Coastal Engineering Shore Protection
Point Allerton – Hull, MA

dcr
Massachusetts

Conceptual Design Report
September 2024

SUBMITTED BY:

COLLINS ENGINEERS INC
1485 S. County Trail, Suite 103
East Greenwich, RI 02818

IN CONJUNCTION WITH:

Edgewater resources
434 S. Yellowstone Drive, Suite 203
Madison, WI 53719

REVISION RECORD

Rev #	Date Issued	Description of Revisions
00	7/2/2024	Draft Conceptual Design Report
01	9/30/2024	Revised Conceptual Design Report
02	10/15/2024	Final Conceptual Design Report

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1.0 PROJECT BACKGROUND

1.1 PURPOSE AND SCOPE

Collins Engineers, Inc. in conjunction with Edgewater Resources (the Collins Team) was retained by the Massachusetts Department of Conservation and Recreation (DCR) to provide an assessment of shore protection at Point Allerton in Hull, MA.

As part of the scope of work, the Collins Team performed several site investigations and prepared a Basis of Design memorandum to provide a summary of existing conditions, the existing and projected future wave climate, the data collection and site-specific modeling processes, and a discussion of how sea level rise and climate change were incorporated into analysis. This Conceptual Design Report presents long-term solutions to address ongoing erosion and damage to the coastal engineering structure at Point Allerton, including a methodology for repair approaches that are developed, conceptual cost estimates, advantages and disadvantages, and permitting considerations.

1.2 FACILITY DESCRIPTION

Point Allerton is located at the northeast corner of the Nantasket Peninsula in Hull, MA off Point Allerton, Ave. The site is exposed to the Massachusetts Bay on three sides with limited obstructions to reduce fetch distances from the open ocean. The site consists of approximately 1,200 LF of stone masonry seawall, riprap revetment, apron, drainage swale, and vegetated slope located seaward of several residential homes as shown in **Figure 1**.

Figure 1: Aerial of Point Allerton

2.0 BASIS OF DESIGN CONSIDERATIONS

The Basis of Design (BOD) provides the recommended design approach, standards, and project objectives to define the analysis methodology, design criteria, and intent for the project. As discussed in the Final BOD memorandum submitted in June 2024, the results of site investigations and modeling indicate that the existing coastal engineering structure at Point Allerton has likely continued to fail for several reasons, but can mainly be attributed to large overtopping volumes that reach the back of the crest.

When developing proposed alternatives for the project, the following segments of design were specifically reviewed and evaluated due to their observed and calculated influence on the existing damaged section.

- **Transition Zones:** At the transition zones in the northwest and southeast corners, the riprap revetment begins reducing in size towards the extents and may not have been properly tied in. Local wave transformations leave these areas particularly vulnerable, with overtopping calculations indicating a substantial volume of water reaching the crest.
- **Bedding Material:** The size of bedding material for the riprap revetment is unknown, which may have led to loss of slope material through voids in the revetment stone.
- **Apron:** The elevated mortared apron installed as part of the 1998 repairs reduced porosity along the front face of the structure, likely resulting in higher overtopping volumes and velocity leading to erosion behind the structure, as well as settlement, instability, and stone loss as the overtopped water has limited area to flow.
- **Cross Section:** The existing revetment primarily consists of a 1.5:1 slope with a maximum elevation of ±EL. 24' (NAVD88). Given the high energy wave environment, the existing slope and elevation may not be effective in reducing runup, and overtopping volumes and velocities.
- **Drainage:** The drainage swale behind the existing apron does not extend along the entire front face where large overtopping volumes were calculated. The drainage structure has been reconstructed several times and continues to fail, and was likely undersized for current conditions.

The existing coastal engineering structure was likely undersized to effectively withstand present-day environmental loads (waves) and overtopping volumes, with short-term repairs creating additional weak points and transition zones leading to continuing erosion and damage to the structure.
Understanding and predicting the overtopping volumes for rubble mound structures (revetments or breakwaters) involves a detailed analysis of wave conditions, structural geometry, and material properties to ensure adequate protection against coastal flooding and erosion is provided. Conceptual design of the proposed alternatives follows methods described in industry standards and guidelines such as EurOtop Manual on Wave Overtopping of Sea Defenses and Related Structures (EurOtop). It should be noted that over the past decade, design of rubble mound structures (revetments) has shifted towards allowable overtopping rather than wave runup.

As indicated in the BOD submitted in June 2024 and coordination with DCR, the proposed alternatives were developed based on modeling the 0.8% annual percent chance storm at high tide for the 2070 design horizon, including 24.8 inches of sea level rise. This produces a maximum wave height at the toe of the structure is approximately 15 feet (4.6 meters).

Based on guidance provided by EurOtop, the backland portion of a proposed coastal engineering structure must be designed for heavy overtopping when the incident significant wave height (H_{m0}) is greater than 16.4 feet (5 meters) to avoid risk of failure (as shown in Table 1 of Conceptual Design Analysis). During development of conceptual design alternatives, the proposed elevations, slope, and sections of the structures were evaluated and compared to anticipated drainage swale sizes to provide an efficient conceptual design based on effectiveness, cost, environmental impacts, permitability, and ecological value. Although guidance for a wave height of 15 feet is not specifically shown within the table, we have conservatively limited the tolerable mean wave overtopping rate to less than 5 l/s/m to minimize the magnitude of the required drainage swale for purposes of this conceptual design phase. It was determined that limiting the overtopping rate to 5 l/s/m helps to effectively manage anticipated overtopping volumes while providing a balance between size of the coastal engineering structure and drainage swale, which can be accomplished when the incident significant wave height at the toe of the structure is approximately H_{m0} = 15 feet.

A summary of key parameters evaluated during conceptual design include:

- Incident significant wave height at toe of structure (H_{m0} = 15 feet)
- Wave steepness (ratio of wave height to wavelength S_0 = 0.01)
- Breaker parameter ($\xi_{m-1,0}$ = 3.27 for surging on structure)
- Wave runup (max runup on existing structure at STA 7+00 = EL. 38.2' NAVD88)
- Mean overtopping discharge (q = 5 l/s/m max when H_{m0} < 15 feet)
- Presence of existing seawall and porosity within the drainage system

A detailed discussion of the wave overtopping calculations performed as part of the conceptual design effort is included in the conceptual design analysis by Edgewater Resources (Edgewater) in **Appendix D.**

3.0 CONCEPTUAL DESIGN ALTERNATIVES

The four (4) alternatives presented are considered a long-term solution to extend the service life of the structure to the year 2070 and protect against anticipated storm events and sea level rise considering the 0.8% East Northeast (ENE) event. The conceptual design alternatives are provided in the following sections and include a general description of work, description of anticipated authorities having jurisdiction and summary of required permits, construction considerations, and conceptual cost estimates. Conceptual drawings for each alternative are provided in **Appendix A**, and an estimated permit and construction schedule is included in **Appendix B.**

3.1 ALTERNATIVE 1 – REVETMENT RECONSTRUCTION

Limited information is available from previous revetment repair projects; however, it's anticipated that previous projects have not been properly designed or included the addition or replacement of core stone and drainage stone layers within the revetment, thereby leading to internal stability issues. This alternative consists of removal of the existing revetment and full replacement with a new reconstructed slope and apron, and installation of a new concrete drainage swale. During development of this alternative, multiple iterations were compared to determine the most effective crest elevation, apron width, and slope to reduce overtopping volumes to approximately 5 l/s/m. For the revetment reconstruction, this was accomplished with a higher crest elevation, wider apron width, and shallower slope than other alternatives, described as follows.

The existing slope and mortared apron along the front face would be removed, and a new elevated revetment and non-mortared apron would be constructed. To effectively reduce runup, it's anticipated that

United States Army Corps of Engineers (USACE) – Individual Permit (IP)

It's anticipated that an Individual Permit (IP) will be required for most alternatives under the USACE Massachusetts General Permits (GP) as indicated below.

- **GP 2 – Maintenance:** IP for permanent impacts greater than ½ acre in tidal waters
- **GP 4 – Structures in Navigable Waters of the U.S.:** IP for artificial reefs
- **GP 9 – Bank and Shoreline Stabilization**: IP for new bank stabilization > 500 linear feet

It may be possible to authorize Alternative 4 (Revetment Reconstruction and Recurve Seawall) as a Pre-Construction Notification (PCN) as the impacts are primarily located within the existing footprint; however, given the significant alteration proposed it's possible that USACE may consider the impacts as new bank stabilization and require an IP. The MA GP's indicate that material used for bank stabilization should not be placed in excess of the minimum needed for erosion protection will result in no more than minimal adverse environmental effects. The application should reference wave studies performed as part of the project to demonstrate that the fill placed is the minimum required to effectively manage overtopping in the high energy wave environment.

It is recommended that a USACE representative be consulted early in the permitting process to arrange a pre-application meeting to determine the information required for the permit application. Following the meeting and dependent on suggestions made by the representative, the application package is anticipated to include an ENG 4345 Form, project narrative, maps, photographs, abutter list, project drawings, and information required for agency consultation.

The USACE will coordinate reviews with other agencies and organizations as follows:

National Marine Fisheries Service (NOAA Fisheries) – Essential Fish Habitat (EFH)
Consultation with NOAA Fisheries is required if a project is authorized by a federal agency that may adversely affect an Essential Fish Habitat (EFH) pursuant to the Magnuson-Sevens Fishery Conservation Management Act (MSA). A review of the EFH Mapper indicates that the project is located within an EFH for several species, including winter flounder and a Habitat of Particular Concern (HAPC) for juvenile cod. The USACE has internal thresholds for projects that indicate if programmatic or non-programmatic consultation is required. For the purpose of this project, it's assumed that all of the alternatives would require non-programmatic consultation with NOAA Fisheries and therefore require additional information as part of the USACE application, including an EFH Assessment. It's anticipated that regional concerns regarding winter flounder and juvenile cod include potential time of year restrictions; however, Technical Report TR-47 does not provide recommended TOY restrictions in Hull near the project location.

Endangered Species Act (ESA) – Section 7 Consultation
Consultation with NOAA Fisheries and the U.S. Fish and Wildlife Services (USFWS) is required through Section 7 of the Endangered Species Act (ESA) if a project is undertaken and authorized by a federal agency that may adversely affect a critical habitat or federally listed species. Review of the ESA Section 7 Mapper and iPaC database indicates that endangered species may be located within the project area, and the proposed project is located in or near Critical Habitat for the North Atlantic Right Whale. The USACE should include assessment of impacts to listed species based on the NLAA Program Verification for NOAA Fisheries and an official species list and consultation with USFWS requested through the iPaC database.

Based on the consultations indicated above, it's anticipated that USACE may require compensatory mitigation, particularly for alteration of natural rocky habitat for new impacts to the cobble stone beach. The threshold of compensatory mitigation is not available to the public, therefore early coordination with USACE is recommended.

Following submission, the USACE will issue a public notice for an open comment period while also conducting a public interest review. Collins anticipates that a public hearing will need to be held and revisions will likely need to be made to either the project plans or application package based on the USACE evaluation procedure. USACE regulations indicate that Individual Permit decisions are generally made within two to three months of their submission date. However, based on Collins' recent experience obtaining USACE permits, it is possible that the review timeline may take up to 18 months or greater.

<u>Massachusetts Department of Environmental Protection – 401 Water Quality Certification (WQC)</u>

It's anticipated that a 401 Water Quality Certification (WQC) from MassDEP will be required for all alternatives as the work includes removal and/or placement of over 100 cubic yards of material below MHW in accordance with 314 CMR 9.00. MassDEP considers repositioned fill or material below MHW as "dredging"; therefore, it's anticipated that a combined application both Dredge and Fill/Excavation (WW026) will be required.

Information required as part of the 401 WQC application typically includes a grain size analysis, chemical analysis of sediment, evidence of DEP Sampling Analysis Plan (SAP) approval, project narrative and plans, USGS quadrangle map, alternatives analysis, letter from Massachusetts Division of Fisheries and Wildlife regarding recommended Time of Year restrictions, Eelgrass Management Plan (if applicable), ENF Certificate, and proof of public notice. It may be possible to receive an exception for chemical analysis or sediment analysis if a Due Diligence Review of the site is prepared; however, it's recommended that early coordination be completed to determine application requirements.

<u>Massachusetts Department of Environmental Protection – Chapter 91 License</u>

A Chapter 91 License is required under the Massachusetts Wetlands Protection Act for any new impacts located in, on, or under tidal waters seaward of the present MHW shoreline in accordance with 310 CMR 9.00. All alternatives include raising the existing revetment elevation; therefore, it's anticipated that any proposed design will require a new Chapter 91 License. Prior to filing an application, a meeting should be coordinated MassDEP Waterways Regulation Program staff to review the project, and the ENF certificate must already be obtained.

It's anticipated that the project will be determined as water-dependent, and public access on the revetment with appropriate signage be maintained. As part of the Chapter 91 application process, the ENF Certificate must be obtained and public notice with 30-day public comment period be provided.

<u>Massachusetts Endangered Species Act (MESA) (321 CMR 10.00)</u>

A review of MassGIS indicates that the proposed work under this alternative would be located outside of the Priority or Estimated Habitat of Rare Wildlife, and is therefore not subject to a MESA review. However, the Division may review and comment on the ENF in accordance with 301 CMR 11.00. It is anticipated that NHESP may provide recommendations for the avoidance, minimization, and mitigation of impacts to endangered, threatened, or special concern species including Time of Year restrictions for the work, the use of a debris boom/turbidity curtain, noise monitoring, or a fish startle system.

Alternative	Anticipated Permits	Estimated New Impact Quantities*	Estimated Total Impact Quantities	Exceeded Thresholds
1 – Revetment Reconstruction	• MEPA – Environmental Notification Form • CZM – Consistency Review • WPA – Notice of Intent • USACE – Individual Permit • MHC – Project Notification Form • MassDEP – 401 Water Quality Certification • MassDEP – Chapter 91 License	• WPA o 69,000 SF of impacts beyond existing structure footprints • USACE o 72,000 SF (33,000 CY) of new fill below HTL • MassDEP o 68,000 SF (30,000 CY) of new fill below MHW	• WPA o Coastal Bank - 1,200 LF, 60,000 SF; Land Under Ocean – 53,000 SF; Rocky Intertidal Shore – 16,000 SF; LSCSF - 65,000 SF • USACE o 87,000 SF (37,750 CY) of new fill and existing fill being removed and reset within the existing footprint below HTL • MassDEP o 80,000 SF (33,200 CY) of new fill and existing fill being removed and reset within the existing footprint below MHW	• 301 CMR 11.03(3) • 310 CMR 10.25, 10.30, 10.31 • USACE GP GP 2, GP 4, GP 9 • 314 CMR 9.04(12) • 310 CMR 9.05(1)
2 – Composite Berm	• MEPA – Environmental Notification Form • CZM – Consistency Review • WPA – Notice of Intent • USACE – Individual Permit • MHC – Project Notification Form • MassDEP – 401 Water Quality Certification • MassDEP – Chapter 91 License	• WPA o 92,500 SF of impacts beyond existing structure footprints • USACE o 100,000 SF (45,000 CY) of new fill below HTL • MassDEP o 95,000 SF (39,000 CY) of new fill below MHW	• WPA o Coastal Bank - 1,200 LF, 60,000 SF; Land Under Ocean – 72,000 SF; Rocky Intertidal Shore – 20,500 SF; LSCSF – 74,000 SF • USACE o 100,000 SF (45,000 CY) of new fill below HTL; note existing seawall and revetment are to remain • MassDEP o 95,000 SF (39,000 CY) of new fill below MHW; note existing seawall and revetment are to remain	• 301 CMR 11.03(3) • 310 CMR 10.25, 10.30, 10.31 • USACE GP GP 2, GP 4, GP 9 • 314 CMR 9.04(12) • 310 CMR 9.05(1)
3 – Composite Berm and Offshore Breakwater	• MEPA – Environmental Notification Form • CZM – Consistency Review • WPA – Notice of Intent • USACE – Individual Permit • MHC – Project Notification Form • MassDEP – 401 Water Quality Certification • MassDEP – Chapter 91 License • MESA – Review	• WPA o 167,500 SF of impacts beyond existing structure footprints • USACE o 175,000 SF (66,000 CY) of new fill below HTL • MassDEP o 170,000 SF (60,000 CY) of new fill below MHW	• WPA o Coastal Bank - 1,200 LF, 60,000 SF; Land Under Ocean – 150,000 SF; Rocky Intertidal Shore – 17,500 SF; LSCSF – 70,000 SF • USACE o 175,000 SF (66,000 CY) of new fill below HTL; note existing seawall and revetment are to remain • MassDEP o 170,000 SF (60,000 CY) of new fill below MHW; note existing seawall and revetment are to remain	• 301 CMR 11.03(3) • 310 CMR 10.25, 10.30, 10.31 • USACE GP GP 2, GP 4, GP 9 • 314 CMR 9.04(12) • 310 CMR 9.05(1) • 321 CMR 10.00
4 – Revetment Reconstruction and Recurve Seawall	• MEPA – Environmental Notification Form • CZM – Consistency Review • WPA – Notice of Intent • USACE – Individual Permit or Preconstruction Notification • MHC – Project Notification Form • MassDEP – 401 Water Quality Certification • MassDEP – Chapter 91 License	• WPA o 0 SF of impacts beyond existing structure footprints • USACE o 0 SF (0 CY) of new fill below HTL • MassDEP o 0 SF (0 CY) of new fill below MHW	• WPA o Coastal Bank - 1,200 LF, 67,500 SF; LSCSF - 54,000 SF • USACE o 14,000 SF (6,250 CY) of existing fill being removed and reset within the existing footprint below HTL; structure to remain within existing footprint • MassDEP o 10,500 SF (3,750 CY) of existing fill being removed and reset within the existing footprint below MHW; structure to remain within existing footprint	• 301 CMR 11.03(3) • 310 CMR 10.25, 10.30, 10.31 • USACE GP GP 2, GP 4, GP 9 • 314 CMR 9.04(12) • 310 CMR 9.05(1)

*New impacts outside of existing footprint. Due to the large volume of impacts for all alternatives, compensatory mitigation may likely be required by regulatory agencies.

Table 2 – Regulatory Impact Matrix of Alternatives

4.0 CONCLUSION

In summary, the proposed conceptual design alternatives provide a long-term solution to the existing coastal engineering structure at Point Allerton. In order to effectively design for the anticipated wave environment and overtopping volumes, it's evident that a large volume of fill material and significant alteration is required. Each alternative presents its own unique challenges and benefits that require careful consideration by DCR and stakeholders. The matrix included in **Table 3** provides a summary of conceptual design results, advantages, disadvantages, and conceptual cost estimates.

Note that these cost estimates are for general planning and budgeting purposes, and actual costs may vary depending on when the work is completed, labor and material cost rates, and the waterfront marine construction bid environment. Future design phases for any of the alternatives will require detailed analysis and physical testing to ensure the proposed structures meet the desired physical performance, which can range in cost from approximately $80,000 to $300,000. Given that the analysis presented herein is preliminary, it may be possible to reduce the footprint of the structures further in final design phases. A detailed breakdown of the conceptual cost estimate is included in **Appendix C**.

Alternative	Results	Advantages	Disadvantages	Stone Quantity (Tons)	Estimated Cost
1 – Revetment Reconstruction	**Overtopping Rate (l/s/m)** 3.6 – 4.8 **EL (ft, NAVD88)** 24 – 30 (Crest)	• Low maintenance when properly sized • Large mass and flatter slope help dissipate much of the wave energy, reducing reflections that can cause scouring at bottom • Typical design for similar conditions where methodology and design parameters are largely standardized	• Large nearshore dimensions and footprint may be difficult to permit • Invasive / long duration construction	120,000 to 190,000	$47.6M to $65.4M
2 – Composite Berm	**Overtopping Rate (l/s/m)** 4.2 – 6.6 **EL (ft, NAVD88)** 24 – 27 (Crest) 12 (Berm)	• Low maintenance when properly sized • Design process is supply-based and allows for flexibility of stone sizes • Dissipation of wave energy further from shoreline allows for lower crest height • Existing revetment may need some improvement, but is less extensive than full reconstruction • Lowest risk of construction unknowns	• Largest nearshore dimensions and footprint may be difficult to permit • Large water level fluctuations at the site may require reconsideration of stone sizes near the toe as higher exposure levels could lead to increased wear and tear • Stone sizes and locations within the structure rely on production capabilities of selected quarries	115,000 to 183,000	$64.4M to $93.2M
3 – Composite Berm and Offshore Breakwater	**Overtopping Rate (l/s/m)** 2.4 – 4.3 **EL (ft, NAVD88)** 20 – 25 (Crest) 12 (Berm) 12 (Breakwater)	• Low maintenance when properly sized • Structure can be built in phases, starting with a smaller berm with lower return period events and expanded to offshore breakwater for long-term solution • Implementing habitat in breakwater may ease permitting process, and funding opportunities exist • Once established, offshore breakwaters can stabilize quickly and promote long-term benefits for coastal protection and habitat creation	• Large nearshore and offshore dimensions and footprint may be difficult to permit regardless of habitat creation • Availability and transport of large volumes of armor stone may be limited • Detailed assessments will be required to address potential environmental impacts and justify ecological benefits of habitat features • Would require implementation of physical modelling during final design • Buoys / navigation channels should be established	140,000 to 219,000	$72.7M to $103.7M
4 – Revetment Reconstruction and Recurve Seawall	**Overtopping Rate (l/s/m)** N/A **EL (ft, NAVD88)** 21 – 31 (Crest) 24 – 37 (Wall)	• Recurve walls can significantly reduce overtopping volume and allow for lower crest elevations during final design phase • Could be constructed closest to existing footprint, potentially easing the permitting process • Requires least amount of imported stone	• Less standardized design • Staying within existing footprint may require extensive coordination with abutters including easements • Invasive / long duration construction	26,000 to 58,000	$25.9M to $38.7M

Table 3 – Comparison Matrix of Alternatives

Recommendation

Based on the project impacts, constructability, and uncertainty with alternatives discussed herein, it's recommended that **Alternative 3 – Composite Berm and Offshore Breakwater** be considered for shore protection at Point Allerton. This option provides an opportunity to implement the project in phases -- the first phase would be considered a near-term solution, and would include repair of the existing revetment and installation of the new berm and drainage swale. Further modeling and design would be required to determine the design storm and performance of the standalone berm until the long-term offshore breakwater is implemented; however, grant funding opportunities are available for these types of projects and could be pursued if the project is implemented in phases. Although Alternative 4 (Revetment Reconstruction and Recurve Seawall) has the lowest estimated construction cost, there are more unknowns associated with the recurve seawall and it's ultimate effectiveness without further analysis.

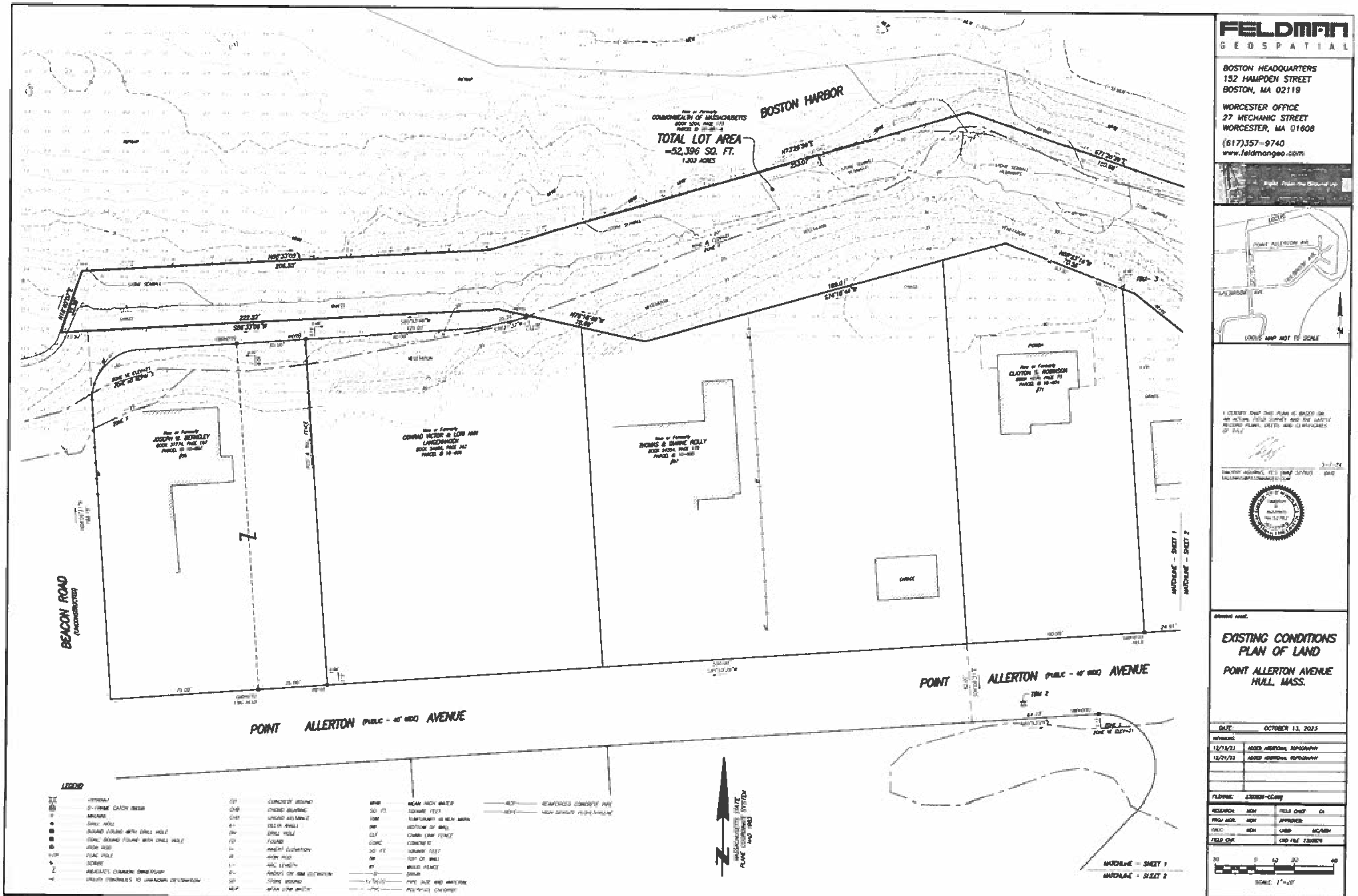
Regardless of which alternative is selected, it is recommended that interim repairs be performed until resiliency improvements can be completed to prevent further damage and deterioration of the structure, including restoration of the existing vegetated slopes. If failed sections of revetment are left in place, it's recommended that these areas are inspected on a 6-month basis until repairs begin. It's also recommended that at least one pre-application meeting be held with all regulatory agencies having jurisdiction prior to final selection of the desired alternative.

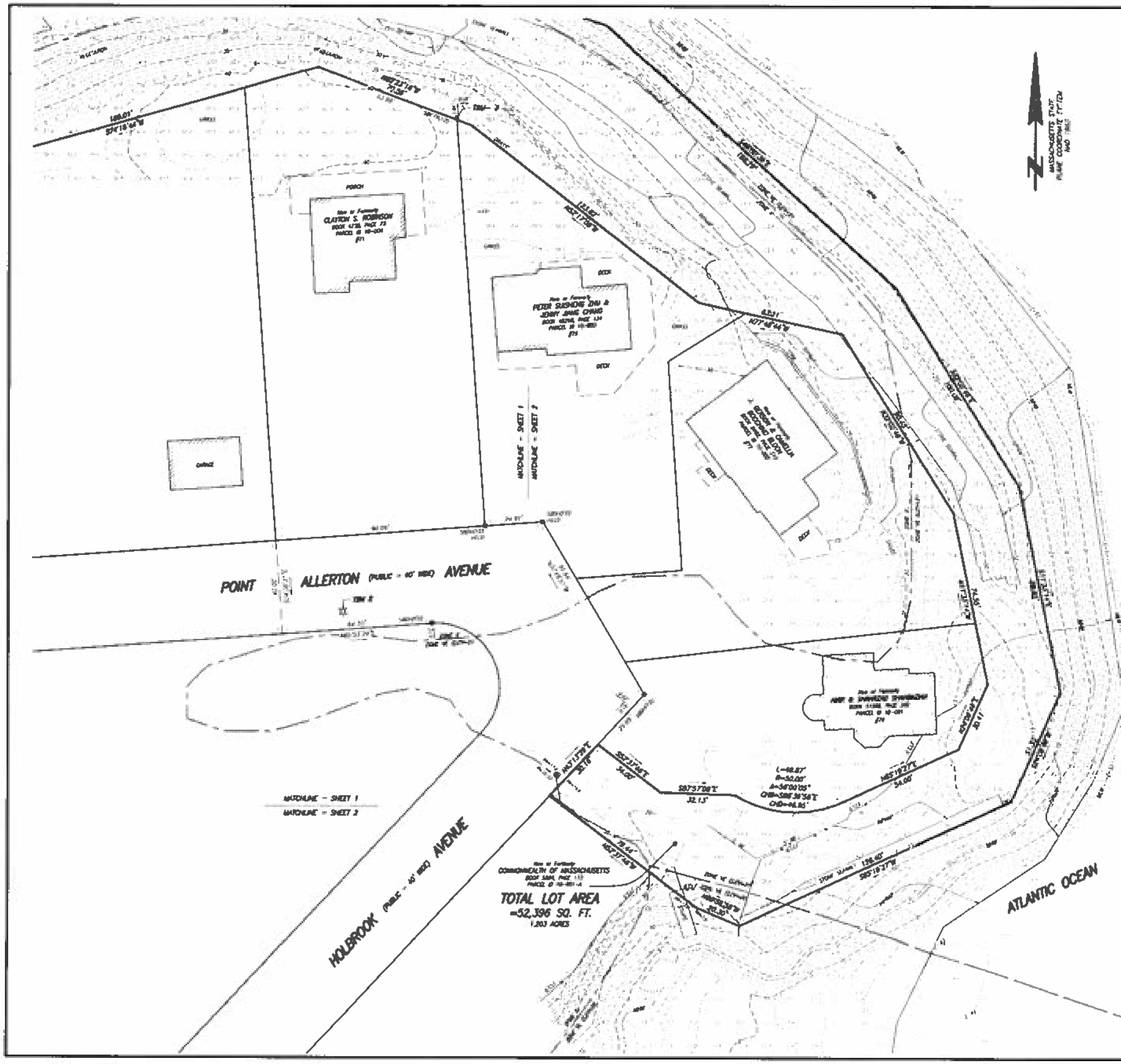
Future design phases of any of the alternatives will involve a detailed analysis, and in some cases, physical modeling to ensure the proposed structures meet the desired performance and resilience standards. The proposed alternatives presented herein are conceptual, and it may be possible to reduce the footprint as part of future design phases if physical modeling is performed. However, overtopping volumes calculated as part of the conceptual design effort are large, and estimated structure sizes should still be presumed to be significant.

COLLINS
ENGINEERS INC

ATTACHMENT A
Conceptual Design Drawings

1485 South County Trail | Suite 103 | East Greenwich, RI 02818 | Phone: 401.732.7714 | Fax: 401.589.1265 | www.collinsengr.com


FELDMAN
GEOSPATIAL
BOSTON HEADQUARTERS
152 HAMPDEN STREET
BOSTON, MA 02119
WORCESTER OFFICE
27 MECHANIC STREET
WORCESTER, MA 01608
(617)357-9740
www.feldmangeo.com
LOCUS MAP NOT TO SCALE
EXISTING CONDITIONS
PLAN OF LAND
POINT ALLERTON AVENUE
HULL, MASS.
DATE: OCTOBER 13, 2023
BOSTON HARBOR
Now or Formerly
COMMONWEALTH OF MASSACHUSETTS
TOTAL LOT AREA
=52,396 SQ. FT.
1.203 ACRES
Now or Formerly
JOSEPH W. BERKELEY
Now or Formerly
CONRAD VICTOR & LORI ANN LANGENHAGEN
Now or Formerly
THOMAS & DIANNE REILLY
Now or Formerly
CLAYTON S. ROBINSON
BEACON ROAD
(UNCONSTRUCTED)
POINT ALLERTON (PUBLIC - 40' WIDE) AVENUE
POINT ALLERTON (PUBLIC - 40' WIDE) AVENUE
MASSACHUSETTS STATE PLANE COORDINATE SYSTEM NAD 1983
LEGEND
MATCHLINE - SHEET 1
MATCHLINE - SHEET 2
SCALE: 1"=20'



LEGEND

NOTES:

1. BENCH MARK INFORMATION

   BENCH MARK USED:
   ELEVATIONS WERE OBTAINED BY GPS OBSERVATIONS ON OCTOBER 13, 2023

   TEMPORARY BENCH MARKS SET:

   TBM 1: FRONT RIGHT BONNET BOLT OF A HYDRANT LOCATED ON THE SOUTH SIDE OF POINT ALLERTON AVENUE IN FRONT OF HOUSE [illegible]
   ELEVATION = [illegible]

   TBM 2: FRONT RIGHT BONNET BOLT OF A HYDRANT LOCATED ON THE SOUTH SIDE OF POINT ALLERTON AVENUE OPPOSITE HOUSE [illegible] - (AS SHOWN HEREON)
   ELEVATION = [illegible]

   TBM 3: HIGH POINT OF A STONE BOUND LOCATED BEHIND HOUSE #75 POINT ALLERTON AVENUE - (AS SHOWN HEREON)
   ELEVATION = [illegible]

2. ELEVATIONS REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

3. CONTOUR INTERVAL EQUALS ONE (1) FOOT.

4. PORTION OF THE PARCEL SHOWN HEREON LIES WITHIN BOTH A ZONE "X" [illegible] AS SHOWN ON THE FEDERAL EMERGENCY MANAGEMENT AGENCY (F.E.M.A.) FLOOD INSURANCE RATE MAP (F.I.R.M.) FOR PLYMOUTH COUNTY, MASSACHUSETTS, [illegible] TOWN OF HULL [illegible] EFFECTIVE DATE OF JANUARY [illegible]

5. THIS PLAN WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND IS SUBJECT TO ANY FINDINGS SUCH A REPORT MIGHT DISCLOSE.

6. TOPOGRAPHIC DATA EXTRACTED FROM LASER SCAN DATA COLLECTED ON OCTOBER [illegible] 2023 USING A LEICA [illegible] LASER SCANNER AND FROM PHOTOGRAMMETRIC MAPPING CONDUCTED ON DECEMBER 21, 2023.

7. THIS DOCUMENT IS AN INSTRUMENT OF SERVICE OF FELDMAN GEOSPATIAL ISSUED TO OUR CLIENT FOR PURPOSES RELATED DIRECTLY AND SOLELY TO FELDMAN GEOSPATIAL'S SCOPE OF SERVICES UNDER CONTRACT TO OUR CLIENT FOR THIS PROJECT. ANY USE OR REUSE OF THIS DOCUMENT FOR ANY REASON BY ANY PARTY FOR PURPOSES UNRELATED DIRECTLY AND SOLELY TO SAID CONTRACT SHALL BE AT THE USER'S SOLE AND EXCLUSIVE RISK AND LIABILITY, INCLUDING LIABILITY FOR VIOLATION OF COPYRIGHT LAWS, UNLESS WRITTEN CONSENT IS PROVIDED BY FELDMAN GEOSPATIAL.

8. MEASUREMENTS SHOWN HEREON INDICATE THE DIRECTION AND DISTANCE OF ERROR FROM THE THEORETICAL LOCATION TO THE FOUND MONUMENT.

REFERENCES

PLYMOUTH COUNTY REGISTRY OF DEEDS

PLAN BOOK [illegible], PLAN [illegible]
PLAN BOOK [illegible], PLAN [illegible]
PLAN BOOK 23, PLAN 184
PLAN BOOK [illegible], PLAN [illegible]
PLAN BOOK [illegible], PLAN 46
PLAN BOOK [illegible], PLAN [illegible]
PLAN BOOK [illegible], PLAN [illegible]

MASSACHUSETTS LAND COURT

LCC [illegible]

FELDMAN GEOSPATIAL

BOSTON HEADQUARTERS
152 HAMPDEN STREET
BOSTON, MA 02119

WORCESTER OFFICE
27 MECHANIC STREET
WORCESTER, MA 01608

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I CERTIFY THAT THIS PLAN IS BASED ON AN ACTUAL FIELD SURVEY AND THE LATEST RECORD PLANS, DEEDS AND CERTIFICATES OF TITLE.

DATE

EXISTING CONDITIONS PLAN OF LAND

POINT ALLERTON AVENUE HULL, MASS.

DATE:	OCTOBER 13, 2023
REVISIONS:	
12/13/23	ADDED ADDITIONAL TOPOGRAPHY
12/21/23	ADDED ADDITIONAL TOPOGRAPHY

RESEARCH:	[illegible]	FIELD CHIEF:	[illegible]
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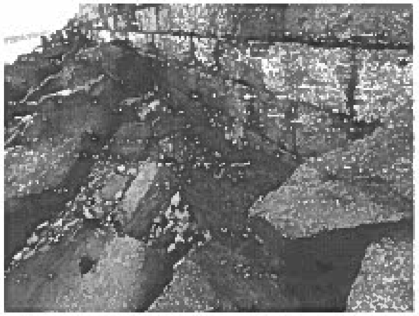
FIELD CHK:		CAD FILE:	[illegible]

SCALE: 1"=30'

SHEET NO. 3 OF 3



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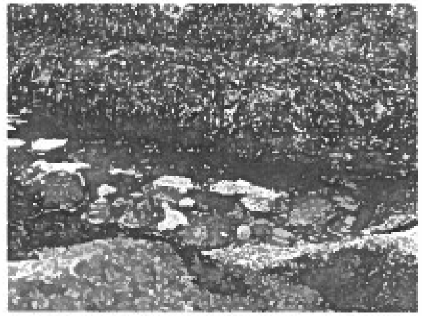
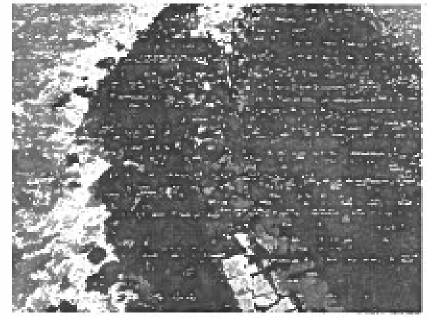


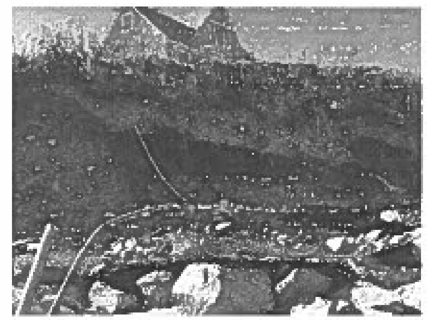
2 – STA. 5+90 EXPOSED AND UNDERMINED FOOTING



3 – STA. 4+10–5+00 FAILURE OF GRANITE BLOCK SEAWALL AND MORTARED APRON

4 – PRESUMED BURIED SEAWALL STARTING NEAR STA. 4+60

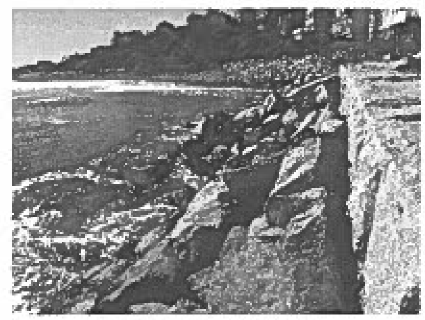
5 – STA. 5+00–5+90 SETTLEMENT OF MORTARED GRANITE BLOCK APRON



6 – EROSION OF EARTHEN SLOPE NEAR STA. 6+00

7 – STA. 9+20–9+50 SETTLEMENT OF MORTARED GRANITE BLOCK APRON

8 – STA. 9+50–10+50 FAILURE OF MORTARED GRANITE BLOCK APRON



9 – STA. 10+55–11+10 MISSING REVETMENT STONE

dcr Massachusetts

COLLINS ENGINEERS INC

REVISIONS

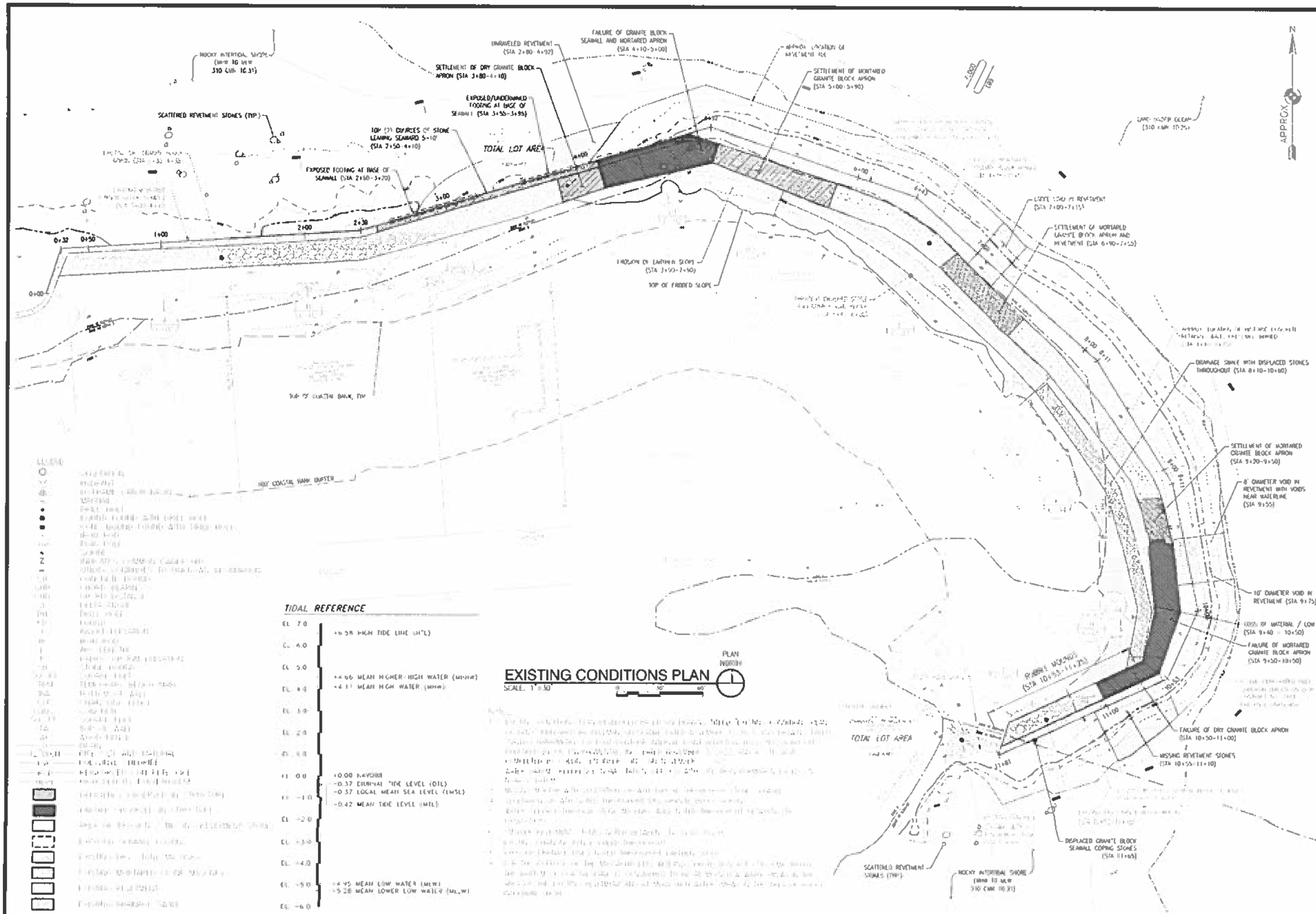
POINT ALLERTON SHORE ASSESSMENT

MASS. DEPT. OF CONSERVATION AND RECREATION

HULL, MA

2024

G-01



dcr Massachusetts

COLLINS ENGINEERS INC

REVISIONS

EXISTING CONDITIONS PLAN

POINT ALLERTON SHORE ASSESSMENT

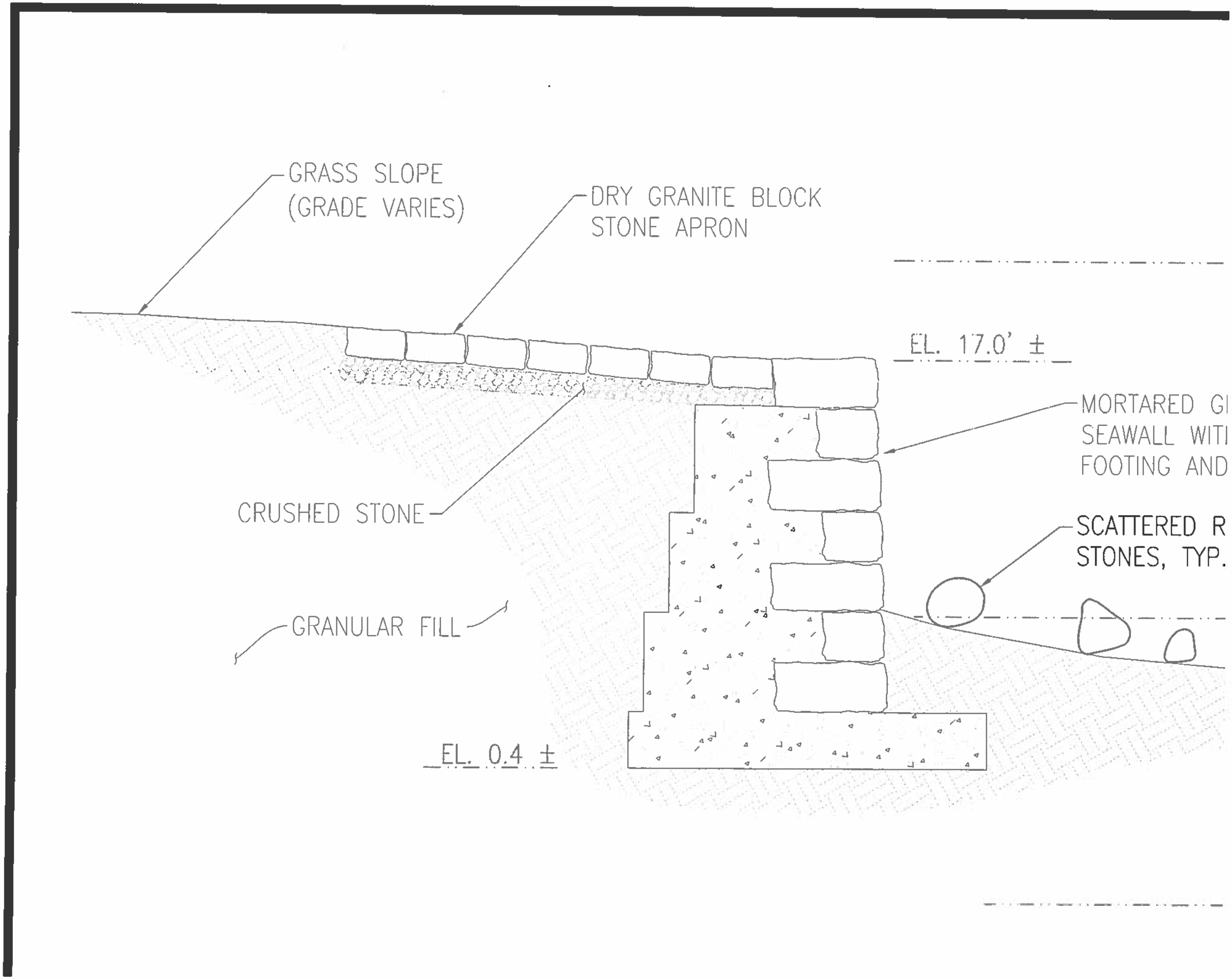
MASS. DEPT. OF CONSERVATION AND RECREATION

HULL, MA DCR PROJECT NO: P23-3493-D1A (4054-D) 2024

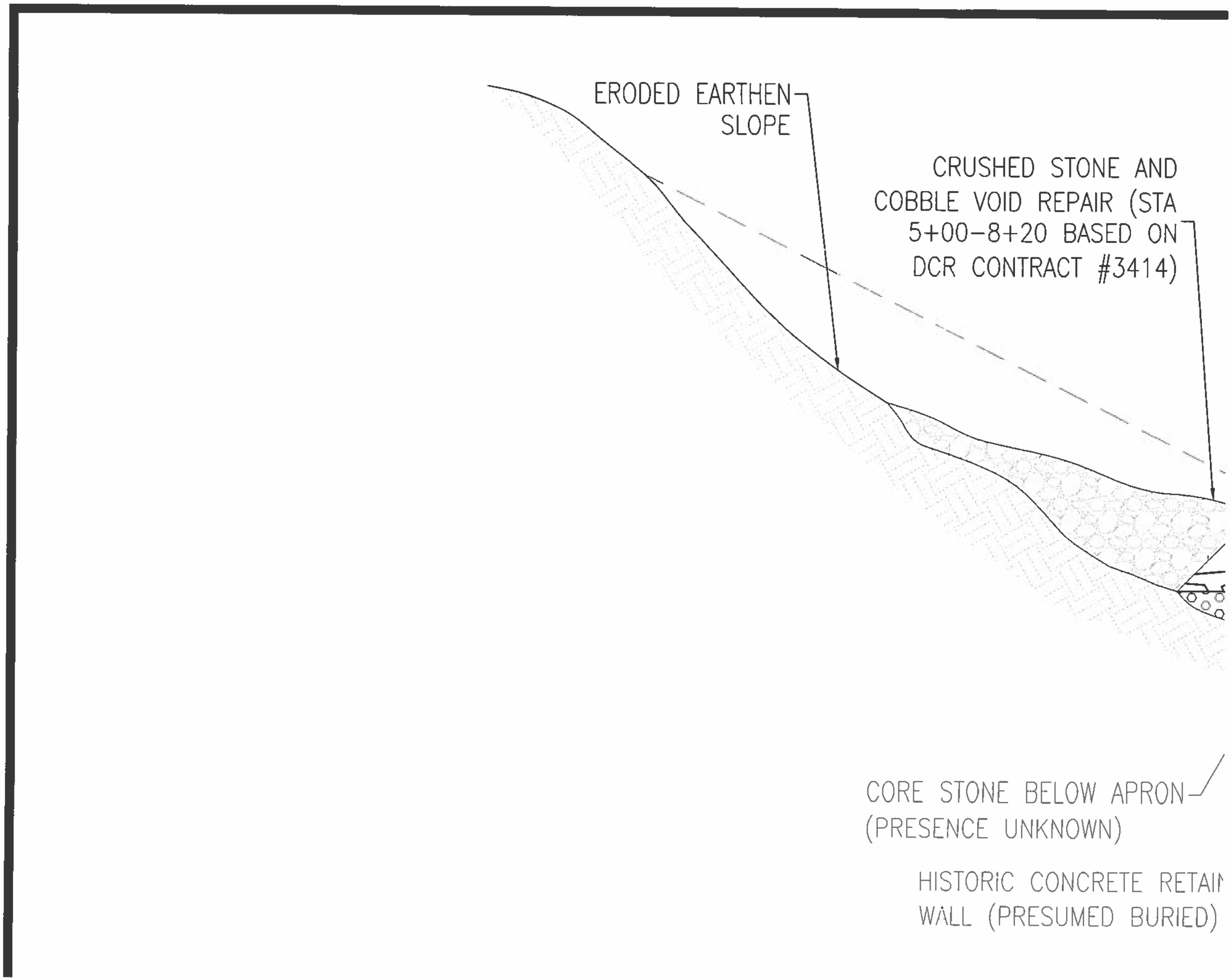
SEPTEMBER 2024

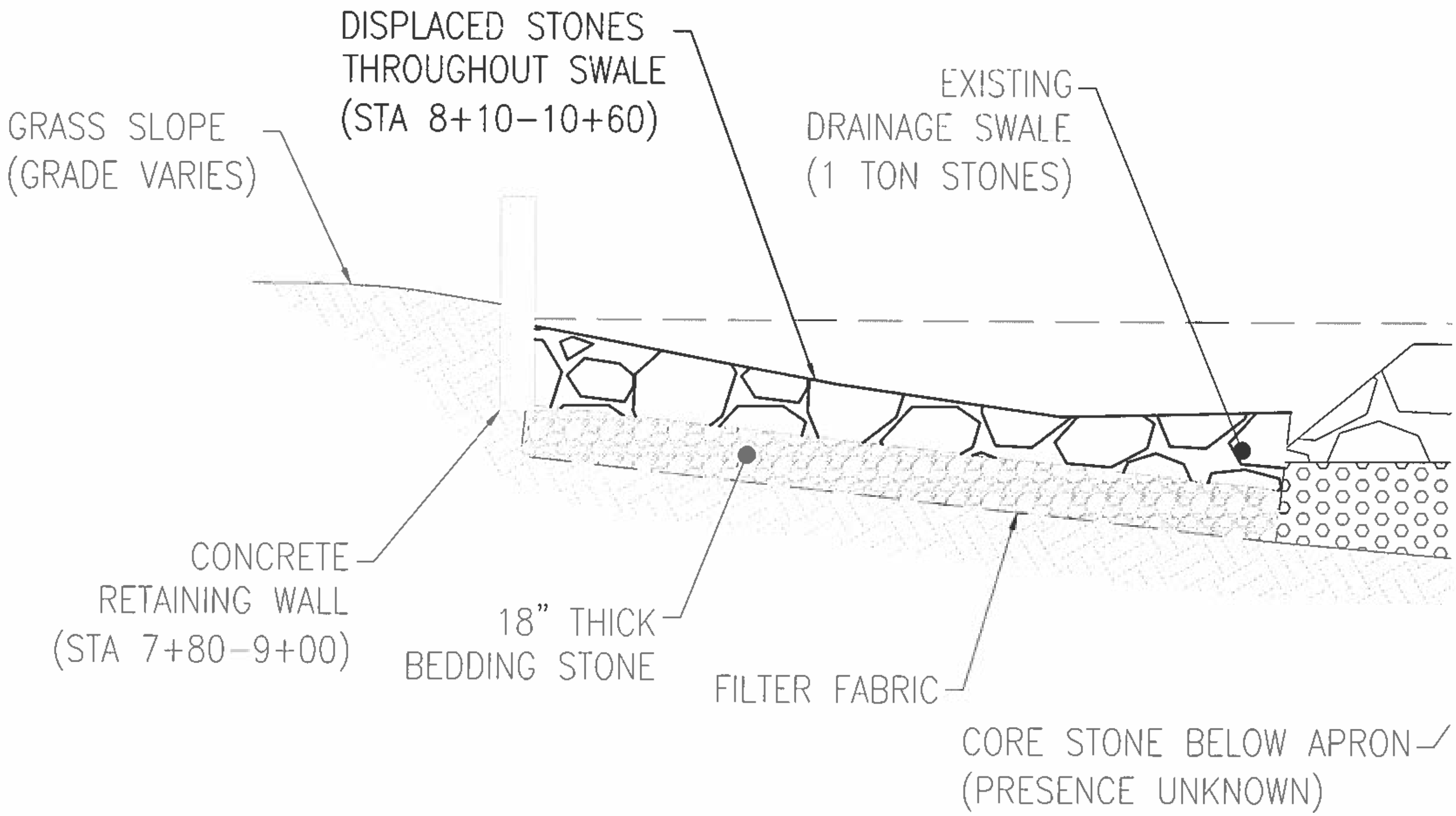
C-01

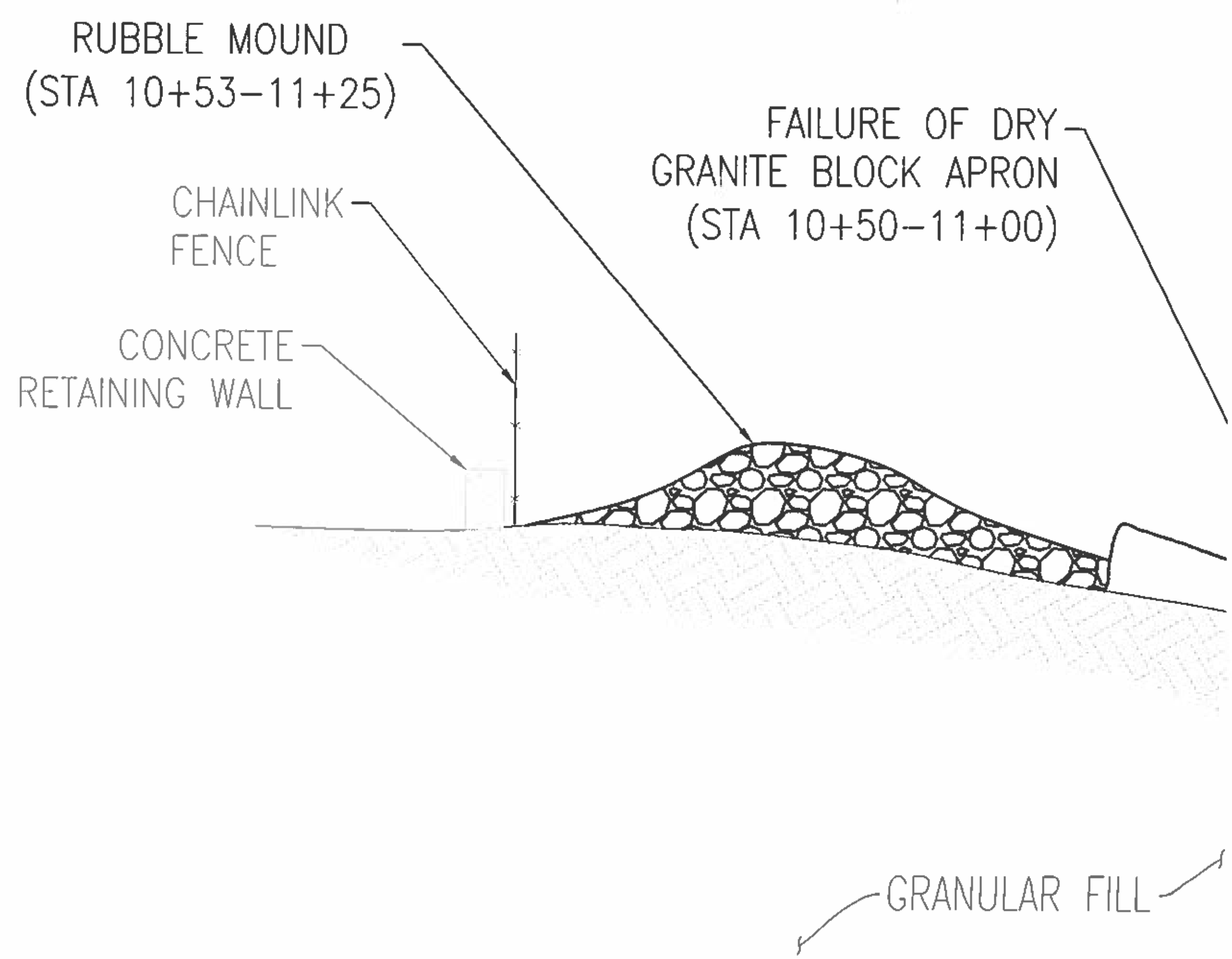
SHEET 2 OF 14



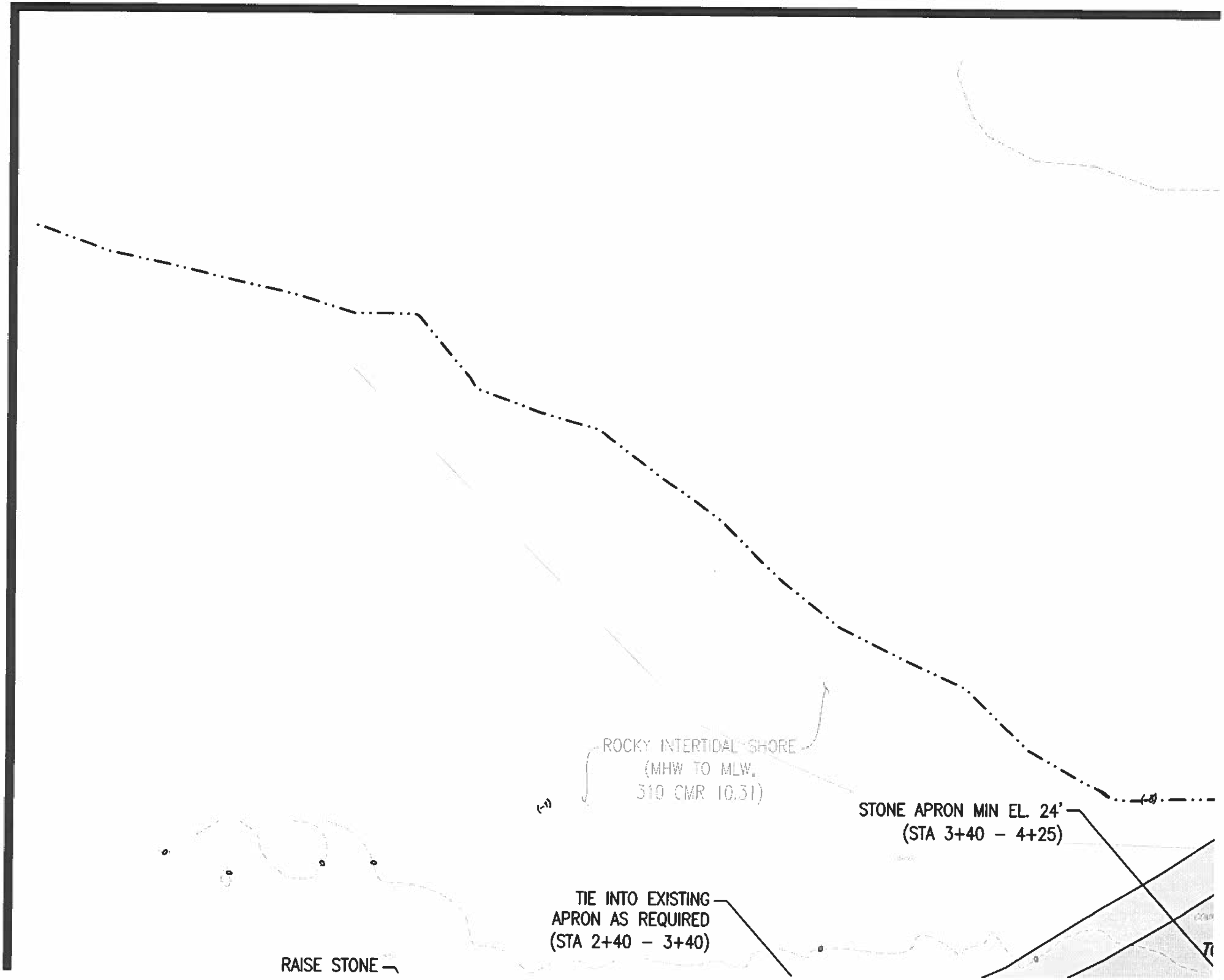
GRASS SLOPE
(GRADE VARIES)
DRY GRANITE BLOCK
STONE APRON
EL. 17.0' ±
MORTARED GI
SEAWALL WITI
FOOTING AND
CRUSHED STONE
SCATTERED R
STONES, TYP.
GRANULAR FILL
EL. 0.4 ±

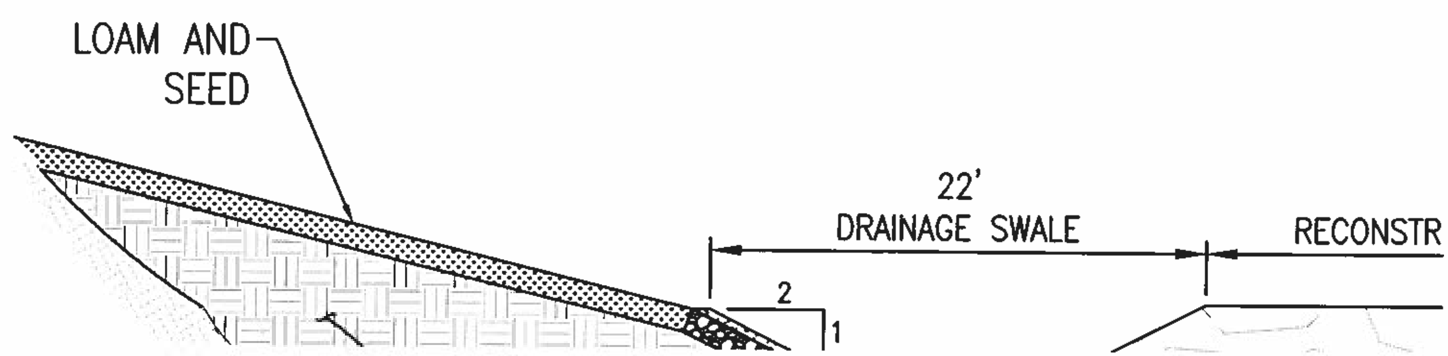

ERODED EARTHEN SLOPE
CRUSHED STONE AND COBBLE VOID REPAIR (STA 5+00–8+20 BASED ON DCR CONTRACT #3414)
CORE STONE BELOW APRON (PRESENCE UNKNOWN)
HISTORIC CONCRETE RETAI
WALL (PRESUMED BURIED)

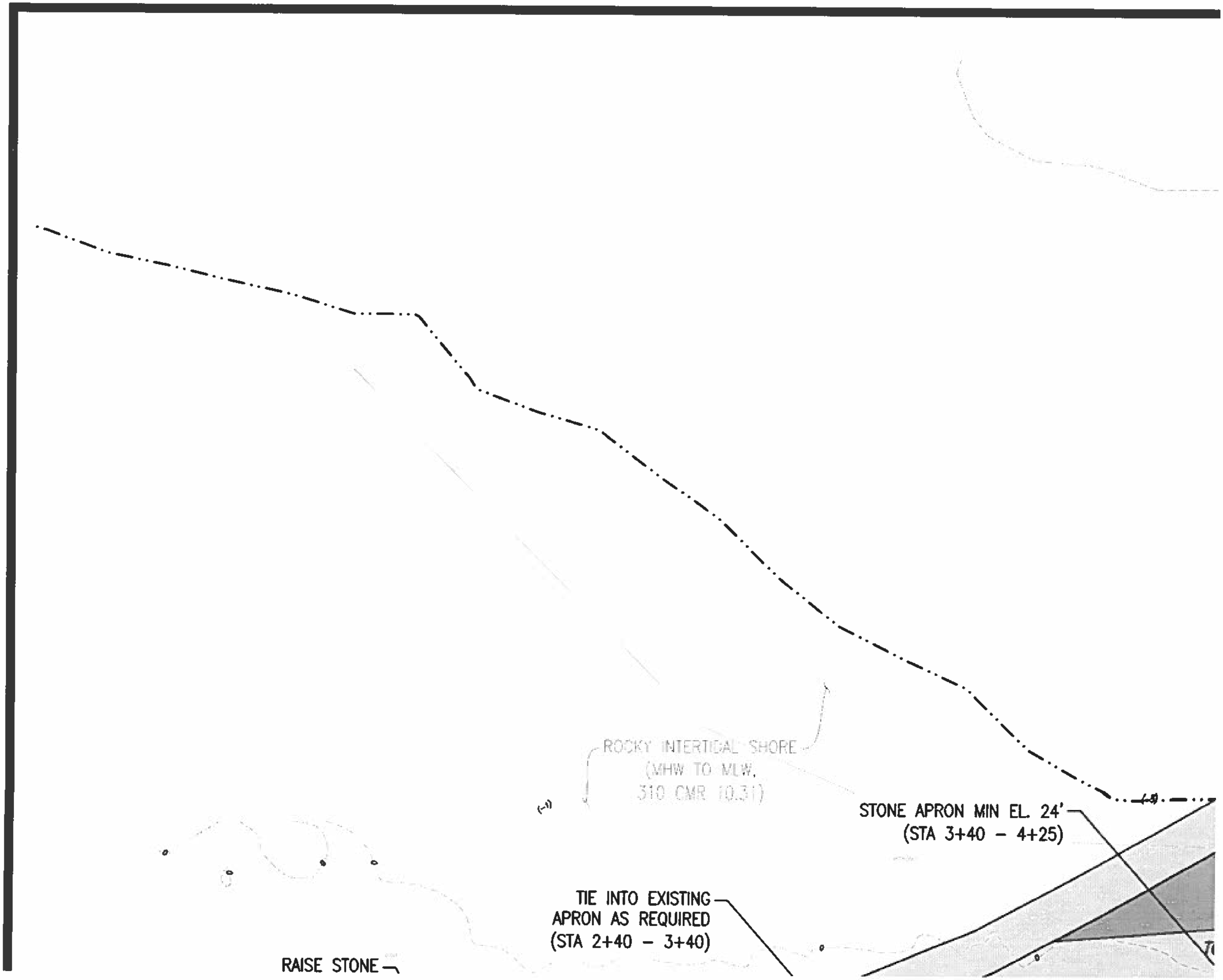

DISPLACED STONES
THROUGHOUT SWALE
(STA 8+10–10+60)
GRASS SLOPE
(GRADE VARIES)
EXISTING
DRAINAGE SWALE
(1 TON STONES)
CONCRETE
RETAINING WALL
(STA 7+80–9+00)
18" THICK
BEDDING STONE
FILTER FABRIC
CORE STONE BELOW APRON
(PRESENCE UNKNOWN)



RUBBLE MOUND
(STA 10+53–11+25)
FAILURE OF DRY
GRANITE BLOCK APRON
(STA 10+50–11+00)
CHAINLINK
FENCE
CONCRETE
RETAINING WALL
GRANULAR FILL


ROCKY INTERTIDAL SHORE
(MHW TO MLW,
310 CMR 10.31)
STONE APRON MIN EL. 24'
(STA 3+40 – 4+25)
TIE INTO EXISTING
APRON AS REQUIRED
(STA 2+40 – 3+40)
RAISE STONE


LOAM AND SEED
22'
DRAINAGE SWALE
RECONSTR
2
1


ROCKY INTERTIDAL SHORE
(MHW TO MLW,
310 CMR 10.31)
STONE APRON MIN EL. 24'
(STA 3+40 – 4+25)
TIE INTO EXISTING
APRON AS REQUIRED
(STA 2+40 – 3+40)
RAISE STONE