A. INTRODUCTION

This chapter presents the existing conditions and addresses the Proposed Action's potential impacts on land within the Fjord Trail North Corridor. An evaluation of the proposed Fjord Trail South is provided in Chapter IV.C, "Land – Fjord Trail South."

This chapter describes the existing geology, soils, and topography within the Fjord Trail North Corridor and addresses potential impacts to these resources. Bedrock geology, surface soils, and steep slopes are based on topographic surveys and data published by the U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS). Impacts to these resources are based on the potential for soil erosion and impacts to geologic resources. The sections on surficial geology and soils consider the unconsolidated surficial deposits and the uppermost layer of the ground, which has been exposed to climatic and erosive forces. The bedrock geology sections consider the underlying bedrock. The topography sections address issues related to slopes, accessibility, and sea level rise.

REGULATORY CONTEXT FOR SLOPES AND ACCESSIBILITY

A portion of the Fjord Trail North Corridor is located on privately owned parcels that are subject to local steep slope regulations, which include:

- Town of Fishkill: Chapter 150 "Zoning" states that existing vegetation on areas of steep slopes—defined as those greater than 20 percent over a horizontal distance of 100 feet—shall not be disturbed.
- City of Beacon: Chapter 223 "Zoning" states that existing vegetation on areas of very steep slopes—defined as those greater than 25 percent over 10,000 square feet of contiguous area—shall not be disturbed wherever practicable.

To the extent other portions of the Fjord Trail North Corridor are on land owned by the Metropolitan Transportation Authority (MTA) or located within the Hudson Highlands State Park Preserve (HHSPP), which is under the jurisdiction of the New York State Office of Parks, Recreation and Historic Preservation (OPRHP), local slope regulations are generally inapplicable.

The Main Trail would be designed to be Accessible, which means it will provide recreational opportunities for everyone regardless of differences in ability. The Main Trail would be 10 to 14 feet wide and gently sloped.

B. EXISTING CONDITIONS

SURFICIAL GEOLOGY AND SOILS

Soils within the Fjord Trail North Corridor generally consist of clay, silt, and loam with varying amounts of sand and gravel, and they vary greatly in depth, ranging from less than a foot to over 50 feet. Several areas along and near the Fjord Trail North Corridor have historically been quarried, including Denning's Point and an area just south of Fishkill Creek for sand and clay,

respectively, used in brick manufacturing, and at the southern and northern portions of Breakneck Ridge for granite-gneiss stone. Surficial soils in the Fjord Trail North Corridor have the potential to be relatively thin in these quarried locations due to removal of surface soils during previous excavations. Removal of surface soils can lead to altered water regimes and erosion patterns, which in turn can impact sedimentation and surface water quality.[1] Between Long Dock Park and Breakneck Ridge, the Fjord Trail North Corridor consists primarily of lacustrine silt and clay with highly variable depths.

Table III.C-1 lists the soil mapping units intersecting the Fjord Trail North Corridor and their primary characteristics. The spatial arrangement of these soil types as mapped by the Web Soil Survey is shown in **Figures III.C-1a and 1b**.

Table III.C-1
Soils Underlying the Fjord Trail North Corridor

Symbol	Soil Series name	Drainage Class	Depth to bedrock	Depth to seasonal high water	Characterization
ClC	Charlton fine sandy loam, 8 to 15 percent slopes, very stony	Well drained	More than 80 inches	More than 80 inches	Moderately low to high capacity of the most limiting layer to transmit water (Ksat = 0.14 to 14.17), moderate available water storage (about 8.7 inches). Hydric Soil Group: B.
CrD	Charlton-Chatfield complex, hilly, rocky	Well drained	More than 80 inches	More than 80 inches	Moderately high to high capacity of the most limiting layer to transmit water (Ksat – 0.57 to 5.95 in/hr), moderate available water storage (about 7.6 inches). Hydric Soil Group: B.
CsD	Chatfield-Charlton complex, 15 to 35 percent slopes, very rocky	Well drained	20 to 41 inches to lithic bedrock	More than 80 inches	High runoff class. Very low capacity of the most limiting layer to transmit water (Ksat = 0.0 in/hr). Low available water storage (about 4.3 inches). Hydrologic Soil Group: B.
CtC	Chatfield-Hollis rock complex, rolling, very rocky	Well drained	20 to 41 inches to lithic bedrock	More than 80 inches	High runoff class. Very low capacity of the most limiting layer to transmit water (Ksat = 0.0 in/hr). Low available water storage (about 4.3 inches). Hydrologic Soil Group: B.
CuD	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	Well drained	20 to 41 inches to lithic bedrock	More than 80 inches	High runoff class. Very low capacity of the most limiting layer to transmit water (Ksat = 0.0 in/hr). Low available water storage (about 4.3 inches). Hydrologic Soil Group: B.

[1] Santos, E.S., D. Aran, M.M. Abreu, and A. de Varennes. 2016. Chapter 8 – Engineered Soils Using Amendments for In Situ Rehabilitation of Mine Lands. Bio-Geotechnologies for Mine Site Rehabilitation. Pages 131-146.

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Trail Corridor - Fjord Trail North

Soil Type

NRCS Soils

Figure III.C-1a

9.22.24

NRCS Soils

Figure III.C-1b

Table III.C-1
Soils Underlying the Fjord Trail North Corridor

Symbol	Soil Series name	Drainage Class	Depth to bedrock	Depth to seasonal high water	Characterization
HoF	Hollis-Chatfield-Rock outcrop complex, very steep	Somewhat excessively drained	10 to 20 inches to lithic bedrock	More than 80 inches	Very low to high capacity of the most limiting layer to transmit water (Ksat = 0.00 to 5.95 in/hr). Very low available water storage (about 1.9 inches). Hydrologic Soil Group is D.
HrF	Hollis-Rock outcrop complex, 35 to 60 percent slopes	Somewhat excessively drained	8 to 23 inches to lithic bedrock	More than 80 inches	Very low capacity of the most limiting layer to transmit water (Ksat = 0.00 in/hr). Very low available water storage (about 2.7 inches). Hydrologic Soil Group is D.
HvB	Hudson and Vergennes soils, 3 to 8 percent	Moderately well drained	More than 80 inches	About 18 to 24 inches	Farmland of Statewide Importance. Moderately low to moderately high capacity of the most limiting layer to transmit water (Ksat = 0.06 to 0.20 in/hr). High available water storage in profile (about 9.8 inches). Hydrologic Soil Group is C/D.
HvC	Hudson and Vergennes soils, 8 to 15 percent	Moderately well drained	More than 80 inches	About 18 to 24 inches	Farmland of Statewide Importance. Moderately low to moderately high capacity of the most limiting layer to transmit water (Ksat = 0.06 to 0.20 in/hr). High available water storage in profile (about 9.8 inches). Hydrologic Soil Group is C/D.
HvE	Hudson and Vergennes soils, steep	Moderately well drained	More than 80 inches	About 18 to 24 inches	Moderately low to moderately high capacity of the most limiting layer to transmit water (Ksat = 0.06 to 0.20 in/hr). High available water storage in profile (about 9.8 inches). Hydrologic Soil Group is C/D.
Hy	Hydraquents and Medisaprists soils, ponded	Very poorly drained	More than 80 inches	About 0 inches	Moderately low to high capacity of the most limiting layer to transmit water (Ksat = 0.06 to 5.95 in/hr). Moderate available water storage in profile (about 7.3 inches). Hydrologic Soil Group is A/D.
KrB	Knickerbocker fine sandy loam, undulating	Somewhat excessively drained	More than 80 inches	More than 80 inches	All areas are prime farmland. High capacity of the most limiting layer to transmit water (Ksat = 1.98 to 5.95 in/hr). Low available water storage (about 5.2 inches). Hydrologic Soil Group is A.
KrC	Knickerbocker fine sandy loam, rolling	Somewhat excessively drained	More than 80 inches	More than 80 inches	Farmland of Statewide Importance. High capacity of the most limiting layer to transmit water (Ksat = 1.98 to 5.95 in/hr). Low available water storage (about 5.2 inches). Hydrologic Soil Group is A.

Table III.C-1
Soils Underlying the Fjord Trail North Corridor

Symbol	Soil Series name	Drainage Class	Depth to bedrock	Depth to seasonal high water	Characterization
NwC	Nassau-Cardigan complex, rolling, very rocky	Somewhat excessively drained	10 to 20 inches to lithic bedrock	More than 80 inches	Low to moderately low limiting layer to transmit water (Ksat = 0.00 to 0.06 in/hr). Very Low available water storage (about 1.7 inches). Hydrologic Soil Group is D.
Pv	Pits, quarry	--	0 to 60 inches to unweathered bedrock	--	--
Ub	Udorthents, smoothed	Moderately well drained	40 to 60 inches to lithic bedrock	About 18 to 48 inches	Moderately low to high limiting layer to transmit water (Ksat = 0.06 to 5.95 in/hr). Low available water storage (about 4.6 inches). Unranked Hydrologic Soil Group.
Uc	Udorthents, wet substratum	Well drained	40 to 60 inches to lithic bedrock	About 6 to 24 inches	Moderately low to high limiting layer to transmit water (Ksat = 0.06 to 5.95 in/hr). Low available water storage (about 4.6 inches). Unranked Hydrologic Soil Group.
Ud	Udorthents, smoothed	Well drained	More than 80 inches	About 36 to 72 inches	Moderately low to high limiting layer to transmit water (Ksat = 0.06 to 5.95 in/hr). Low available water storage (about 5.5 inches). Hydrologic Soil Group is A.
UhB	Urban land-Charlton complex, 2 to 8 percent slopes	Well drained	More than 80 inches	More than 80 inches	Moderately high to high limiting layer to transmit water (Ksat = 0.56 to 5.95 in/hr). Moderate available water storage (about 7.5 inches). Unranked Hydrologic Soil Group.

Source: USDA NRCS Web Soil Survey, accessed March 2024 (https://nrcs.app.box.com/v/soils)

As described in **Table III.C-1**, the soils within the Fjord Trail North Corridor are generally well drained to somewhat excessively well drained and have low water tables (i.e., greater depths to groundwater) and deep bedrock, except for occasional outcrops. Most soils within the Fjord Trail North Corridor have slopes ranging from 0 to 15 percent and are characterized as rocky to very rocky. The areas in the middle section of the Fjord Trail North Corridor (referred to as the Forest Trail Reach, as shown in Figure II-1a and 1b) are mostly characterized by soils of Farmland of Statewide Importance.[2] The areas of the Fjord Trail North Corridor within the City of Beacon are mostly characterized by soils made up of urban fill. Although soils of prime farmland and Farmland of Statewide Significance are present, no Agricultural Districts are located within the Fjord Trail North Corridor.

Geotechnical borings were conducted in 2016 for the Breakneck Connector and Bridge Project (BNCB) just south of the Fjord Trail North Corridor. While outside of the Fjord Trail North

[2] The NRCS defines farmland of statewide importance as those that do not meet the criteria for prime or unique farmland; generally, these areas nearly meet the requirements and can produce high crop yields.

Corridor, the nearest boring was advanced less than 200 feet from the southern end of the Fjord Trail North Corridor and others were drilled in the Hy soil series, which runs along roughly 2,000 feet of the Fjord Trail North Corridor near its southern terminus (see **Figure III.C-1b**). These borings revealed surficial soils consisting of silt and clay with varying proportions of sand and cobbles within the approximately 0.5-mile length of the BNCB. The depth of surficial soils in the borings ranged from 5 feet to 65 feet (see **Appendix III/IV.C**).

BEDROCK GEOLOGY

The Fjord Trail North Corridor is located in the Hudson Highlands, an area of the Hudson River Valley characterized by mountains and steep grade changes. The Fjord Trail North Corridor runs through or adjacent to HHSPP on the east side of the river. The area features bedrock formed during the Grenville Orogeny (during the Middle Proterozoic Eon, 1,300 to 800 million years ago [Ma]), marine sediment deposits formed during the Cambrian Period (543 to 490 Ma), sediments metamorphosed by the Taconic Orogeny (490 to 443 Ma), and glacial till deposited during the Pleistocene's great ice age and the retraction of the glacier after (1.8 Ma to 10 thousand years ago [ka]). The result of the ice age created the current Hudson River Valley and Hudson Highlands.[3] A portion of the Fjord Trail North Corridor between the Notch and the BNCB contains hard granites and gneisses. Softer biotites and gneisses are found southeast of the Fjord Trail North Corridor in the vicinity of Cold Spring, and softer siltstones and shales are found within the vicinity of Beacon. Three types of bedrock intersect the Fjord Trail North Corridor (see **Figure III.C-2**): Pyroxene-hornblende-quartz-plagioclase gneiss (qpg), hornblende granite and granite gneiss (hg), and Austin Glen Formation (Oag) formed during the Grenville Orogeny and the Cambrian Period. According to the soil characteristics in **Table III.C-1**, bedrock is generally 10 inches to more than 80 inches below ground surface. However, the southern portion of the Fjord Trail North Corridor up to the Notch contains areas of exposed bedrock. Based on geotechnical borings conducted for the BNCB, bedrock within the vicinity of Breakneck Ridge, near the southern terminus of Fjord Trail North Corridor, is located between 5 and 65 feet below ground surface (see **Appendix III/IV.C**).

Fault lines representing shifts of the earth's crust from plate tectonic forces during different eras are located along the Fjord Trail North Corridor. The fault lines mostly run northeast to southwest (see **Figure III.C-3**). The fault lines can be seen along the Fjord Trail North Corridor with structural deformation such as folding, which is caused by compression of the rock layers that causes twists and bends within the rocks over time. The faults in the region are considered inactive as they are very old. However, some plate tectonic movement can create small minimally noticeable earthquakes.

TOPOGRAPHY

The topography of the Fjord Trail North Corridor is varied, with some portions located in relatively narrow and flat areas between mountainous terrain to the east and the Hudson River to the west. However, some sections are characterized by steeper slopes, particularly within HHSPP (see **Figures III.C-4a-4e**). Although portions of Fjord Trail North Corridor have minimal slopes, some areas contain steep slopes of greater than 25 percent (see **Figures III.C-5a-5b**). The Trail

[3] Cornell Cooperative Extension Dutchess County (CCEDC) Environment and Energy Program, Cary Institute of Ecosystem Studies, Dutch County Department of Planning and Development, Dutchess County Environmental Management Council, and Vassar College Environmental Research Institute. 2010. The Natural Resource Inventory of Dutchess County, NY. November 2010.

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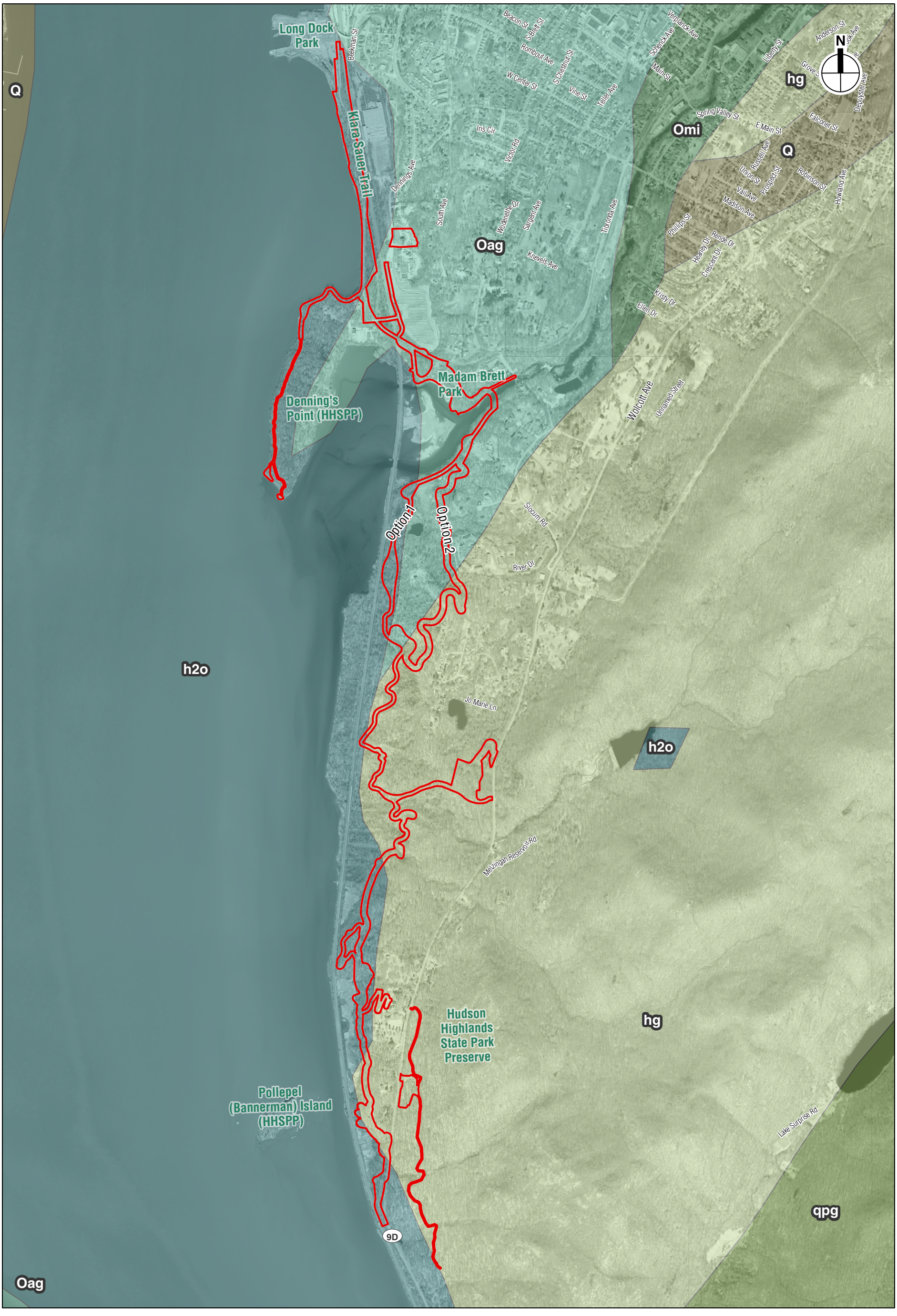

Trail Corridor - Fjord Trail North

Oag *Austin Glen Formation*

Q *Glacial and Alluvial Deposits*

hg *Hornblende granite and granite gneiss*

Omi *Mount Merino and Indian River Formations*

h2o *Water*

qpg *Quartz-plagioclase gneiss*

0 2,000 FEET

HUDSON HIGHLANDS FJORD TRAIL

Bedrock Geology

Figure III.C-2

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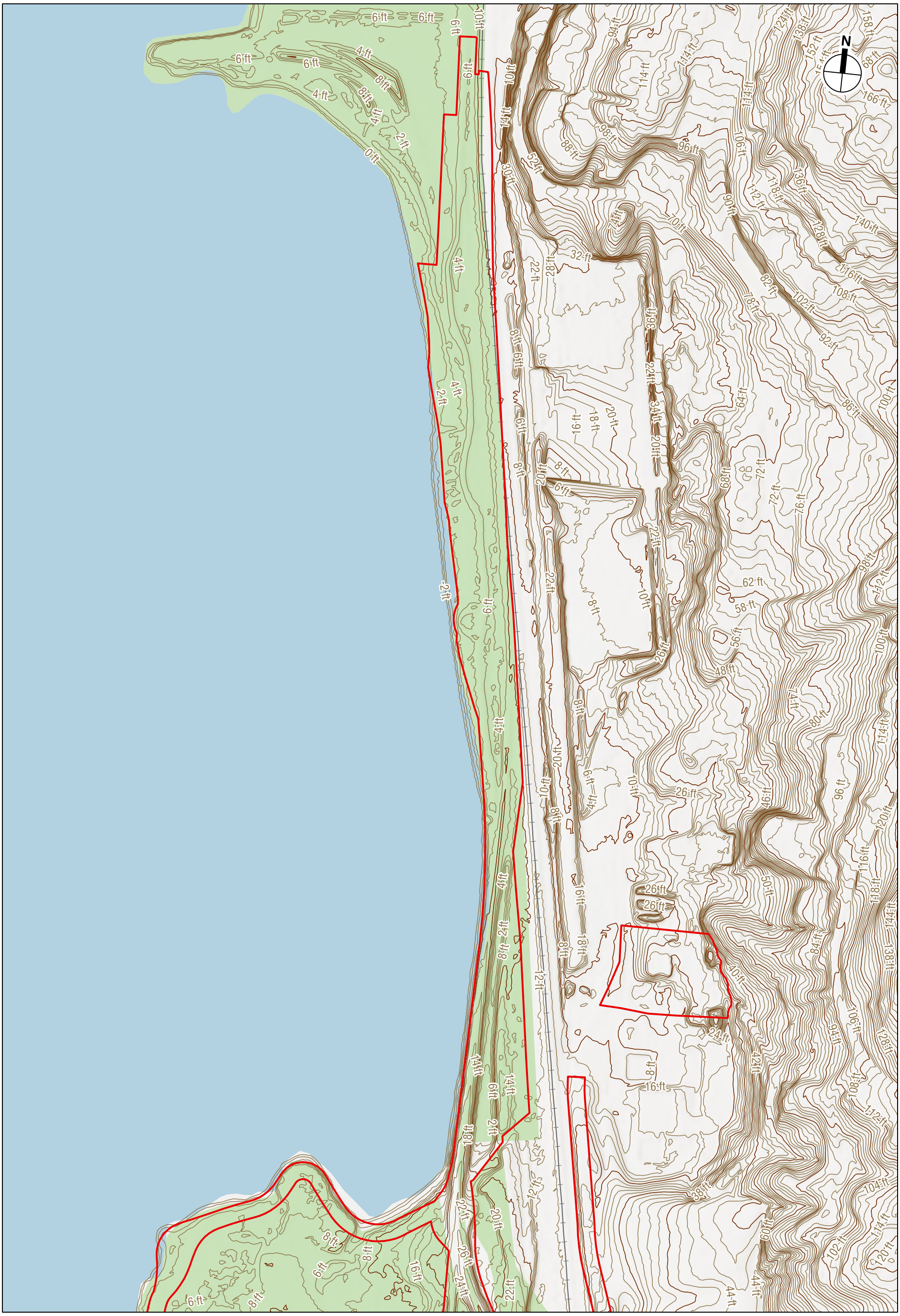
Trail Corridor - Fjord Trail North

Fault Lines

Fault Line Locations

Figure III.C-3

9.22.24



Trail Corridor - Fjord Trail North

Contours

10 foot

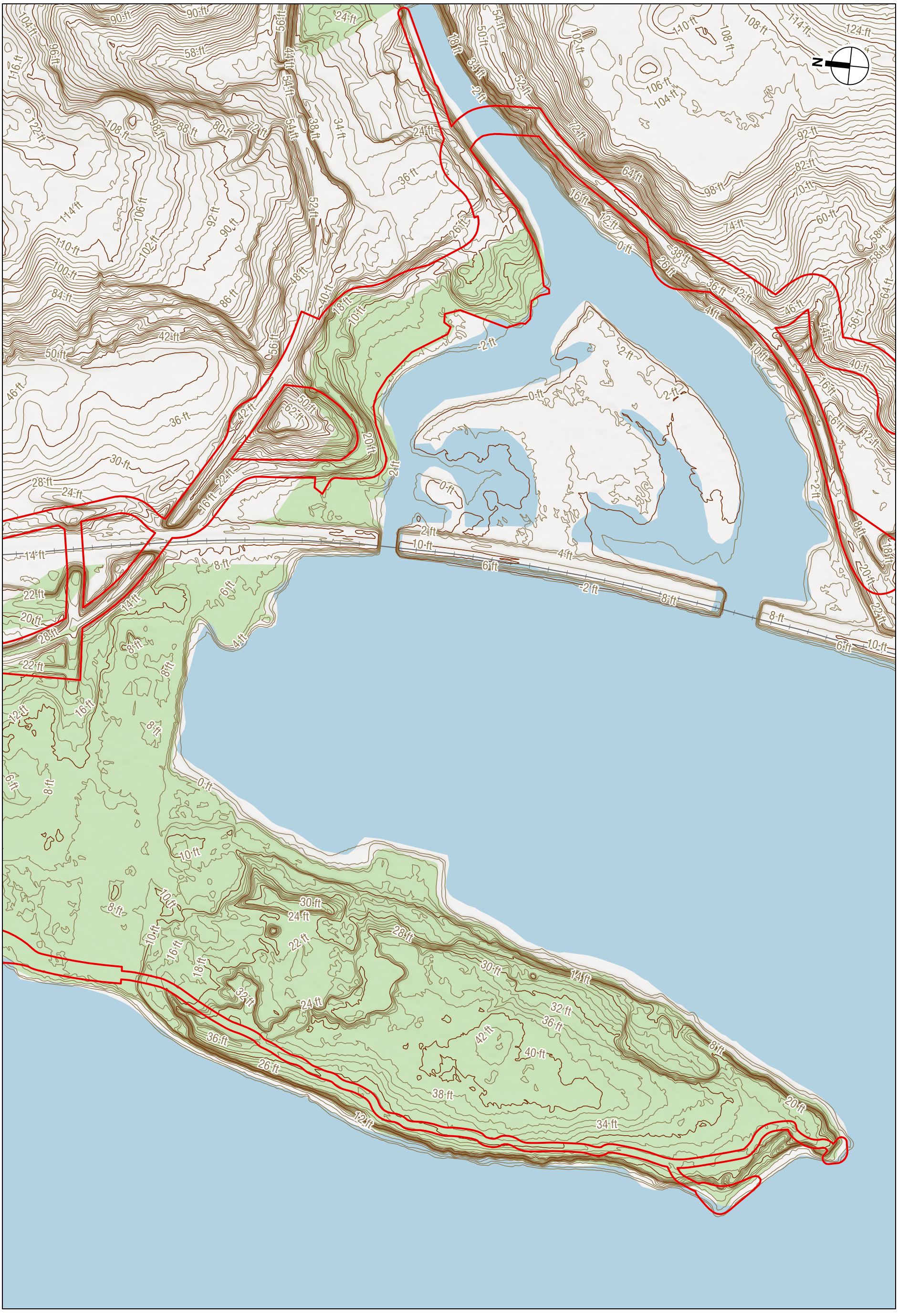
2 foot

HUDSON HIGHLANDS FJORD TRAIL

Topography

Figure III.C-4a

9.22.24



Trail Corridor - Fjord Trail North

Contours

10 foot

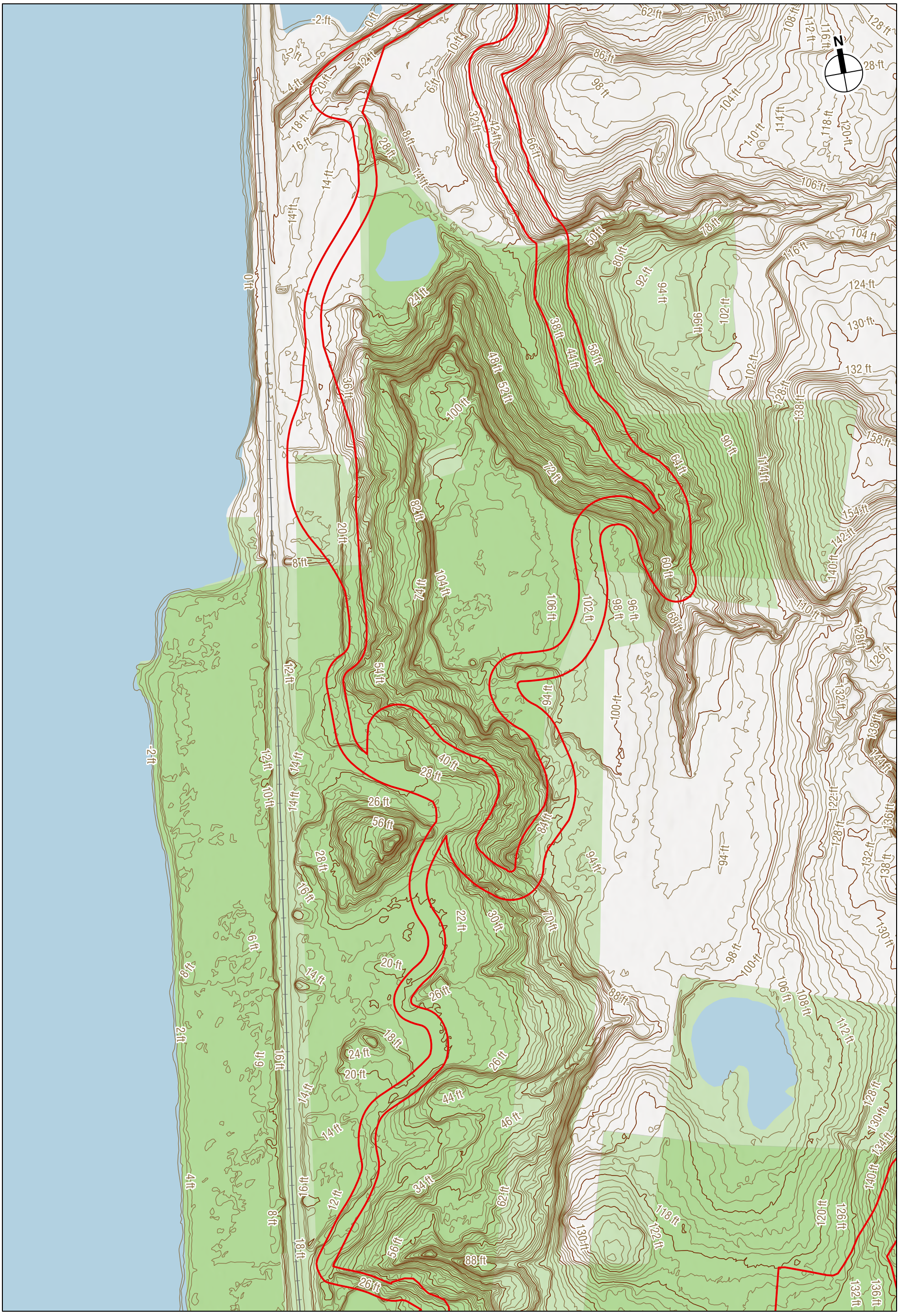
2 foot

HUDSON HIGHLANDS FJORD TRAIL

Topography

Figure III.C-4b

9.22.24



Trail Corridor - Fjord Trail North

Contours

10 foot

2 foot

HUDSON HIGHLANDS FJORD TRAIL

Topography

Figure III.C-4c

9.22.24

Trail Corridor - Fjord Trail North

Contours

10 foot

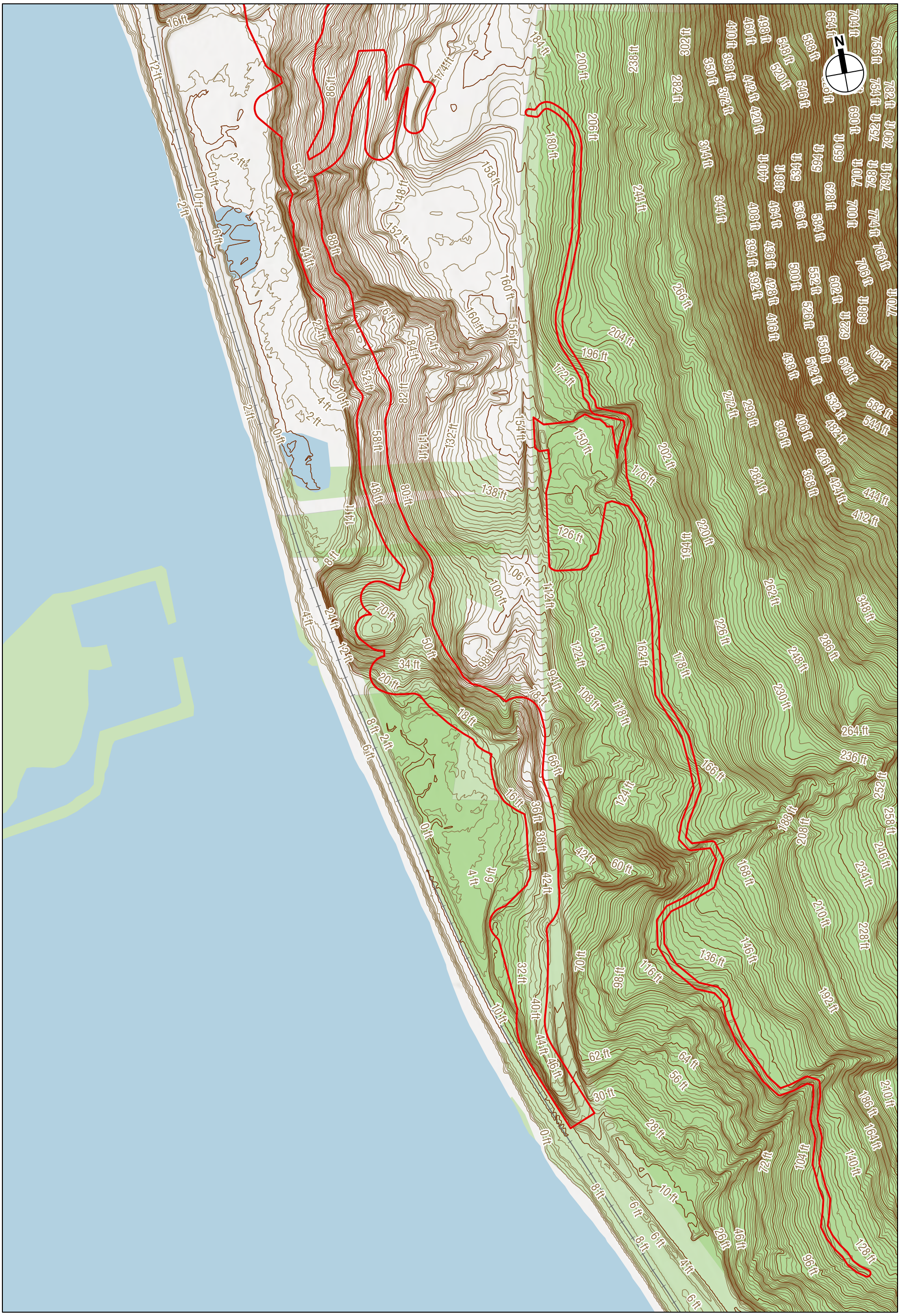
2 foot

HUDSON HIGHLANDS FJORD TRAIL

Topography

Figure III.C-4d

9.22.24



Trail Corridor - Fjord Trail North

Contours

10 foot

2 foot

HUDSON HIGHLANDS FJORD TRAIL

Topography

Figure III.C-4e

9.22.24

Trail Corridor - Fjord Trail North

Slope

15 to 25%

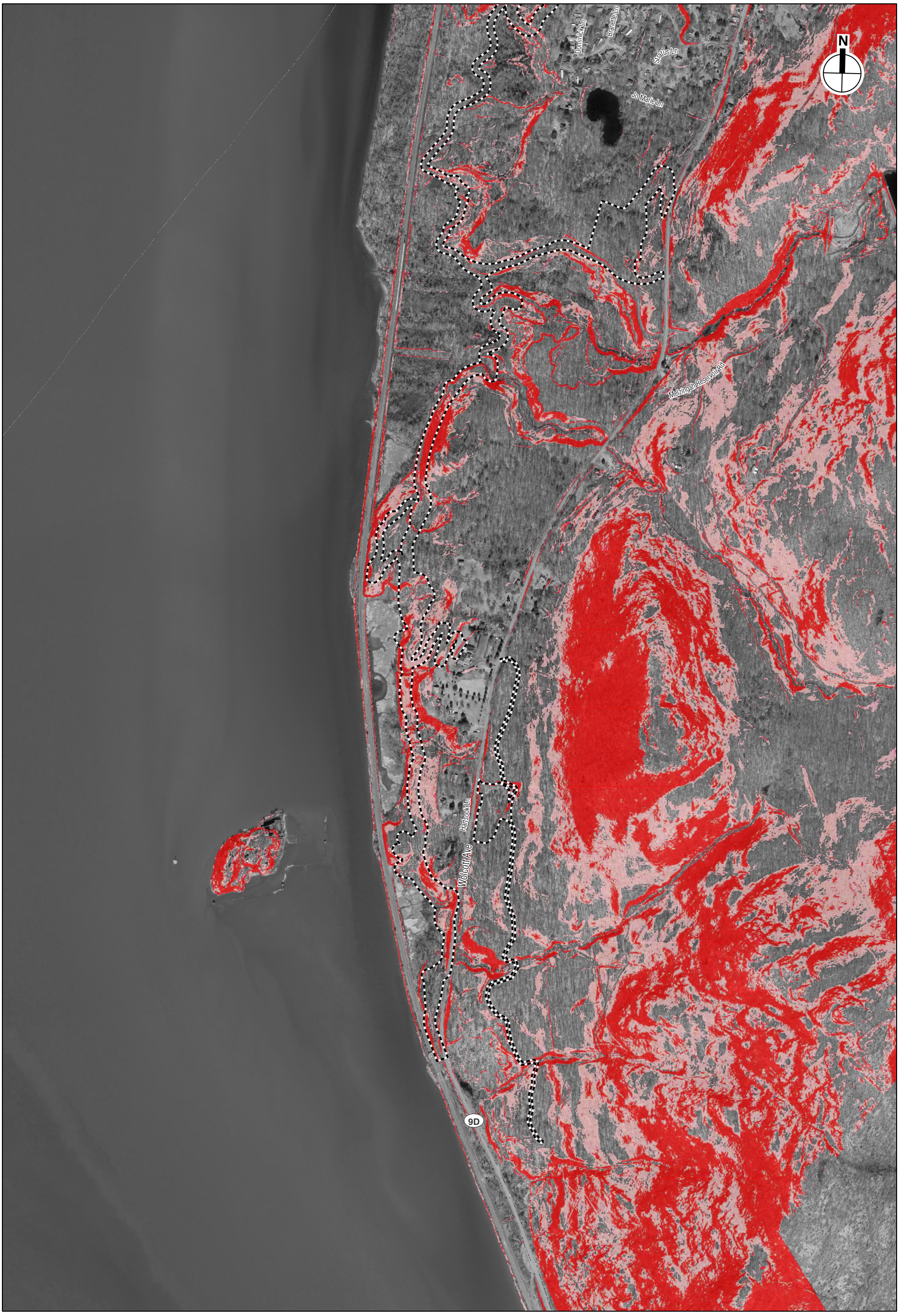
Over 25%

HUDSON HIGHLANDS FJORD TRAIL

Steep Slopes

Figure III.C-5a

9.22.24



0 2,000 FEET

Trail Corridor - Fjord Trail North

Slope

15 to 25%

Over 25%

HUDSON HIGHLANDS FJORD TRAIL

Steep Slopes

Figure III.C-5b

Corridor for Main Trail Option 1 south of Fishkill Creek contains slopes less than 15 percent, and Main Trail Option 2 includes areas with steeper slopes ranging from 15 percent to over 25 percent (see **Figure III.C-5a**).

Elevations within the Fjord Trail North Corridor range from 0 feet (sea level) at the Hudson River shoreline to approximately 200 feet above sea level (asl) in certain inland areas. The northern portion of the Fjord Trail North Corridor between Long Dock Park and Denning's Point and within Madam Brett Park generally contain elevations of 0 to 20 feet asl. Elevations within Denning's Point vary from 0 to 42 feet asl. Elevations within the portion of the Fjord Trail North Corridor between Fishkill Creek and the northern end of the BNCB vary widely, ranging from 0 feet asl to approximately 200 feet asl.

C. FUTURE WITHOUT THE PROPOSED ACTION

Without Fjord Trail North, current conditions are expected to remain with no substantial disturbance to surficial geology and soils, bedrock geology, or topography anticipated in the Fjord Trail North Corridor. Steep slopes along Fjord Trail North Corridor that have not yet been disturbed would remain undisturbed.

D. FUTURE WITH THE PROPOSED ACTION

Components of the proposed Fjord Trail North that would have the potential to affect geology, soils, or topography include construction activities associated with earthwork, cut and fill, and alteration of steep slopes, and any potential for erosion from the completed trail. Construction of each section of Fjord Trail North would begin with land surveying, followed by clearing and grubbing. Clearing activities would involve mowing tractors, chain saws, and stump removal by backhoes. Installation of the trail would then include stabilization, excavation, cut and fill, and compaction in accordance with the design requirements. Stabilization and compaction would use mechanical techniques, such as tamping with heavy equipment, on installed crushed stone surfaces. After completion of the soil stabilization, hardscaping and landscaping for Fjord Trail North would include:

- Boulder embankment to stabilize sloped areas, minimizing earth movement and disturbance;
- Clearing and roughing of boulders;
- Gathering and placement of boulders for seating and aesthetic purposes;
- Stone paving;
- Planting of trees and shrubs;
- Live stakes, plugs, and seeding; and
- Restoration planting and maintenance.

As the design of Fjord Trail North progresses, geotechnical borings would be conducted at key locations along the alignment. Once available, these borings would enable determination of depths, compositions, and qualities of soils, as well as the depth of rock and assessments of slope stabilities. Potential impacts of Fjord Trail North on geology, soils, or topography are discussed in the sections below.

SURFICIAL GEOLOGY AND SOILS

Fjord Trail North would include a series of high and low points, referred to as "rolling grade" or "grade reversals," to allow stormwater to flow across the trail. This technique is recommended by

the U.S. Forest Service to maintain sustainable natural surface trails[4] and would help to minimize erosion of surface soils along Fjord Trail North. Given the preliminary nature of the current design for the Fjord Trail North section of the Fjord Trail, estimates of cut and fill are not available at this time. Earthwork would be balanced as much as possible across each trail section as designs are advanced to limit export of excavated soil. Soils removed as "cut" generated through proposed earth moving activities would be stored, stockpiled, and re-used onsite where proposed earth moving activities require additional "fill." While all portions of the proposed Fjord Trail North would require grading and some level of cut and fill, one area that would require more extensive fill is the portion of Fjord Trail North that would incorporate the Klara Sauer Trail, which would be elevated on a berm to address future sea level rise. In addition, where two options are being considered for the Main Trail south of Fishkill Creek, Option 1 would be on relatively level ground with limited cut and fill required, while Option 2 would be further upslope and navigate steeper topography, requiring more extensive grading and cut and fill.

The potential for soil erosion during construction would be minimized through the implementation of erosion and sediment control measures in accordance with a Stormwater Pollution Prevention Plan (SWPPP) prepared for each trail section for review and approval in accordance with the requirements of the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activities. No more than five acres would be disturbed at any one time, in accordance with Part II General Requirement D.3 of the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-20-0001). During construction of each section of the proposed Fjord Trail North, a water tanker would be used to spray exposed soil to manage dust, and where necessary, contractors would use truck tracking pad and wheel washing stations to minimize the transport of soil onto nearby roadways. Other measures that may be used, as needed in accordance with the SWPPP, would include filter stone, silt fence, stabilized construction access, temporary mulches, and straw bales. With these measures in place, erosion would be minimal and surficial geology and soils would not be adversely affected by construction activities.

Any excavated soil requiring offsite disposal would be managed in accordance with applicable regulatory requirements, including any testing requirements of the intended receiving facility. A soil management plan and disposal protocol would be prepared by the selected construction contractor to ensure that all soil handling and disposal is conducted in accordance with regulations and proper disposal facilities. This would include contingency plans for soil disturbance and/or removal in the event contamination is unexpectedly encountered. Excavation and removal of soil would not be expected to result in substantial changes in volume or composition that would lead to adverse impacts to surficial geology or soils.

Based on the current conceptual design, Fjord Trail North would result in an estimated overall increase in impervious surfaces of approximately 20 acres with Main Trail Option 1 or 21 acres with Main Trail Option 2. This increase would include approximately 8 acres of crushed stone path with limited permeability for new trail with Main Trail Option 1 and 9 acres with Main Trail Option 2, approximately five acres of impervious area for parking and trail entry at the Notch, approximately 2.5 acres of impervious area for parking at the new Wade's Hill Lot, approximately one acre of impervious surface for the proposed maintenance facility along Dennings Avenue in Beacon, and approximately 3.5 acres of impervious areas within Trail Banks to provide

[4] United States Forest Service. 2007. Trail Construction and Maintenance Notebook. July 2007. Available online at: https://www.fs.fed.us/t-d/pubs/htmlpubs/htm07232806/toc.htm.

Accessibility. Given the conceptual level of design, these estimates conservatively assume the full footprints for parking areas and Trail Banks would be impervious. As design advances and is refined, there may be opportunities to reduce impervious surface coverage (e.g., minimizing paved areas, incorporating landscaping, etc.). In addition, the path widths would be minimized to the extent possible to limit the increase in impervious area while meeting Accessibility needs. Elevated trail sections are considered pervious because they would be elevated above the ground level, allowing water to run through the gaps in the decking material and infiltrate into the ground below. This increase in impervious surface is not expected to result in adverse impacts to surficial geology or soils given the narrow linear nature of the trail and its distribution over the entire length of the Fjord Trail North alignment.

BEDROCK GEOLOGY

The Fjord Trail North Corridor intersects with two inactive fault lines within the northern portion of the Forest Trail North reach. Design of the Fjord Trail is intended to follow the natural contours along the Trail Corridor and blasting is not anticipated to be necessary. Therefore, Fjord Trail North would not have the potential to affect bedrock geology or interact with the inactive fault lines. As the design of Fjord Trail North progresses, geotechnical borings would be conducted at key locations along the alignment to confirm this assumption.

TOPOGRAPHY

Most of the Fjord Trail North components would be constructed on slopes below 15 percent. However, portions of the trail would traverse steeper slopes, including areas north and east of Denning's Point, the southern bank of Fishkill Creek, the Notch, and areas near Dutchess Manor (see **Figures III.C-5a-5b**). Option 2 of the Main Trail alignment south of Fishkill Creek would cross some areas containing slopes ranging from 15 percent to more than 25 percent (see **Figure III.C-5a**). Within the 39-acre disturbance area for Fjord Trail North with Main Trail Option 1 (see Chapter II "Project Description"), the steeper areas comprise approximately 0.61 acres with slopes between 15 and 25 percent and approximately 0.35 acres with slopes greater than 25 percent. Within the 45-acre disturbance area for Fjord Trail North with Main Trail Option 2 (see Chapter II "Project Description"), the steeper areas comprise approximately 0.77 acres with slopes between 15 and 25 percent and approximately 0.39 acres with slopes greater than 25 percent. As the design of Fjord Trail North is advanced, the alignment and limit of disturbance will be modified to avoid steep slopes to the extent possible. Where steep slopes cannot be avoided, elevated trail sections may be constructed to avoid impacts to the slopes. As noted above, Main Trail Option 2 would navigate steeper topography that would require more extensive grading as well as design measures for Accessibility and to minimize the potential for erosion along steep slopes. Specific measures would be determined as the design advances and would be incorporated into the trail alignment. Within the northern portion of Fjord Trail North, the alignment would use sections of circuitous routing to meet Accessibility needs. Walking surfaces of Fjord Trail North would also be designed to be Accessible with a minimum 10- to 14-foot width and with consideration of surface texture and cross slope. While some of the Meanders may be as narrow as six feet, they would meet the guideline's surface characteristics and cross slope. All sections of the trail would be designed to minimize the potential for erosion through stabilization of the adjacent soils in some manner. Incorporation of these design measures would minimize the potential impacts of Fjord Trail North on the existing topography.

Depending on the final alignment, some sections of Fjord Trail North could be subject to ice floes on the Hudson River, including the southern portion of the Klara Sauer Trail and the contemplated elevated overlook, and the shoreline access points on Denning's Point. The conceptual design of

Fjord Trail North has been developed with consideration of 10-year, 50-year, and 100-year storm return periods, and would include resiliency measures to reduce the risk of damage from flooding. These measures may include the use of flood resilient structural and pathway materials, stabilization of the trail and supporting piles with vegetation and boulder edges, and adequate freeboard to allow for the passage of ice[5] and debris beneath the elevated sections. As described in detail in Chapter III.D, "Water Resources – Fjord Trail North," the elevated trail would remain above both the floodplain and mean higher high water (MHHW) elevations for the 2100 High Scenario throughout the 50-year lifespan of materials used for trail construction and would not be susceptible to inundation from sea level rise. Measures would also be incorporated to ensure Fjord Trail North can withstand ice shear forces with adequate freeboard to allow for passage of ice and debris beneath the elevated sections. With these design measures in place, the elevated trail sections would be resilient to ice impacts and inundation from flooding, storm surge, and sea level rise.

E. CONCLUSIONS

As set forth above, measures would be incorporated into Fjord Trail North's final design to avoid, minimize, or mitigate impacts to geologic, topographic, or soil conditions. These measures include the following:

- A SWPPP would be prepared for each trail section for review and approval in accordance with the requirements of the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-20-0001) that would be obtained for the project. Each SWPPP would include an Erosion and Sediment Control Plan with erosion and sediment control measures developed in accordance with the New York State Stormwater Management Design Manual (NYSSMDM).
- Construction of Fjord Trail North would include temporary erosion and sediment control measures implemented during construction to minimize erosion and sedimentation, including: a water tank to spray exposed soil, truck tracking pad and wheel washing stations, a soil management plan, filter stone, silt fence, stabilized construction access, temporary mulches, and straw bales.
- Limits of site clearing and grading would be established prior to site clearing operations to protect adjacent soils and vegetation. In accordance with the SWPPPs, erosion and sediment control measures would minimize erosion and soil movement, and construction would not result in any unplanned changes to plant species composition or coverage in adjacent areas.
- Topsoil removed from areas of land disturbance would be stockpiled and reused as planting medium, as appropriate.
- A soil management plan and disposal protocol would be prepared to ensure that all soil handling and disposal is conducted in accordance with regulations and proper disposal facilities.
- Elevated trail structures and grading would be used in areas where steep slopes cannot be avoided.
- Fjord Trail North would be sited above the projected MHHW elevation for the 2100 High Scenario and would use resilient materials and design practices to minimize impacts from sea level rise.

[5] U.S. Army Corps of Engineers Cold Regions Research Labs (CRREL) design standards.

No significant adverse land impacts would be anticipated to result from construction of Fjord Trail North. Therefore, no further mitigation is proposed. ✷