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To: Shoreline Trail Design Team

From: Langan

Date: 25 February 2021

Re: Civil Design Narrative
Shoreline Trail
Hudson Highlands Fjord Trail
Langan Project No.: 170553206

Stormwater Management Strategy

The proposed Shoreline Trail project consists of the construction of new trails and landscape features. We expect that increases to impervious surfaces will be minimal. In alignment with project sustainability goals, any increased stormwater runoff associated with impervious coverage will be captured and treated prior to discharge into the Hudson River. The project will be designed to meet New York State Department of Environmental Conservation (DEC) standards with minimal environmental impacts. This can be accomplished through the use of stormwater Best Management Practices (BMPs) to reduce the quantity of stormwater runoff and improve water quality.

The reduction of stormwater can be achieved through the use of pervious trail materials as well as opportunities to promote infiltration. Use of pervious paving material will have approximately a 40% reduction in runoff compared to impervious material. Possible pervious paving materials for on grade trailways could consist of crushed stone, grasscrete pavers, pervious concrete and/or asphalt, or engineered gravel paving surfaces.

The expected disturbance of the proposed project is over an acre, therefore we will need to comply with DEC standards for water quality. Presently the site drains via overland flow across a vegetated buffer and stone revetment to the Hudson River. The drainage design for this project intends to keep these existing flow pattern. No new point source discharges are proposed as part of this project.

One of the project sustainability goals are to exceed state standards. A potential path for exceeding state standards for stormwater management would be with respect to water quality. DEC standards requires the project to treat stormwater runoff for the 90% rainfall event. However LEED V4 requires treatment of the 95% storm event to obtain 1 credit and of the 98% storm event for 3 credits. A reasonable goal to achieve would be treatment of the 95% storm event which will result in approximately 20% greater volume when compared to the state standard.

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UTILITY DESIGN CONSIDERATIONS

Langan reviewed the following the project survey titled "Hudson Highlands Fjord Trail Shoreline Section (Breakneck Tunnel to Dockside Park)," dated December 5, 2020 as prepared by Badey & Watson Surveying & Engineering, P.C.

In addition, the design team has researched publicly available information to gain a general understanding of the site, including available current and historic aerial maps, and United States Geological Survey (USGS) topographical maps. The design team has also identified some utility information during a site walk on October 7, 2020.

The following existing utility information was observed on the surveys within the Shoreline Trail limit of work:

- Storm
 - 14 culverts crossing under Route 9D
 - 7 culverts crossing under MNR rails
 - 1 culvert in Little Stony Point
- Electric and telecommunications
 - Underground electric service along the east and west side of the Metro North Railroad (MNR) rails
 - Overhead electric service along the west side of Route 9D
 - Future test trench for MNR signal infrastructure along west side of MNR rails
 - Approximately 7,400 LF of unclassified utility line east of MNR rails between utility boxes, assumed to be electric or telecommunications
- Water – not shown on survey
- Sanitary – Not shown on survey
- Gas – Not shown on survey

Storm Sewer Considerations

It is anticipated to minimize the amount of proposed storm sewers needed for the project. Drainage swales will be proposed as a means of conveyance in order to reduce the amount of pipe needed. In addition, the existing stormwater culverts crossing Route 9D and Metro North rails are expected to remain and will not be replaced.

Water Infrastructure Considerations

There are no public water lines in the proximity of the project. No water lines or wells are proposed as part of this project

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Electric Considerations

No electrical improvements are proposed as part of this project. If any of the overhead utility poles along Route 9D must be adjusted due to conflicts with the proposed design, this will need to be coordinated with the utility provider and DOT.

Proposed lighting is not anticipated to be part of this project. If at any point lighting is pursued, it will be subject to agency approvals including DOT and the Town of Philipstown.

GEOTECHNICAL CONSIDERATIONS

Our understanding of the project is based on information from project team meetings, Shoreline Trail Presentations prepared by Scape (dated 12/07/2020 and 01/08/2021), the project survey prepared by Badey and Watson Surveying and Engineering P.C. (dated 08/24/2020), geologic maps, and a site visit on 10/08/2020.

The Shoreline Trail, extending from Dockside Park in Cold Spring (south end) to Breakneck Ridge (north end), is a subproject of the 8-mile Hudson Highlands Fjord Trail (HHFT). Figure 1 is a key plan with proposed trail features summarized below.

Figure 1: Shoreline Trail Key Map



- Trail Section A: Overlook (about 700 ft)
- Trail Section B: Cantilevered Elevated Trail (about 2,800 ft)
- Trail Section C: Combination of Elevated and At-Grade Trail (about 2,600 ft)
- Trail Section D: At-Grade Trail over Little Stony Point (about 1,500 ft)
- Trail Section E: Cantilevered Elevated Trail (about 2,900 ft)
- Trail Section F: At-Grade Trail (about 600 ft)

We anticipate that the subsurface exploration would consist of borings and test pits along the trail alignment. Proposed scope for the frequency of borings and test pits for each trail section are provided in Table 1. The suggested frequency and depth of borings and test pits are dependent on the proposed structure, trail alignment, and constraints of existing conditions. We note that the subsurface exploration scope provided herein is subject to change based on alternations to the proposed Shoreline Trail scheme and design, and agency approvals (e.g., Metro North Railroad).

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Access to the site is limited – the majority of the site is not accessible to truck-mounted drill rigs. The subsurface exploration will require Metro North Railroad (MNR) approval, insurances, and flag-persons during field work – particularly at Trail Sections B, C, and E. MNR has indicated that they prefer equipment to be 10 ft clear of the tracks.

Table 1: Proposed Subsurface Exploration Scope

| Trail Section (Refer to Figure 1) | Proposed Subsurface Exploration Type | Proposed Subsurface Exploration Frequency | Proposed Subsurface Exploration Depth |
|-----------------------------------|--------------------------------------|---|--|
| A | Borings | 1 boring per 100 ft | Core 5 ft of bedrock or 40 ft deep, whichever is shallower |
| B | Borings | 1 boring per 100 ft | Core 5 ft of bedrock or 60 ft deep, whichever is shallower |
| C | Borings | 1 boring per 100 ft | Core 5 ft of bedrock or 40 ft deep, whichever is shallower |
| D | Test Pits | 1 test pit per 200 ft | To top of bedrock or up to 5 ft deep, whichever is shallower |
| E | Borings | 1 boring per 150 ft | Core 5 ft of bedrock or 60 ft deep, whichever is shallower |
| F | Test Pits | 1 test pit per 150 ft | To top of bedrock or up to 5 ft deep, whichever is shallower |

The borings are to be drilled using mud rotary drilling techniques. Standard Penetration Testing (SPT) split spoon sampling is to be performed in accordance with ASTM D1586 at each boring location – continuously through the upper 12 ft, and at 5 ft intervals or changes in strata thereafter. Undisturbed samples are to be taken in clay layers. Drilling and soil samples are to be field visually classified by a geotechnical engineer. The borings shall be backfilled with soil cuttings and/or grout to match the adjacent grade upon completion.

Each test pit excavation is to be a minimum of 4 ft by 4 ft in plan. Test pits are to be excavated using a mini-excavator or hand equipment. Test pits are to be sloped, benched, sheeted and shored in general accordance with OSHA requirements. After the test pit information is recorded by the geotechnical engineer, the contractor is to backfill each test pit with the excavated material and compact in lifts to the engineer’s approval. Each excavation is to be patched to match the existing adjacent surface, as required.

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SHORELINE STABILITY CONSIDERATIONS

Langan conducted a desktop study for reaches 4, 5, and 6 of the Shoreline Trail. The desktop study followed the criteria set out in the ASCE Waterfront Facilities Inspection and Assessment Practice No. 130, and the NYC EDC Waterfront Inspection Guidelines Manual. Photographs of the site were reviewed for evidence of the following:

- Erosion of escarpment
- Washout
- Vegetation type, quality, quantity, root exposure
- Level of exposure to environmental impacts
- Misalignment, settlement, or bulging

Additional site observation and assessment of subsurface investigation necessary to confirm. Visual inspections by walkthrough or kayak will be necessary to confirm the results of the desktop study. Langan will observe the site for evidence of erosion of escarpment, washout, vegetation type, quality, quantity, and root exposure, level of exposure to environmental impacts, misalignment, settlement, or bulging. Borings will be needed along the trail alignment to determine depths, compositions, and qualities of soils, determine the depth of rock, and assess slope stabilities.

Reach 4

Overall, the Reach 4 shoreline appears to be largely stable at this time based on desktop study. Near the north end of Little Stony Point, the cove's shoreline slope is relatively shallow and the shoreline sediment appears to consist of fine sand at the high tide line and increasingly gravelly towards the river. Mud-trapping grasses and trees grow inboard of the shoreline. At the north end of the cove, the shoreline has been fortified with armor and bedding stone. There appears to be some gaps in the armor stone, albeit with no indication of scour. The tide/flood markings on the stone appear to rise from about $\frac{1}{2}$ to about $\frac{3}{4}$ of the armor stone embankment height. There appears to be some evidence of upper embankment drop-offs which expose some of the upper embankment soils.



Photo Set 1: Reach 4 Southern End

A stone jetty juts out from the shoreline in an about southwest by south direction. The jetty may have been originally constructed to support a wharf that was sheltered from southward

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flowing ice flows and wind driven waves (whereas Little Stony Point protects the jetty from Southern wind and waves). This is evidenced by the partially exposed timber “facing” on the jetty’s south side. Behind the jetty, stone cover varies greatly. North of the jetty, the armor stone embankment resumes.



Photo Set 2: Reach 4 Middle

Inboard the stone embankment is generally vegetated. Does not appear to include a significant amount of ground cover other than shrubs and trees. The width of vegetated area between the embankment and RR appears to vary greatly.

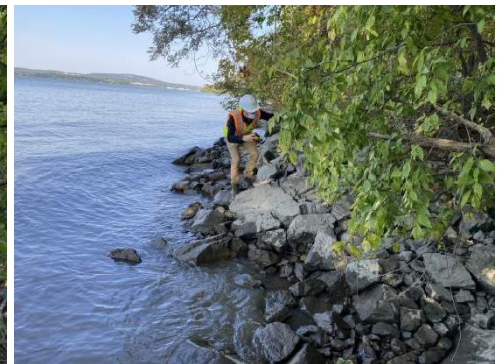


Photo Set 3: Reach 4 North End

Reach 5

Overall, the Reach 5 shoreline appears to be largely stable at this time based on desktop study. The shoreline has armor stone embankment similar to Reach 4. The armor stone embankment north of Breakneck Creek starts with a shallow rise and becomes steeper as one travels north. The width of the vegetation buffer between the river and railroad varies greatly. The armor stone becomes less consistent going north and the shoreline slope becomes increasingly shallow, in particular near the end of Reach 5 (e.g., at Breakneck Point).

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Photo Set 4: Reach 5 South End



Photo Set 5: Reach 5 North End

Reach 6

Overall, the Reach 6 shoreline appears to be largely stable at this time based on desktop study. The width of the vegetation buffer between the river and railroad becomes dominant at Breakneck Point. The armor stone becomes less consistent going north and the shoreline slope becomes increasingly shallow, throughout Reach 6. North of Reach 6, the trail is proposed to tie in to the Breakneck Connector section of the Hudson Highlands Fjord Trail.



Photo Set 6: Reach 6

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APPROXIMATE PERMITTING TIMELINES

The table below summarizes the timeline for expected permits from each agency having jurisdiction related to the Shoreline Trail:

| Agency | Timeline (months) | Permit | Notes |
|---------------------|-------------------|--------------------------------------|---|
| USACE | 3 - 4 | Tidal Wetland Application | A joint permit application between the US Army Corp of Engineers (USACE) and NYS Department of Environmental Conservation (NYS DEC) will be required for all sections of the trail that are proposed in the Hudson River, in the tidal wetlands, or within the wetland adjacent areas. |
| | 4 - 6 | Wetland Mitigation | |
| NYS DEC | 4 - 6 | Tidal Wetland Application | |
| | 4 - 6 | Wetland Mitigation | |
| | 3 | SPDES Permit Application | The estimated disturbance area for construction of the Shoreline Trail will be greater than one acre. Therefore a Storm Water Pollution Prevention Plan (SWPPP) will need to be developed and submitted to NYS DEC as part of the required SPDES permit application. |
| MNR | 6 - 8 | Site Plan Review | Metro-North Railroad (MNR) will need to review all proposed construction on its property and near the existing rails. |
| NYC DEP | 8 - 12 | Site Plan Review | NYC Department of Environmental Protection (NYC DEP) will need to review all work within its easement. This may impact work within Reach 06-01 at the Lower Overlook and tie ins to the Breakneck Connector section of the trail. |
| Putnam County | 3 | Site Plan Review - overall | Putnam County will need to review all components of the trail design for conformance with local code. |
| Town of Philipstown | 3 - 6 | Site Plan Review - overall | The Town of Philipstown will need to review all components of the trail design for conformance with local code. |
| | 3 | SWPPP Review | The Town of Philipstown will need to review the SWPPP that is prepared as part of the NYS DEC SPDES permit for conformance with local requirements. |

Additional approvals:

NYSDOS Office of Planning and Development - This is the delegated agency for the federal Coastal Consistency determination required for all federal permits in the Coastal Zone.

NYS Office of General Services - Any structures over underwater lands of the state require a permit or easement from OGS.