Appendix 2

Civil Engineering

CIVIL ENGINEERING APPENDIX

1.0 SCOPE OF WORK

a. Existing Conditions
b. Revetment Alignment/Layout
c. Site Access/Constructability
d. Tie-In to Existing Stone
e. Design Calculations

2.0 RELEVANT CRITERIA

a. NA

3.0 DESIGN CONDITIONS AND ASSUMPTIONS

a. Existing Conditions

The area of Montauk Point, East Hampton, New York includes the entire historic Montauk Point Lighthouse Complex. Situated on a high bluff underlain with glacial till, the lighthouse and the surrounding grounds include a museum and State Park. The critical area of study consists of the fronting bluff covering about 900-feet of shore line.

The bluff and beach along this entire area are considered to be critical elements of the stability of the lighthouse. Erosion control structures are required to protect the bluff faces from the forces of oncoming waves.

CENAE did not survey Montauk Point. The existing conditions shown on the project documents is the union of 2012 Lidar Data and the topo survey conducted for the 2005 Feasibility Study (FS). The horizontal datum for the 2012 Lidar is NAD 83 Long Island State Plane Feet. The vertical datum for the 2012 Lidar is NAVD 88 Feet. The 2005 Feasibility study is from CAD File, “Figure-07-Edited.” NAN could not supply a field book for this data set, however, based upon the 2005 Feasibility Report the horizontal datum was noted as NAD 27 Long Island State Plane Feet. The vertical datum was noted as NGVD 29 Feet.

To develop the existing conditions shown on the project documents, the 2005 FS data was converted from NAD 27 to NAD 83. Following the horizontal conversion, the 2005 FS data was converted from NGVD 29 to NAVD 88. Once the 2005 FS was converted, the data was merged with the 2012 Lidar.

b. Revetment Alignment/Layout

The final proposed revetment alignment was based on the following criteria:

- Minimize impact to surrounding Rocky Intertidal Habitat and Marine Beach Habitat
- Limit required excavation/re-work of existing revetment
- Provide protection for wave strike and run-up along the revetment
- Ease of construction
- Allow for future maintenance of revetment using heavy equipment

c. Site Access and Constructability

Montauk Point is accessible either by land via Route 27 Long Island, or by ferry. Once at the project site, construction vehicles may work down from the top of bank and up from the proposed bench. From the bench, two crews can work at the same a time. Starting from the center of the revetment, the crews can work backwards filling and narrowing the bench as the equipment backs up. For example, the crew can start by building a 25' wide bench. As the crews back up, they will bury the bench with two layers of 15 ton stone. A 12' bench will remain and be available for future maintenance access.

It is assumed that a roadway will be built along the lower bench located at Elevation 10. For construction access, stone ramps will be built to transitioning between the new and old revetment. Furthermore, the ramps will act to support the ends of the new revetment and should remain in place following construction.

Excavation of loose material made up of sand and cobbles from the foundation of the toe shall be required wherever it is encountered. The size of the armor stone within the transition at the toe shall generally be 15 ton and no less than 10 ton.

d. Tie-in to Existing Stone

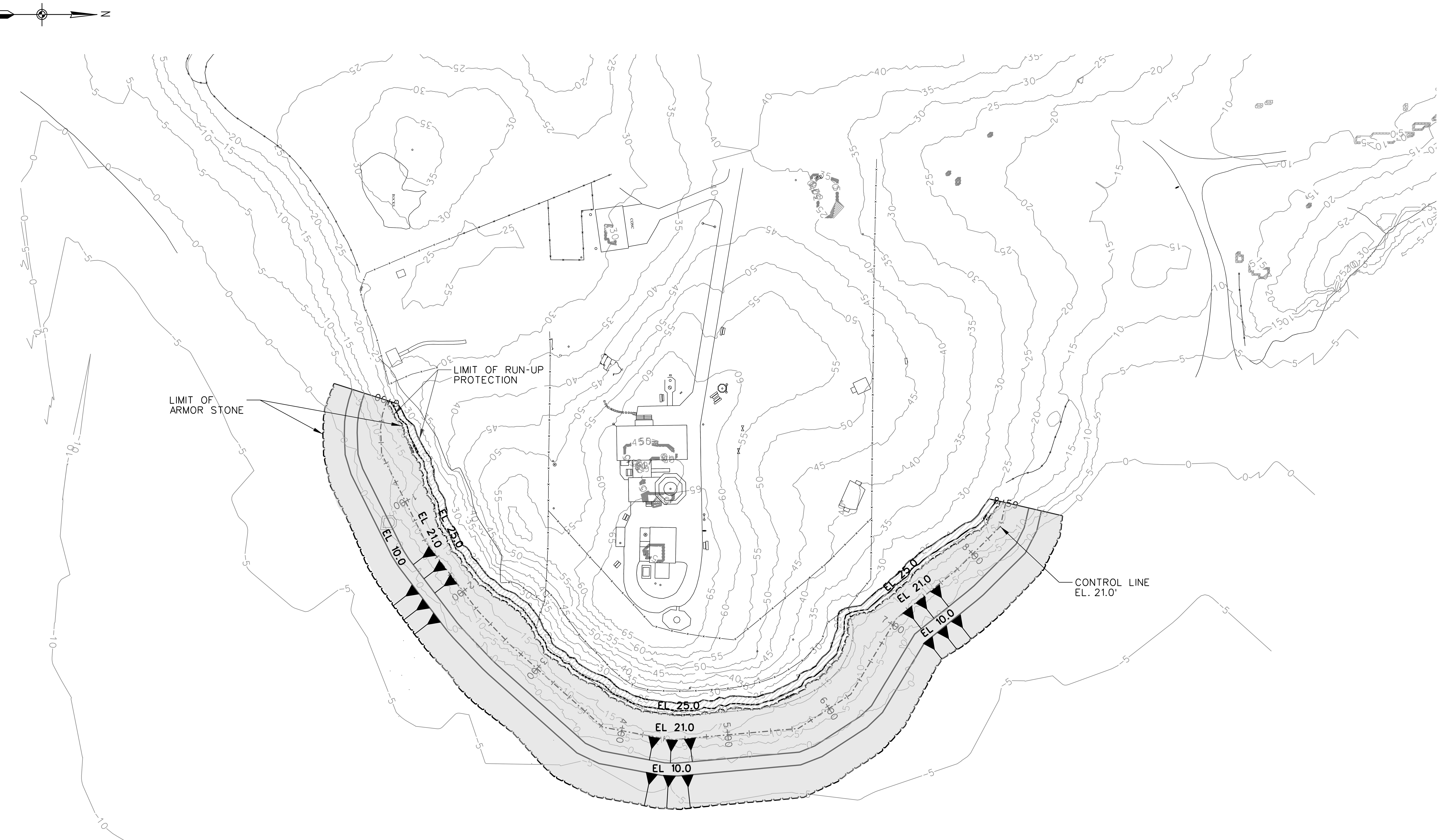
The ends of the new revetment shall be braced by smaller rock to prevent the ends from unraveling. For the run-up protection to Elevation 25, the gravel and filter fabric will not be extended beyond the end of the new revetment. From Elevation 10' to 21', three rows of 5 to 7 ton stone shall be placed on the slope to tie the ends of the new stone into the existing revetment. The stone should be placed such that two layers abut the new revetment and transition to one stone high in the second and third rows of stone away from the new revetment. The top stone in the third row can be omitted to transition to the upper bench located at Elevation 21'.

e. Design Calculations

1. Design surfaces were created using Bentley InRoads. A 3D model was created for each revetment option. The model includes components for each material type (1 ton stone and 15 ton stone).
2. The model was projected to the existing surface (MONTAUK_FINAL_VSP_CONTOUR.DGN) and a design for each option was created.
3. Cross sections with both material types were developed in five foot intervals for each design surface.
4. From the cross sections, End-Are Volumes were extrapolated. The end-area volume calculation computes the Total Cut, and Fill (additional 1 Ton Stone) for the subgrade of the design template. The report lists all computed quantities

on a station-by-station basis. The stations were analyzed against the generated cross sections, and the cut and fill volumes were adjusted by-hand for more accuracy.

5. The InRoads Roadway Designer Component Quantities Report computes the total volume for each component (15 ton stone and 1 ton stone). The report lists all computed quantities on a station-by-station basis. The stations were analyzed against the generated cross sections, and the fill volumes were adjusted by-hand as needed for more accuracy. Hand adjustments were made at the new revetment end points.
6. From the above two reports the total cut, 15 ton stone fill, and 1 ton stone fill volumes are estimated. The 3D model is an evaluation tool used in Bentley InRoads to compute cut and fill volumes. Cut and fill volumes obtained with this tool are calculated between two surfaces, or Digital Terrain Models (DTMs), by projecting the triangles from the Original Surface (Existing) onto the Design Surface and then computing the volume of each of the resultant prismoids. The volume calculated using the Triangle command is the exact mathematical volume between the two selected surfaces. The accuracy of the results of the 3D model is limited only by the accuracy of the DTMs you are using.
7. The total tons of stone required are calculated from the volumes estimated above. Using a stone density of 165 lb/ft3, a porosity of 30%, and a construction contingency of 20%, the total tonnage is estimated for each design option. The 20% contingency was placed on the total cut to account for existing stone rework and removal of existing unsuitable stone.
8. The quantity of stone required for the tie-ins were calculated utilizing the assumptions made in the “Tie-in to Existing Stone” section. Sixteen six-ton stone were estimated for each tie-in.
9. The gravel required for road improvements were calculated by measuring the linear feet of each anticipated access road from the CAD file. The total linear feet were multiplied by the recommended road width and gravel sub base layer thicknesses.
10. The stone ramp transitioning from the new and old revetment was estimated to require a 12’ wide, 16’ long, 8’ deep transition of six-ton stone. These dimensions result in 24 six-ton stones for each ramp.



SITE PLAN

SCALE: 1" = 50'

NOTES:

1. DATA SHOWN IN LISTATEPLANE NAD 83, FT AND NAVD 88, FEET.
2. EXISTING CONDITIONS DEVELOPED FROM 2012 LIDAR AND LEVEL SRF-VIEW FROM CAD FILE FIGURE-07-EDITED. SRF-VIEW CONVERTED FROM NAD 27 TO NAD 83, FEET. SRF-VIEW CONVERTED FROM NGVD 29 TO NAVD 88, FEET.
3. MLLW = -1.57FT NAVD 88

GRAPHIC SCALE:

50 0 50 100

1" = 50'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

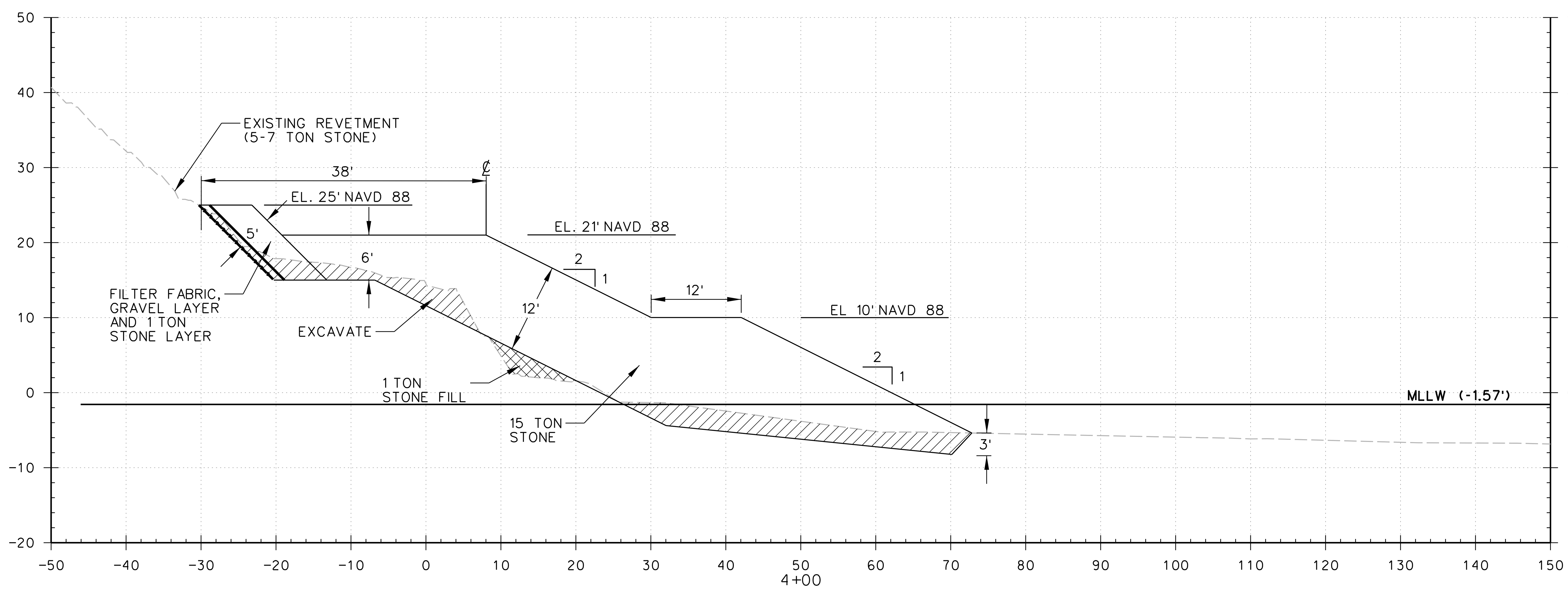
DESIGNED BY: | DATE:
DWN BY: | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
PLOT SCALE: | PLOT DATE: | DRAWING CODE:
SIZE: | FILE NAME: MONTAUK_C-101-OPTIONC.dgn

MONTAUK POINT
HSLRR DESIGN
SITE PLAN

SHEET IDENTIFICATION
C-101

SHEET 0 OF 0

PRELIMINARY



TYPICAL SECTION

SCALE: 1" = 10'

GRAPHIC SCALE:

1" = 10' 10 0 10 20

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New England District

MARK	DESCRIPTION	DATE	APPR.

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U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: JOE A. DESIGNER		DATE: MONTH/YEAR
DWN BY: DRB	CKD BY: CKB	SOLICITATION NO.:
SUBMITTED BY: BOB A. SUBMITTER		CONTRACT NO.:
PLOT SCALE: SCALE	PLOT DATE:	DRAWING CODE:
SIZE: ANSI D	FILE NAME: MONTAUK_C-301_OPTIONC.dgn	

MONTAUK POINT
HSLRR DESIGN
TYPICAL SECTION

SHEET IDENTIFICATION
C-301

SHEET 0 OF 0

PRELIMINARY

NOTES:

1. DATA SHOWN IN LISTATEPLANE NAD 83, FT AND NAVD 88, FEET.
2. EXISTING CONDITIONS DEVELOPED FROM 2012 LIDAR AND LEVEL SRF-VIEW FROM CAD FILE FIGURE-07-EDITED. SRF-VIEW CONVERTED FROM NAD 27 TO NAD 83, FEET. SRF-VIEW CONVERTED FROM NGVD 29 TO NAVD 88, FEET.
3. MLLW = -1.57FT NAVD 88

SITE PLAN

SCALE: 1" = 50'

GRAPHIC SCALE:

1" = 50' 50 0 50 100

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MARK	DESCRIPTION	DATE	APPR.

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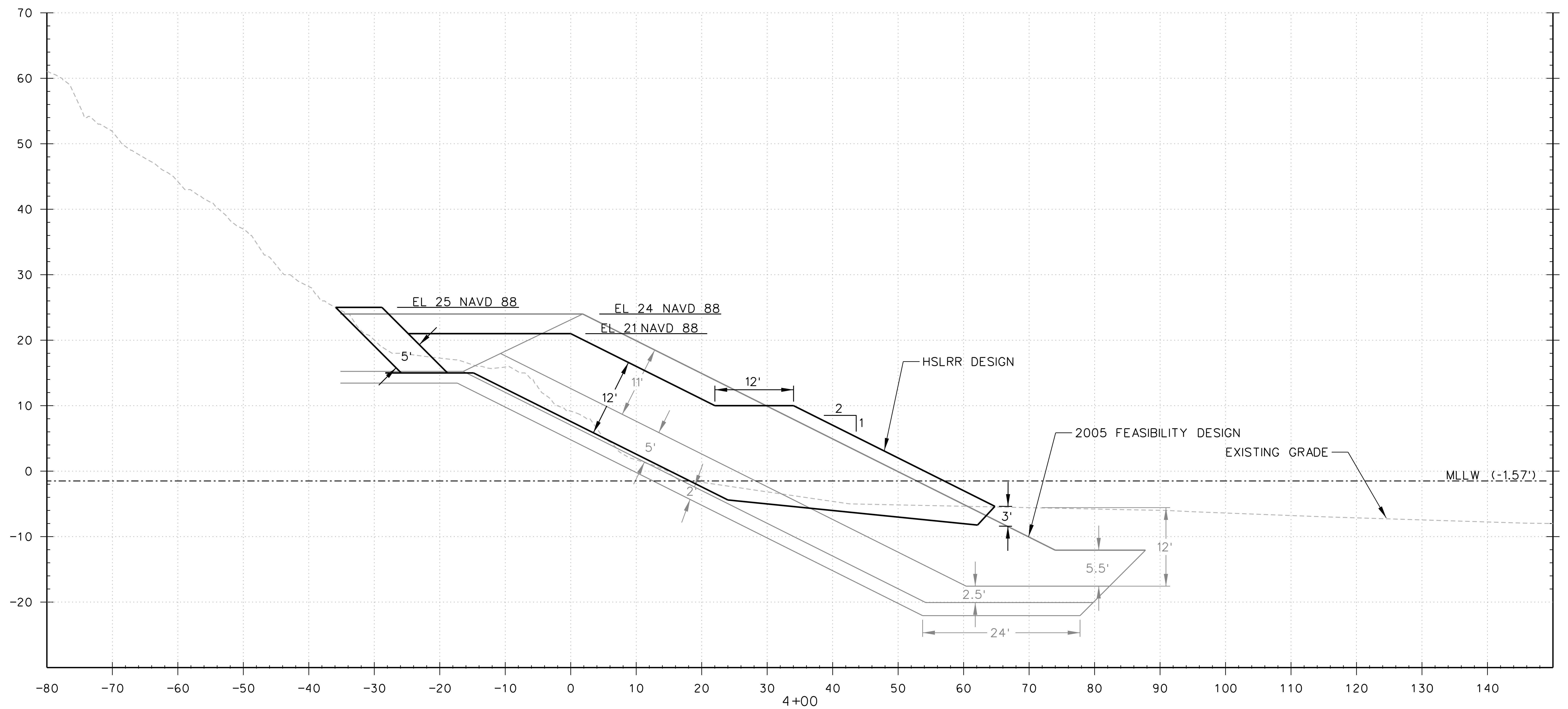
U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: | DATE:
DWN BY: | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
PLOT SCALE: | PLOT DATE: | DRAWING CODE:
SIZE: | FILE NAME: MONTAUK_C-101_COMPARE_C.dgn

MONTAUK POINT
SITE PLAN
COMPARISON

SHEET IDENTIFICATION
C-101
SHEET 0 OF 0

PRELIMINARY



DESIGN SECTION COMPARISON

SCALE: 1" = 10'

GRAPHIC SCALE:

1" = 10'

US Army Corps of Engineers® New England District

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

DESIGNED BY: JOE A. DESIGNER
DWN BY: GRB
CKD BY: GRB
SUBMITTED BY: BOB A. SUBMITTER
PLOT SCALE: SCALE
PLOT DATE:
SIZE: ANSI D
FILE NAME: MONTAUK_ENV.dgn
DATE: MONTH/YEAR
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE:

MONTAUK POINT
DESIGN SECTION
COMPARISON

SHEET IDENTIFICATION
C-301

SHEET 0 OF 0