April 19, 2023

Ms. Melissa Harlinski
Anne Arundel County Department of Public Works
Bureau of Engineering
2662 Riva Road, 3rd Floor (MS-7301)
Annapolis, Maryland 21401-7374

Re: P468700 (Contract No. P469716) Downs Park Shoreline Improvements
30% Schematic Design

Dear Ms. Harlinski:

BayLand Consultants & Designers, Inc. (BayLand) has developed the following schematic design for improvements to the existing shoreline at Downs Park, located at 8311 John Downs Loops in Pasadena, Maryland. On November 16, 2022, representatives of Anne Arundel County Department of Public Works (DPW), the Department of Recreation and Parks (DRP) and BayLand met to discuss the goals and objectives of the shoreline improvements project along the Chesapeake Bay shoreline at Downs Park. Figure 1 below shows the shoreline reaches and the applications discussed during the meeting.

Figure 1 – Shoreline Reaches and Intended Uses

Background

Downs Park has approximately 2,250 feet of shoreline along the Chesapeake Bay that consists of beach area and revetment with a small area of phragmites marsh. The shoreline is exposed to wind-generated waves across the Chesapeake Bay with fetch distances ranging between 8 to 40 miles. Storms impacting the shoreline have resulted in deterioration of areas with revetment, coastal erosion of the beaches, and even damage to infrastructure such as the walking trail.

In 2022, the Anne Arundel County DRP initiated the design of a shoreline protection project along the existing beach areas to address the observed erosion. The DRP is also interested in moving the dog beach to the beach area south of the fishing pier and providing an Americans with Disabilities (ADA)-compliant path to the new dog beach. The existing dog beach would be replaced with a living shoreline. Finally, the revetment south of the existing beach was assessed and recommendations for improvement provided.

BayLand conducted a site investigation on November 13, 2022. Topographic and hydrographic surveys were performed by BayLand on November 21, 23, 28, 29, 2023. The field investigations and review of past and present shoreline data indicated that erosion of sand is occurring in certain areas while others are experiencing relatively stable conditions. The following subsections document observations from the field investigations and a summary of data review.

Existing Dog Beach Area

The existing dog beach (Photo 1) is located at the northern most extent of the Chesapeake Bay shoreline. A set of stairs leads down from the walking path (Photo 2), located at approximately elevation +12.5 feet Mean Low Water (MLW), to the beach at +3 feet MLW. The beach is bordered by a concrete wall to the north (Photo 3) and a revetment to the south (Photo 4). The back of the beach contains a sand fence that separates the dog beach area from the marsh and pond area just west of the beach (Photo 5). A blaze orange fence was placed along the northern concrete wall to discourage visitors from moving onto private property.

The beach is approximately 30 feet wide and consists of sand with a small amount of gravel. The average elevation of the beach is approximately +2.5 feet above MLW. A few trees line the back sand fence with one tree located within the beach area. The Maryland Department of Natural Resources (DNR) analysis of the 30-year average shoreline erosion rate indicates the beach is stable and not actively eroding.

Photo 1 – Dog Beach Area (looking Northwest)

Photo 2 - Stairs leading to Dog Beach Area

Photo 3 – Concrete Wall at North End

Photo 4 – Beach and Revetment at South End

Photo 5 – Sand Fence and Pond Marsh Area

Photo 6 – Dog Beach (looking South)

Proposed Design – Living Shoreline

The preferred alternative for protection at the existing dog beach is a living shoreline with a stone headland breakwater, sand fill and marsh plantings, shown in Figure 2. The stone breakwater will be constructed in approximately 2 feet of water with a maximum encroachment of 45 feet from existing Mean High Water (MHW). Given the wave exposure at this location, the breakwater will have a top elevation of +3.5 feet MLW. Gaps of approximately 15 – 20 feet will be constructed to allow for inundation of the proposed marsh. Behind the breakwater, sand fill will be placed between the structure and tie-into the +3 feet contour. The sand will be planted with a combination of low and high marsh plantings, as appropriate. Marsh plantings and coastal shrubs will also be installed along the back of the beach area in front of the sand fence where current elevations are between +3 and +3.5 feet MLW.

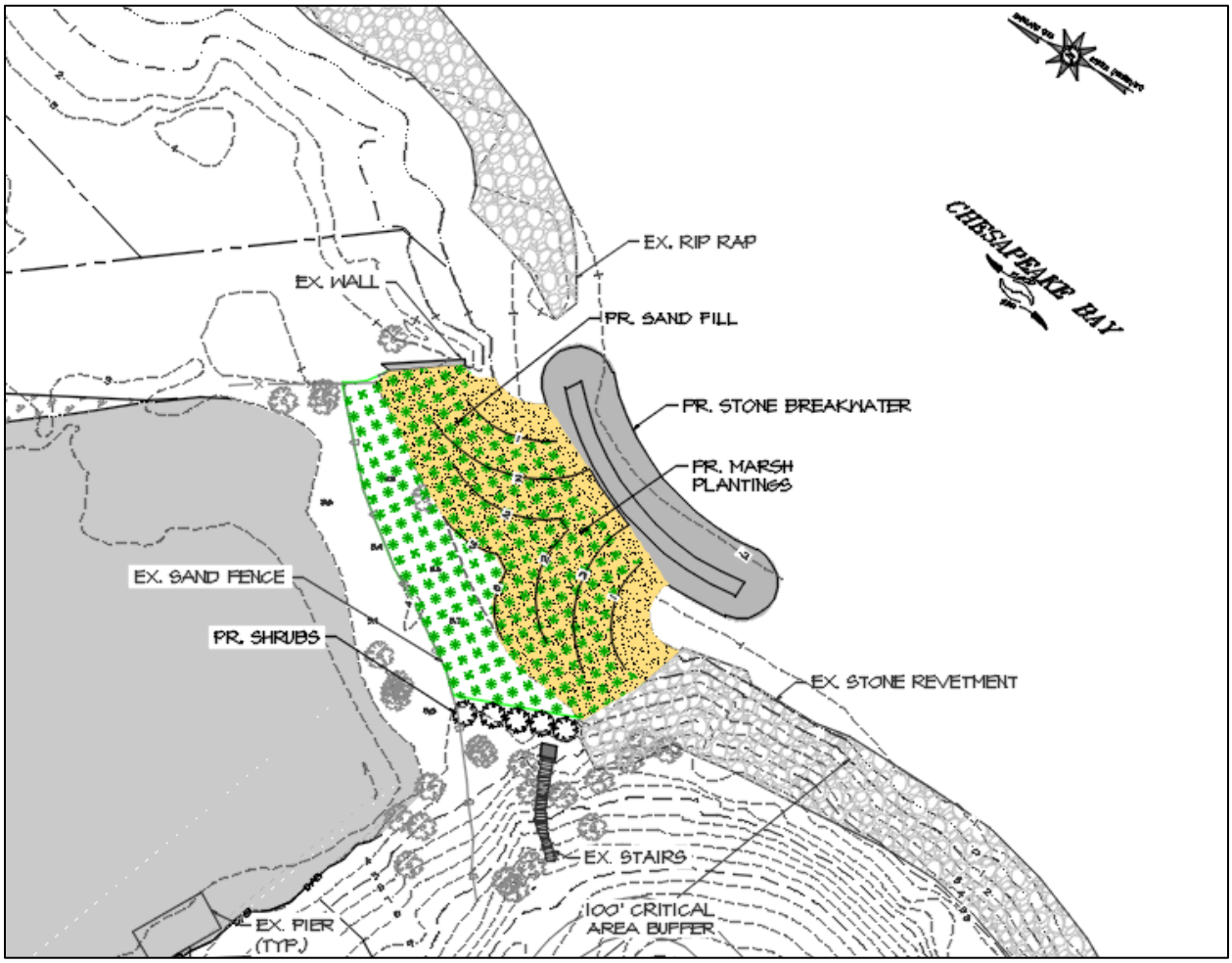

Figure 2 – Proposed Living Shoreline at Existing Dog Beach

Beach South of Fishing Pier

The beach south of the fishing pier is adjacent to revetment on both sides (Photo 7). The current width of the beach is less than 20 feet and has a documented erosion rate of 1 foot/year.[1] On the northern end of the beach, a trodden path leads from the main paved paths around the Park to the beach area, serving as access to the beach area and ad-hoc kayak launch (Photo 8 and 9). Adjacent to the path, the beach fronts a phragmites marsh (Photo 10) that likely collects stormwater from higher elevations in the park and is tidally influenced during periods of high tide. The beach area in front of this marsh is approximately +3 feet above MLW. The southern portions of the beach are backed by low, vegetated banks and forested areas with a paved walking trail (Photo 11). At the narrowest point located where the beach ties into the southern revetment, the paved walking trail is located less than 30 feet from the shoreline. This area has the highest rates of erosion along the beach, resulting in a recent path blow-out that occurred during the high-water event of October 29, 2021 (Photo 12). Another ad-hoc trodden path leads from the paved walking path to the beach area at this location (Photo 13).

[1] Maryland Coastal Atlas: https://gisapps.dnr.state.md.us/coastalatlas/WAB2/

Photo 7 – Southern Beach (looking Southwest from Fishing Pier)

Photo 8 – Path to Beach Area (looking South)

Photo 9 – Path to Beach Area (looking North)

Photo 10 – Phragmites Marsh along Back beach (looking North)

Photo 11 – Shoreline south of Phragmites Marsh backed by forest area

Photo 12 – Path Blown Out behind Narrowest Part of Beach

Photo 13 – Trodden Path leading to Beach

Photo 14 – Beach Area (looking north)

Proposed Design – Living Shoreline

The preferred alternative for shoreline protection along this area is a combination of beach nourishment and living shoreline. The existing ad-hoc path at the northern end of the shoreline reach is proposed to be formalized into an ADA-compliant permeable paver path that connects the beach to the existing paved walking trails within the Park. The dog beach is proposed to be moved to the area in front of the revetment where sand fill will be placed. A headland breakwater structure will be constructed to an elevation of +5 feet above MLW to provide adequate protection to the newly placed sand for the dog beach.

South of the proposed dog beach area, headland breakwaters to an elevation of +4 feet MLW will be constructed and sand fill will be added for additional beach nourishment or living shoreline. The southern-most reaches of the existing beach area, where erosion rates are the highest, will be protected by two breakwaters connected with a stone vent. The sand placed behind the breakwaters and vent will be an area of low marsh meant to serve as mitigation for impacts to tidal waters from the sand and stone structures. The added protection from the stone vent is necessary to protect the low-lying marsh area from wave fetches across the Chesapeake Bay.

Coastal dunes to an elevation of +5 feet above MLW are proposed along the back of the beach and living shoreline. These dunes will provide an additional buffer from storm conditions as well as act as 'feeders' to the marsh and beach to help them keep up with rising waters due to sea level rise (SLR). The dunes will be oriented so as to allow hydraulic connectivity between the phragmites marsh area and the Chesapeake Bay.

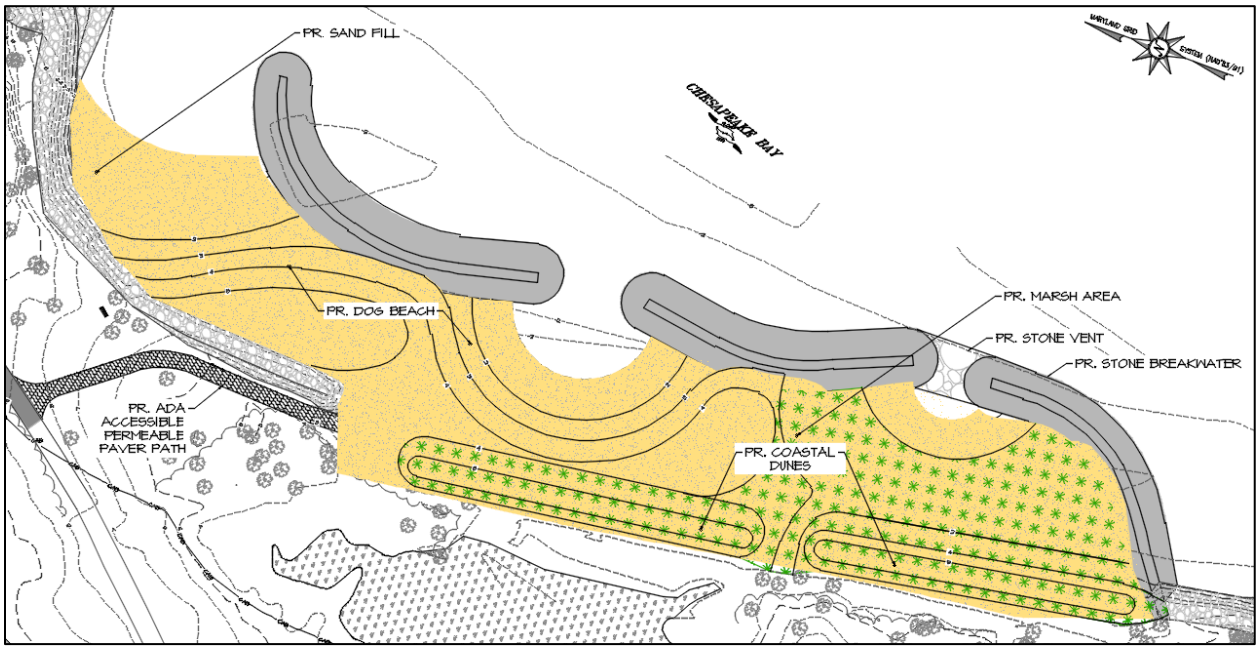

Figure 3 – Beach Nourishment for New Dog Beach and Living Shoreline

Southern Revetment

As part of the 30% Schematic Design Phase, the revetment to the south of the beach was assessed to determine its condition. During the site investigation, the revetment was observed to consist of large stones that are haphazardly placed or dumped along the shoreline. The presence of geotextile fabric and some remnants of a crest apron (stone landward of the structure to prevent scour from overtopping waves) indicate the stone may have been constructed as a revetment once but has lost its structural integrity. Voids with vegetation growing through them were observed as the stone was not properly interlocked. Additionally, the lack of interlocking was observed as stones from the structure appeared to be scattered either seaward (Photo 16) or landward (Photo 17) of the structure. Multiple washout areas (areas eroded by waves overtopping the slope protection structure) were observed (Photo 18), indicating that the structure is not dissipating wave energy efficiently. In the northern portion of revetment, closest to the existing beach area proposed for protection, the structure appears to be more robust, with multiple layers of stone placed (Photos 19 and 20).

Elevation measurements taken of the revetment during the November 2022 field investigations indicate the structure has a top elevation between +6 and +8 feet above MLW, typically considered appropriate for revetments along the Chesapeake Bay. However, due to the lack of structure crest and apron, the structure does not provide adequate wave protection.

Photo 15 – Stone Slope Protection with Voids

Photo 16 – Stones Scattered Seaward of Structure

Photo 17 – Stones Pushed back off Structure

Photo 18 – Multiple Washout Areas behind Structure

Photo 19 – Larger Revetment at Northern End (looking North)

Photo 20 – Larger Revetment at Northern End (looking South)

Recommended Improvements
Three options were considered for implementing improvements to the Southern Revetment. The first alternative consists of performing maintenance of the structure by backfilling the washout areas behind the structure crest. This option aims only to repair damage caused by previous storms and does not offer additional protection for future high wave or water level events. This option could be implemented by DRP staff or could be contracted out at a cost not expected to exceed $10,000 - $15,000.

The second option would be to rebuild the crest and apron of the revetment while leaving the slope and toe of the structure in their current condition. This would likely be done by adding stone to the crest and apron and re-grading the area landward of the structure. It is anticipated that this option will repair existing damage as well as provide protection for approximately the next 10 years. This option is anticipated to cost approximately $75,000.

To improve the performance of the revetment in protecting the shoreline for a longer term, the third option recommends that a more formalized revetment be constructed along this area. The proposed revetment would build an appropriate crest and apron for future water levels and slope down at 2 feet horizontal to 1 foot vertical to 0 feet MLW. A five-foot wide toe would be constructed to support the structure. It is anticipated that these improvements would provide protection for the next 50+ years and would cost approximately $250,000.

ADA Access Upgrades

The path leading from the Fernwood Parking area to the proposed dog beach was surveyed to determine if the path met ADA-compliance regulations. The survey showed that the path generally meets all regulations except for a few areas where slopes are steeper than the allowable maximum of 2% cross slope and 5% slope in the travel direction. The recommended alternative for repairing the areas that exceed this limit is to resurface the walking trail with slightly varying thickness of bituminous pavement in order to achieve the correct slopes.

Basis of Design

The following coastal analysis will be utilized during design development for the design of the shoreline improvements and protection measures.

Daily Water Levels
Water levels were obtained from Tide Station 8575512 in Annapolis, MD[2] operated by the National Atmospheric and Oceanic Administration (NOAA). Tidal datums (daily observed water levels) were developed at this station for the 19-year tidal epoch between 1983 and 2001. However, given the amount of sea level rise that has occurred since 2001, adjustments to the established tidal datums are necessary to accurately depict today's daily water levels.

Measurements of the highest and lowest daily tides from the NOAA tide station in Annapolis for 2022 were averaged to determine what are likely more current daily high and low water levels. Both the established tidal datums and those estimated for 2022 are proved in Table 1.

[2] https://www.tidesandcurrents.noaa.gov/map/index.html?id=8575512

Table 1 – Tidal Datums at Station 8575512 Annapolis, MD		
Datum	**Established Tidal Datums (1983 – 2001) ft MLW**	**Average Daily Tidal Datums (2022) ft MLW**
Mean Higher High Water (MHHW)	+1.21	+1.68
Mean High Water (MHW)	+0.97	+1.20
North American Datum of 1988 (NAVD88)	+0.55	-
Mean Sea Level (MSL)	-0.50	+0.98
Mean Low Water (MLW)	0.00	+0.70
Mean Lower Low Water (MLLW)	-0.22	+0.28

During Design Development, these water levels will be used to verify the elevations of the structure, beach nourishment and marsh plantings.

Storm Surge
Storm surge, or the abnormal rise of water over and above the astronomical tides generated by a low-pressure weather system, should also be considered when determining the appropriate structure elevations and stone sizes. A storm surge analysis was performed to determine the probability of elevated water levels above the daily tides. The amount of storm surge estimated for each return period (estimated average time between events) was approximated based on the 94-year water level record at the NOAA Annapolis tide gauge and are presented in Table 2.

Table 2 – Return Period Storm Surge	
Return Period (year)	**Storm Surge (feet)**
2	1.87
5	2.29
10	2.67
25	3.29
50	3.88
100	4.60

The tidal datums and storm surge estimates will be combined to determine appropriate storm water levels to verify structure elevations and slopes as well as stone sizes during Design Development.

Wind-generated Waves
Wind-generated waves impact the existing shoreline and will need to be considered in the design of the structures, beach nourishment and marsh areas. Wind data from the NOAA Station TPLM2 in Thomas Point, MD, was analyzed into a wind rose which groups wind speeds by frequency and direction and is presented in Figure 4.

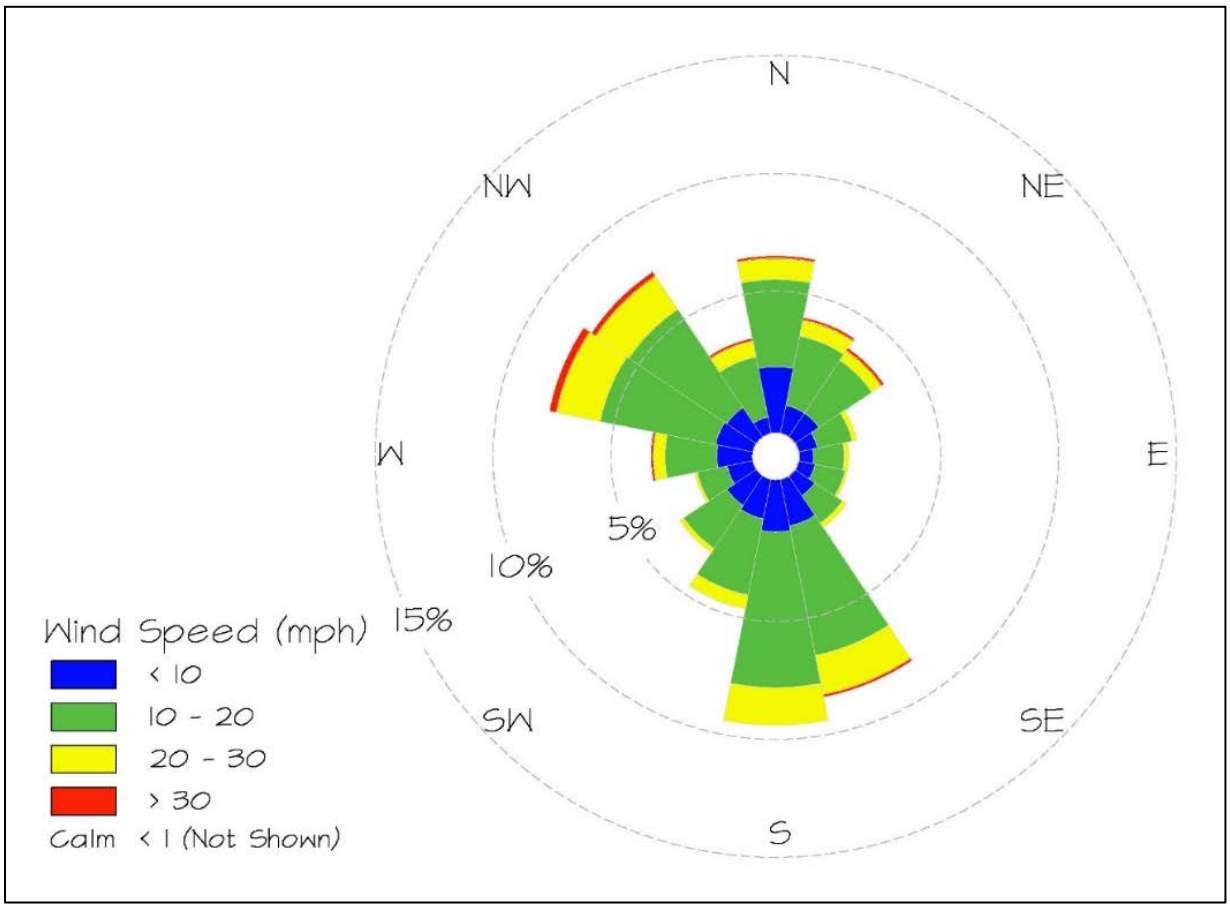

Figure 4 – Thomas Point Lighthouse Wind Rose

During Design Development, appropriate wave heights for the design of the stone structures and beach and marsh elevations will be estimated. Methodology will be based on the US Army Corps of Engineers (USACE) Coastal Engineering Manual (CEM) and other empirical relationships developed for living shorelines in similar coastal conditions.

Other Considerations

BayLand would like to mention the following design issues to be discussed at the 30% Schematic Design meeting:

1. Path Repair Area – In a recent visit to Downs Park, it was observed that path repairs had occurred with gabion baskets placed to protect the path and a new pipe installed. The schematic design proposes this area to be constructed as a tidal marsh. Discussion is requested on how to include and/or replace the elements of the repair project into this design.
2. Permeable Paver Path – The current Schematic Design proposes to use plastic cellular geogrids filled with gravel, as have been constructed for access paths in other County Parks (Jack Creek Park, proposed at Mayo Beach Park). Discussion is requested on whether or not the County would like to consider a more robust option such as brick pavers or a concrete permeable paving system.

3. Revetment Repairs – Discussion is requested on the preferred option for the revetment repairs.

Upon approval of the concept design, BayLand is prepared to move forward with the Design Development (DD) phase. If you have any questions or require additional information, please do not hesitate to contact Sepehr Baharlou, P.E. or myself at (410) 694-9401.

Sincerely,

Anna Johnson, P.E.
Coastal Engineer

Enclosures

SB/jm