHORELINE AND NATIVE PLANT GARDENS

Purpose

The purpose of this Planting and Maintenance Plan is to describe the existing wetland vegetation at Schanda Park, propose wetland vegetation as part of the living shoreline project, and recommend vegetation and park maintenance.

1.0 Current Living Shoreline Plants

The current living shoreline plants will be displaced if construction of the new park plan occurs. These plants should be dug up before construction begins, in order to preserve them. Once removed, they can be planted in containers until they're ready to be replanted. The plants identified at the park are listed below:

Current Shoreline Plants

Common Name	Scientific Name	Notes
Water pimpernel	*Samolus parviflorus*	Along boat ramp and low marsh. Perennial wildflower with small, white flowers.
Virginia rye grass	*Elymus virginicus*	Along low marsh and rock embankments. Fast growing perennial bunchgrass.
Seaside crowfoot	*Ranunculus cymbalaria*	Along boat ramp and banks of low marsh. Perennial that spreads via stolons and forms low-lying mats in wetlands.
Grass-leaved goldenrod	*Solidago graminifolia*	Along banks of low marsh. Upright perennial wildflower with narrow leaves and yellow flowers.
Blue vervain	*Verbena hastata*	Along banks of low marsh. Perennial wildflower with square stems and blue flowers.
Soft-stemmed bulrush	*Scirpus validus*	Along banks of low marsh. Flowering perennial in the sedge family.

2.0 Planting Plan

The living shoreline restoration project for Schanda Park will increase tidal marsh, reduce erosion, support local wildlife, and preserve the unique beauty of the area. This plan also includes instructions for restoring the public garden spaces by removing obstructing plants and invasive species and replanting with native plants.

There will be four environments for the plants:

1. **Low Marsh**- From the mid tide to the mean high tide
2. **High Marsh**- Between the 6-foot contour and mean high tide line
3. **Tidal Buffer**- Land adjacent to the water banks
4. **Upland** (Courtyard, Rain Garden)- Flooded by storm surges occasionally

2.1 Low Marsh

Low Marsh Plant List

Common Name	Scientific Name	Notes
Smooth cordgrass	*Spartina alterniflora*	Planted in the lower section of low marsh. Perennial grass with flat, blade-like leaves.
Sea lavender	*Limonium nashii*	Planted in the upper elevations of low marsh. Flowering perennial with large leaves and purple flowers.
American glasswort	*Salicornia depressa*	Planted in the upper elevations of low marsh. Succulent perennial with upright leaves and small flowers.

2.2 High Marsh

High Marsh Plant List

Common Name	Scientific Name	Notes
Salt meadow cordgrass	*Spartina patens*	Planted in lower section. Perennial grass with wiry leaves that form a whorled pattern.
Saltgrass	*Distichlis spicata*	Planted in lower section. Perennial grass with rhizomes that form dense colonies of dark-green, leafy stems.
Saltmarsh rush	*Juncus gerardii*	Planted in lower section. Flowering perennial in the rush family that forms extensive colonies.
Switchgrass	*Panicum virgatum*	Planted in upper section. Perennial bunchgrass that spreads through rhizomes and has reddish-purple seed heads.
Prairie cordgrass	*Spartina pectinata*	Planted in upper section. Fast growing perennial cordgrass.

2.3 Tidal Buffer

Tidal Buffer Plant List

Common Name	Scientific Name	Notes
Switchgrass	*Panicum virgatum*	Perennial bunchgrass that spreads through rhizomes and has reddish-purple seed heads.
Prairie cordgrass	*Spartina pectinata*	Fast growing perennial cordgrass.

2.4 Upland

Courtyard Garden

Current plants and shrubs within the courtyard garden should be removed or pruned to increase water views and improve the park's aesthetics. The new garden will feature native shrubs, interplanted with native perennials. All of the plants listed below are native to New Hampshire and relatively low maintenance.

Courtyard Plant List

Common Name	Scientific Name	Notes
Redosier dogwood	*Swida sericea*	Slow spreading shrub with bright red twigs for winter interest.
Winterberry	*Ilex verticillata*	Shrub in the holly family with purple-ish green foliage and bright red berries.
Creeping juniper	*Juniperus horizontalis*	Low growing evergreen shrub with blue berries.
Sweet fern	*Comptonia peregrina*	Low growing shrub with fern-like leaves and pleasant fragrance.
Red baneberry	*Actaea rubra*	Upright woodland perennial with bright red berries.
Northern maidenhair fern	*Adiantum pedatum*	Perennial fern with wiry black stems and curved fronds.
Anise hyssop	*Agastache foeniculum*	Perennial plant in the mint family with anise scented leaves and purple flowers.
White sage	*Artemisia ludoviciana*	Perennial shrub with smooth, oval shaped leaves.
Butterfly weed	*Asclepias tuberosa*	Perennial in the milkweed family with flowers that attract butterflies.
False indigo	*Baptisia australis*	Large, bush like perennial with deep blue flowers on upright spikes.
Switchgrass	*Panicum virgatum*	Perennial bunchgrass that spreads through rhizomes and has reddish-purple seed heads.
Creeping wood phlox	*Phlox stolonifera*	Perennial ground cover that forms mats of needle-like foliage and masses of flowers.

Rain Garden

The rain garden can be filled with sand or grass for a low maintenance plan. If a rain garden planted with native plants is preferred, some initial care will be required, as well as at least two pruning and weeding sessions between June-October. The rain garden plants that would do well at this site are listed below.

Rain Garden Plant List

Common Name	Scientific Name	Notes
Highbush blueberry	*Vaccinium corymbosum*	Upright shrub with twiggy branches, rounded leaves, and blueberries.
Meadowsweet	*Spiraea latifolia*	Upright shrub with white, sweet-smelling flowers.
Sweet pepperbush	*Clethra alnifolia*	Upright shrub with fragrant white flowers that attracts pollinators.
Redosier dogwood	*Swida sericea*	Slow spreading shrub with bright red twigs for winter interest.
Swamp milkweed	*Asclepias incarnata*	Tall, moisture loving perennial that feeds monarchs.
Joe Pye weed	*Eutrochium purpureum*	Tall perennial plant in the sunflower family with pink, early fall flowers.
Beebalm	*Monarda fistulosa*	Perennial in mint family with vibrant flowers that are great for pollinators.
Cutleaf coneflower	*Rudbeckia laciniata*	Tall, sunflower-like perennial with bright yellow flowers.
New England aster	*Symphyotrichum novae-angliae*	Flowering perennial with small purple flowers that bloom in the fall.
Upright sedge	*Carex stricta*	Perennial sedge with green stems and clusters of seed capsules that cling high on the stem.

3.0 Park Maintenance

Invasive Species Control

Before any new plants are installed, the current invasive plant species at the park should be removed. Otherwise, they'll compete with the new plantings and could overtake the small shrubs, perennials, and plugs. If any roots of invasive species remain, they are very likely to come back. Monitoring for invasive species should be done at a minimum of two times between May-October. When monitoring, look for new growth of invasive species and take the steps to remove it immediately before it spreads.

Current Invasive Plant Species

Common Name	Scientific Name	Notes
Japanese knotweed	*Fallopia japonica*	Along Moonlight Brook. Shrub-like perennial that forms large, dense clumps with bright, green leaves and white flowers. Spreads through rhizomes and seeds.
Bittersweet	*Celastrus scandens*	Along shoreline and in garden beds. Vining perennial with red berries and bright orange roots.
Beach rose	*Rosa rugosa*	Along shoreline and in garden beds. Quickly spreading shrub forming dense, multi-stemmed plants.
Purple loosestrife	*Lythrum salicaria*	Along shoreline banks and in rock crevices. Rapidly growing perennial that spreads via seed and crowds out native wetland plants.
Virginia creeper	*Parthenocissus quinquefolia*	Along shoreline and in garden bed. Vining perennial with five leaves and purple berries.

Invasive Species Treatment Plan

1) Prune the plants as low as possible with hand clippers, loppers, or brush saws. This is best done before the plants have gone to seed (late summer) to minimize spread during removal activities.
2) Dig up the plant's roots with a shovel or trowel
3) If needed, treat remaining plant material with an herbicide (Check in with regulations on what is acceptable to use within a shoreland zone beforehand)
4) Dispose of invasive plant material off site in accordance with state and local disposal regulations.
5) Continue monitoring the invasive plants for new growth and pull/treat as needed at least twice per year between May-October.

Living Shoreline Protection Protocol

Newly planted plants will be vulnerable to people and animal foot traffic, erosion, predation, and invasive plants. It's important to protect the new shoreline as much as possible, as well as garden areas, at least until they're established. Below are protocols that should be followed to do so:

- Create fencing to limit foot traffic and animals in the shoreline areas (see project narrative for fencing and signage recommendations)
- Move location of fishing weir storage off shoreline area
- Launch kayaks from boat ramp instead of living shoreline area
- Add in New Hampshire native shoreline plants to sparse areas
- Remove invasive plant species surrounding shoreline