Jacobs

Project Notes

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Client	NAE	**Date**	10 March 2022
Project	New Bedford Harbor Superfund Site	**Project No.**	35BG7000
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Issued By	Lonnie Fallin		
Subject	Final Intertidal Erosion and Storm Repairs at West Zone 4 (WZ4)		

Distribution	(* Denotes Part Time Participation)	**Distribution (attendees plus)**	**See below**

Client	**EPA**	**Sevenson**	**Jacobs**	**AECOM**
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			Josh Cummings	**CR Environmental**
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1 PURPOSE

This project note summarizes repairs to be made by Jacobs and their subcontractors at WZ4 prior to the installation of marsh plantings.

2 BACKGROUND

The excavation and restoration of the intertidal area WZ4 occurred between June and August of 2021, with upland areas being restored and demobilization running through October 7, 2021. Upland seed and landscape shrubs, transition zone shrubs of Northern bayberry (*Myrica pensylvanica*), arrow-wood (*Viburnum dentatum*) and Virginia rose (*Rosa virginiana*), and high tide bush zone *Iva frutescens* were installed between October 12, 2021, and October 21, 2021. This was anticipated to be the completion of construction activities until the installation of warm season panic grasses, seaside goldenrod (*Solidago sempervirens*) and salt marsh grasses during the spring of 2022.

Attachment A contains photographs of the completed construction at WZ4 taken up to mid-October 2021. On October 26 and 27, 2021, a strong northeast storm brought substantial rain, and winds exceeding 70 mph to the New Bedford area. The wind and waves generated by the storm did not negatively affect most of the previously established intertidal restoration areas at NBH, however, components of the newly constructed WZ4 showed damage. Following the storm, on October 28, 2021, Jacobs, EPA, USACE-NAE, SES, AECOM and CR inspected the intertidal restoration and were able to document damage. Photos of WZ4 following the storm are included as Attachment B. Damage included lifting or displacement of many of the coir logs, which were installed at the toe of the planned low marsh, erosion of much of the marsh topsoil, and erosion of the bank, including above the MHHW elevation (1.99 ft. NAVD88). During November 2021, Jacobs staff conducted interim stabilization activities at WZ4 to minimize the additional loss of restoration materials or damage to upland areas. These activities included replacement of some coir logs, re-staking and re-tying coir logs, and backfilling behind some coir logs with gravel.

On December 16, 2021, a call was held amongst Jacobs, CR, and AECOM to discuss methods and designs that might be incorporated into the repairs at WZ4 to make it more resistant to future storm damage and erosion, particularly while plants are establishing. Notes from that discussion are included as Attachment C.

On January 13, 2022, EPA, USACE-NAE and Jacobs met at WZ4 to inspect the state of the site and discuss potential repairs.

3	**PROPOSED REPAIRS TO WZ4**
	To effectively address the proposed repairs, WZ4 has been broken down into 5 Zones. Figure 1 shows these 5 zones, which are delineated by green bars. Additionally, 3 cross section locations are identified on Figure 1, which are discussed further in the following sections. **WZ4 repairs to be made across the entire site (as needed).** • Check coir logs, top of log elevation design is 0.5 ft. NAVD88 (+/- 0.1 ft), adjust logs as needed. (Approximately 70% will need some adjustment in elevation). To adjust the elevation, field crews will have to re-grade the area and / or add additional 3 inch minus gravel. (Estimate 250 cy of gravel) • Re-tie & re-stake any coir logs that are not secure. ALL coir logs must be inspected (see specific instructions for coir log installation). • Inspect butted junctions of coir logs, ensuring each junction is tied a minimum of 3 times at opposing sides of the coir logs alternatively the butts may be laced, this includes any coir logs previously installed. • If a log is lifted and stakes are loose, install 4 ft. long stakes and/or duckbill style anchors. Note that 3 ft hardwood stakes were used for the 2021 installation. • Install compacted gravel wedge on seaward side of coir log to protect log, similar to Parcel 265 (estimated area of repair is approx. 1300 ft long, 1 ft high, 3 ft wide and sloped 3:1 (220 CY of material)). Drawing 1 illustrates a typical cross section of the gravel wedge to be installed at the toe of the coir log.). In locations where coir log is adequately protected, such as where it is adjacent capping materials, this step may be omitted. • Steeper sloped intertidal areas will be re-graded as possible given localized conditions prior to placement of topsoil. Ideally intertidal areas will be sloped to 10:1, although it is understood that conditions may not allow this in some locations. • Replace lost topsoil with stone reinforced topsoil (standard NBH marsh soil plus 20% by weight ¾ inch crushed stone). Original design used 1,630 CY of topsoil. For estimating purposes, it is assumed that 1,630 CY of topsoil will be required, but the actual amount will be determined in the field, and deliveries controlled to avoid a surplus. • In some areas it will be necessary to temporarily remove plantings such as high tide bushes (*Iva frutescens*), these will be carefully removed by hand, set aside, kept moist and replaced when the repair work is done. • Plastic construction mats should be utilized as practical to protect areas of lawn, pavement, or undamaged restoration areas. **Localized WZ4 Repairs:** **Zone 1:** • Remove large coir log installed above marsh and replace with stone (see Attachment B, Zone 1 photos for current conditions). Figure 2 illustrates the location. • Install large stones (avg 2.5 ft dia.) for approximately 50 ft. on the seaward edge of *Rosa rugosa* planting area, sourcing stones from the DDA. Use smaller stones or 3 inch minus gravel to fill voids. • Backfill as needed with 3 inch minus gravel. • Topsoil fill to blend into existing topography above armor stones. The stone reinforced topsoil will be placed within intertidal zones up to the top of the high tide bush zone (3.6 ft. NAVD88), above that elevation the standard NBH topsoil will be placed as needed. • A biodegradable erosion control blanket will be installed above the armor stone and cover the soil up to the crushed stone *Rosa rugosa* planting area. Erosion control blankets will be keyed into the existing soil at the upper elevation and behind and under the armor stone. Adjacent blankets are typically overlapped several inches and secured with soil staples. Field installation will be per manufacturer's instructions. Erosion control

blankets will be installed above elevations subject to anticipated icing and storm tidal fluctuations (observed to be approximately 3.5 - 3.7 ft. NAVD88).

- Coir log will be installed at the toe of the armor stone, tightly against it. Approximately 50 ft. of coir log required. Duckbill (or similar) type anchors should be used to secure this coir log due to the amount of urban fill known to be present.
- Drawing 2 illustrates a proposed cross section of the Zone 1 repair.
- Cover PVC pipe (yard drain) with riprap, soil will not stay on pipe within intertidal area (less than 5 cy riprap). This feature will be installed so it functions as a small groin.

Zone 2

- Upgrade L-014 cap so that it appears more uniform to allow better tracking of changes over time. Specifically, add additional armor stone to L-014 cap. Grade cap surface with excavator bucket and additional stone. Do not alter existing cap, add to it. Neaten edges to appear more uniform. Allow several tide cycles to pass. Survey cap surface and photo document. Update Cap survey file for comparison against the 2022 annual cap monitoring survey which is planned for the fall. Estimate 20 cy rock to cover 100 ft long x 10 ft wide (visible) cap with one (0.5 ft) layer of stone.
- Notable erosion appears to be confined to toe of low marsh area.
- It is anticipated that if heavy equipment must access the relatively intact low marsh area West of the L-014 cap, plastic construction mats or similar materials will be utilized to prevent excess damage.

Zone 3

- At the point just south of the L-014 cap, rebuild slope to incorporate a second rock wall (similar stepped structure to WZ1 Pyropel wall on smaller scale). Utilize large stones (avg 2.5 ft dia.) with smaller stone fill for any voids. Measure elevations of substrate to determine appropriate species for planting. The space between the rows of rock will be back filled with 3 inch minus gravel to within several inches of final grade. Stone reinforced topsoil will be placed over the gravel and seeded with New England salt tolerant grass seed mix. The most seaward line of stones will be set so the top is at approximately 3.5 ft. with 3 ft. of space between them. Three-inch minus gravel will be used for the base of the stones and provide the majority of fill between them. (Estimate 30 CY of gravel).
- A biodegradable erosion control blanket will be installed above the armor stone and over the soil between the lines of stones. Erosion control blankets will be keyed into the existing soil at the upper elevation and behind and under the armor stone. Adjacent blankets are typically overlapped several inches and secured with soil staples; field installation will be per manufacturer's instructions. Erosion control blankets will be installed above elevations subject to anticipated icing and storm tidal fluctuations (typically observed to be approximately 3.5 ft. – 3.7 ft. NAVD88).
- Coir log will be installed at the toe of the armor stone, tightly against it. Approximately 80 ft. of coir log required. Duckbill (or similar) type anchors should be used to secure this coir log due to the amount of urban fill known to be present.
- Drawing 3 illustrates a proposed cross section of the Zone 3 repair.

Zone 4

- Repair existing stone armoring along top of slope using 3 in. minus backfill in any washouts. Add additional rock as needed. Compact large rock into bank. Replace any eroded soil with the stone reinforced topsoil up to the top of the high tide bush zone (3.6 ft. NAVD88), above that elevation the standard NBH topsoil will be placed as needed.
- Coir log will be installed at the toe of the armor stone tightly against it. Approximately 120 ft. of coir log required. Duckbill (or similar) type anchors should be used to secure this coir log due to the amount of urban fill known to be present.

	• Drawing 4 illustrates the proposed cross section of the Zone 4 repairs. **Zone 5** • South of iron pipe outfall, rock wall at slope break is intact. Fill any minor erosion rills as needed. **Planting replacement (excludes already scoped marsh plantings)** During the late October storm, many of the newly installed *Iva frutescens* plants closest to the shoreline were displaced and washed away. Replace missing plants. Assume 20% missing. Re-seed high tide bush zone with New England salt tolerant grass seed mix grass. **Coir Log Installation** All coir logs installed at the toe of low marsh will be staked and tied at a minimum per the manufacturer's recommendation. Additional stakes and tying should be installed at particularly vulnerable locations (toe of steeper slopes or NE facing points. Rope securing coir log shall be tied with a knot securely to each stake and not just wrapped. Adjacent logs shall be secured tightly butted against each other with a minimum of 3 separate knots on opposing sides or laced around the entire circumference. Stakes will be driven flush with the top of coir logs; any excess stake material must be cut off upon completion of staking. Some manufacturer's instructions include notching the wooden stake prior to tying. This should be done if recommended. If replacement 4 ft. stakes do not appear secure upon installation, duckbill anchors should be installed, supplementally to secure the log. Any stakes remaining from the 2021 installation which are not utilized for securing erosion controls must be driven flush with the soil or removed. Any damaged coir logs will be disposed of or cut up and spread out for mulch. Any coir log netting will be collected and disposed of at Area C. **Demobilization** Following the installation of marsh plantings and replacement plantings, repair any ruts created during repairs, add additional topsoil if needed, and re-seed with appropriate seed mixture (per WZ4 planting plan).
4	**SUMMARY OF MATERIALS**
	Construction Materials • Large rock from DDA (avg. 2.5 ft dia) 130 linear ft. Additional smaller rock may be required if sufficient rock of this size is not able to be supplied. • 3 in. minus gravel (estimate. 500 CY). • Stone reinforced topsoil (1630 CY). • Standard NBH topsoil for upland fill and repairs as-needed (estimate 40 CY). • Rip-rap cap armor stone (same spec as capping plan, 25 CY). • Wood stakes, 4 ft. hardwood. • Duckbill anchors (or similar) suitable for securing coir log at toe of rocks. Minimum 300 lb capacity, 20 in. installation depth below ground surface. Attachment D provides an example duckbill anchor sales brochure. It is requested that Sevenson consult with a vendor to determine the best method of installing the anchors. For example, double ended anchor assembly installed snugly over coir log, and determine if a more corrosion resistant assembly (stainless steel and / or coated) would be recommended for use at WZ4 with a minimum expected service life of 2 years.

	• Coir logs (as needed). • Natural rope for securing coir logs. Planting Materials • *Iva frutescens* (estimated 20% of total (1077 plants) in planting plan= 215). • New England salt tolerant grass seed mix 9 lbs. (allows re-seeding of entire high tide bush zone from planting plan). • New England Conservation seed mix to repair any upland rutting of areas disturbed during repair work.
5	**MONITORING AND MAINTAINANCE**
	Following any significant storm with winds greater than 50 mph or rain >2 inches in a 12 hr period, Jacobs will inspect WZ4 for storm related erosion or loss of plantings. If issues are noted they will be brought to the attention of the USACE-NAE QA rep within 24-hrs, and a mitigation plan will be developed. This monitoring will continue through Fall of 2022 when the team will re-evaluate if additional monitoring is necessary. This monitoring will be conducted in addition to planned restoration monitoring.
6	**Figures, Attachments and Drawings**
	Figure 1 and Figure 2 provide a plan view of WZ4 and specific repair areas. Attachment A and Attachment B provide photos of pre- and post-storm conditions of WZ4. Attachment C provides a summary of topsoil and erosion controls proposed to be incorporated into the repairs of WZ4. Attachment D provides manufacturers sales literature for Duckbill Anchors as an example. Drawing 1 through Drawing 4 provide cross sections for proposed repairs at WZ4. Locations of sections are referenced on Figure 1.

Zone 1

Approximate location of stone armor to install.

A

A'

105-170

Zone 2

L-014 CAP

Approximate location of tiered stone armor to install.

B'

105-183

B

Zone 3

C

C'

Zone 4

Riverside Ave

Zone 5

L-114 CAP

Manomet Street

Upper Harbor

West Zone 4

Site Location

Legend

- West Zone 4 Management Area
- Parcel Boundary
- Proposed Limits of Excavation
- Excavation Extent with Sand Backfill and Cap
- Final Extent Engineered Cap
- Proposed Additional Stone Armor
- A — A' Proposed Cross Section
- Restoration Zone Divider

Basemap Data Source: MassGIS, ESRI

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 150 300 Feet

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors,

Intertidal West Zone 4 Proposed Repair Zones

New Bedford Harbor Superfund Site

October 2020 **Figure 1**

Path: Y:\NBH\Projects\35BG1001\20200925_Update_to_WZ4\ArcGIS\Fig 2-1 WZ4_Update_WP_Site_Location_20200929.mxd

Notes:
Proposed High Marsh plantings to include 50/50 mix of Spartina patens and Distichlis spicata, plugs, 12" on-center spacing requirements.

Proposed Low Marsh plantings to include Spartina alterniflora, plugs, 12" on-center spacing requirements.

Any native trees removed as part of access road construction or excavation will be replaced in-kind (1-gallon containers). Any invasive trees removed will be replaced on a one-to-one basis with native tree species constituting similar growth form, habit, and size (1-gallon containers).

Areas of proposed restoration surface shall be uniformly graded with a smooth finished surface and will transition back to match existing grades upon completion of construction. Slight differences between depicted and constructed surfaces may occur due to microtopographic variations across the site.

Final restored elevations will be documented in the After Action Report.

MHHW and MLLW lines are approximate.

Upland areas shall be seeded with conservation seed mix as specified in the Generic Intertidal Work Plan.

Scrub-Shrub Marsh areas shall be planted with a 50/50 mix of Iva frutescens, 1-gallon containers, 36" on-center spacing requirements, and Juniperus virginiana at landward edge, 1-gallon containers, 48" on-center spacing requirements.

Shrub Restoration Area Plantings:
Area 1:
Iva frutescens, 1-gallon containers, 36" on-center spacing requirements.

Area 2:
Myrica pensylvanica, 1-gallon containers, 36" on-center spacing requirements.
Clethra alnifolia, 1-gallon containers, 36" on-center spacing requirements.
Rhus glabra, 1-gallon containers, 48" on-center spacing requirements.

Replace 18" dia. coir log with rock armoring

Area 1

Area 2

105-170

105-183

111-155

5

0

-5

-10

Legend

- 0-1' Excavation Depth
- 1-2' Excavation Depth
- 2-3' Excavation Depth
- 3-4' Excavation Depth
- Proposed Access
- 1-foot Contour
- Mean Lower Low Water
- Mean Higher High Water
- Proposed Coir Log
- Parcel Boundary
- Proposed Shrub Restoration Area
- Proposed Beach
- Proposed High Marsh
- Proposed Low Marsh
- Minimal Backfill as Needed for Drainage or Slope Stability
- Proposed Scrub-Shrub Marsh

0 50 100 Feet

October 2020

Basemap Data Source:
Green Seal Environmental, MassGIS

Vertical Datum:
NAVD88

USGS, MassGIS

Figure 7-1a from WP Intertidal West Zone 4 Parcel 105-170 Proposed Wetland Cover Types and Topography

New Bedford Harbor Superfund Site

JACOBS

Figure 2

Path: Y:\NBHP\projects\358GI.001\20200925_Update_to_WZ4\ArcGIS\Fig 7-1a_Parcel_105-170_Proposed_Veg_WZ4_update_20200929.mxd

Attachment A
Pre-Storm WZ-4

Attachment B
Post Storm Damage Zone 1

Attachment B
Post Storm Damage Zone 2

Attachment B
Post Storm Damage Zone 3

Attachment B
Post Storm Damage Zone 4

Attachment B
Post Storm Damage Zone 5

Attachment C

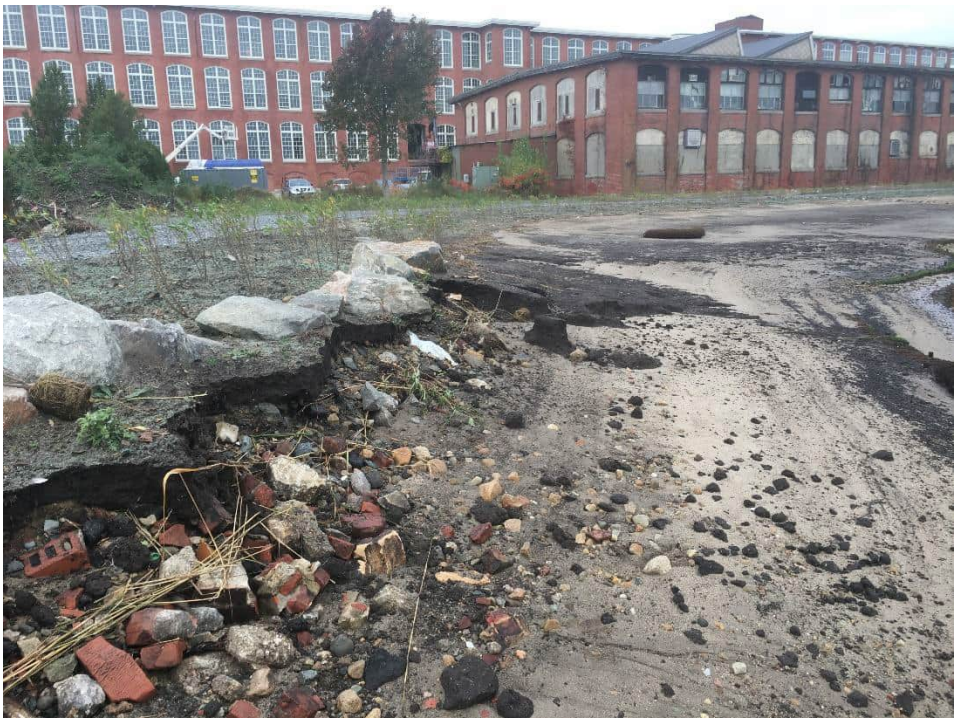
WZ4 substrate erosion discussion 12/16/21 (CC notes with JRC additions in yellow) rev1

- Original mix of topsoil ~ 75-85 % sand, 14-19 silt, 6% clay (4 % organics) possibly add more sand and ¾ inch gravel. The original substrate was often pebble/cobble on the surface there is no longer bulkhead protection. Read Topsoil has indicated they can manufacture a coarser soil to our specifications in large or small batches. The process is to manufacture the soil then add the rock at the end. An example was topsoil with 20% ¾ inch crushed stone. An "armored topsoil" could be used to replace all missing topsoil or be used in areas considered most susceptible to erosion while vegetation is establishing such as steeper slopes, narrow marsh areas or areas with a lot of NE facing fetch. The photo below is an example of the pre-existing conditions at WZ-4.

- Use a coarser subsoil.
- Add erosion control mat over the topsoil in select areas that are narrow and prone to erosion
    - Choose one that is natural fiber and will degrade – talk to SWCA /other suppliers about what would work best in an inundated setting.
    - A blanket that degrades by the first winter may help alleviate some ice issues noted at earlier restoration sites (NWS).

    - Mass Wildlife has a guidance document that could be helpful.
- Discuss use of rock and/or crushed stone reinforcement along the seaward edge of coir logs as has been used successfully at other sites on the western shore (P265). Photo below illustrates that a displaced coir log allowed substantial loss of topsoil.

- Use boulders and/or 2man-stone instead of the coir logs at the northern end of WZ4 near the pea gravel landscaping for ACORN to stop erosion – possibly also at the southern parcel on the corner where it turns from east to south. The photos below show areas where larger stone above the marsh would help prevent erosion.



- Ideally use more reinforced herbivore fencing to stand up to the storms but at a minimum some type of panel of construction fence that obstructs the view (line of sight) for geese at and around (or up to rock slope) for the low marsh plantings. [Published reports theorize that obstructing their line of sight makes them wary of predators.]

- Use longer stakes for securing the coir logs, when re-staking or doing repairs at WZ-4. Discuss options with SES. It appeared that in some areas the stakes had lifted with the coir log during the October 21st storm.

WZ5 also has some erosion above the riprap slope but not as severe as WZ4

Attachment D

Manufacturers Sales Literature for Duckbill Anchors

*Note, this information is provided as an example and should not be considered an endorsement of a particular brand or vendor

MPS Civil Products

Duckbill Earth Anchors

Features >>>

- Tree Support
- Theft Deterrent
- Erosion Control
- Multi-Purpose

Benefits >>>

- Faster Installation and Penetrates Harder Soils
- Quicker Loading, Stronger Hold
- More Stable Drive Plane Installation Angle

Breakthrough Earth Anchoring Technology

DUCKBILL® EARTH ANCHORS

The Duckbill Anchor Principle >>>

Saving time and labor, patented Duckbill® Anchors work like toggle bolts in the soil.

Duckbill Anchors are driven into the ground (with no holes, no digging and no concrete), providing a safe and environmentally sensitive installation.

An upward pull on the anchor tendon rotates the Duckbill Anchor into a perpendicular “load lock” position in undisturbed soil.

Duckbill Anchor systems offer the most effective, lightweight, economical solutions to any anchoring application, large or small.

Models >>>

Model 40

300 lbs. capacity in normal soils

Model 68

1,100 lbs. capacity in normal soils

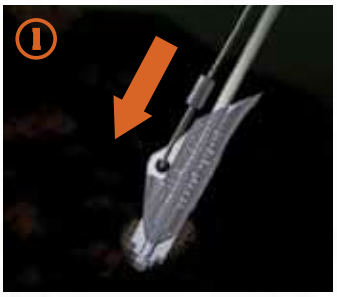
Model 88

3,000 lbs. capacity in normal soils

Model 138

5,000 lbs. capacity in normal soils

How It Works >>>



Drive Anchor

Remove Drive Steel

Pull On Wire Rope

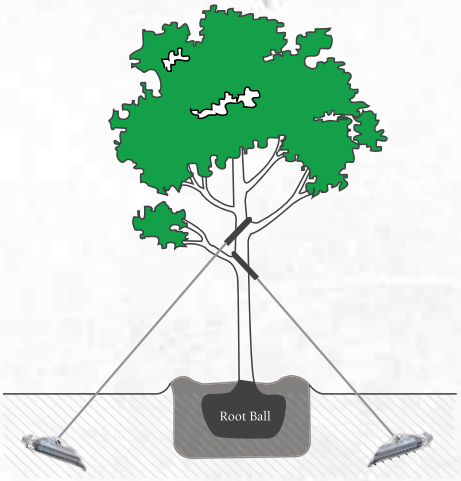
Load Locked

1. Drive anchor into the soil using a hammer and drive steel rod (a small jack hammer can also be used with power drive steel).
2. Once anchor is at the proper depth, remove the drive steel.
3. Set the anchor in the soil by pulling up on the wire rope.
4. The upward pull on the wire rope rotates the anchor into a perpendicular load locked position.

> **Safe**
> **Strong**
> **Easy to Install**

Tree Support Kits

No time wasted assembling various components. With Duckbill Anchors, everything is done for you. All kits are available with galvanized steel, clear or highly visible orange / white vinyl coated wire rope.



The Advantages

- Easy, safe installation
- More trees anchored per hour
- Professional appearance

**One kit anchors one tree. Drive steel additional.*

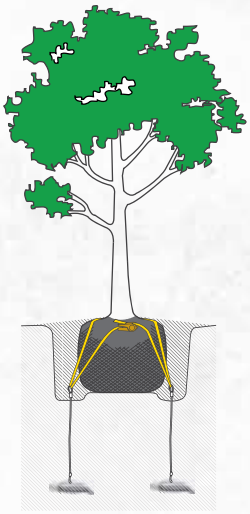
Tree Support Kit Specifications

Product	Model 40 DTS Kit For trees up to 3 in (75 mm) diameter	Model 68 DTS Kit For trees up to 6 in (150 mm) diameter	Model 88 DTS Kit For trees up to 11 in (279 mm) diameter
Kit Contents	- 3 DUCKBILL® anchors - 12 ft (3.6 m) of wire rope per anchor attached - 3 tree collars - 3 1/16 in (1.6 mm) wire rope clamps	- 3 DUCKBILL® anchors - 13 ft (4 m) of wire rope per anchor attached - 3 tree collars - 6 1/8 in (3.2 mm) wire rope clamps	- 3 DUCKBILL® anchors - 15 ft (4.6 m) of wire rope per anchor attached - 3 tree collars - 6 3/16 in (4.8 mm) wire rope clamps
			
Capacity (Per Anchor)	300 lbs (1.33 kN) in normal soil	1,100 lbs (4.89 kN) in normal soil	3,000 lbs (13.39 kN) in normal soil
Standard Case & Weight	12 units at 10 lbs (4.6 kg)	6 units at 24 lbs (11 kg)	4 units at 30 lbs (13.5 kg)

Drive Steel for DUCKBILL Anchors >>>

Model 40	Model 68	Model 88	Model 138
DS-40: 3/8 in (9.7 mm) round 2 ft (0.6 m) long hand drive steel with large striking head	**DS-68:** 1/2 in (12.7 mm) round 3 ft (0.9 m) long hand drive steel with large striking head **DS-68 HD (Heavy Duty):** 3/4 in (19 mm) round 4 ft (1.2 m) long hand drive steel with large striking head **Power Drive Steel:** 4 ft (1.2 m) drive tip to under collar, for use with mechanized jack hammer	**DS-88:** 3/4 in (19 mm) round 4 ft (1.2 m) long hand drive steel with large striking head **Power Drive Steel:** 4 ft (1.2 m) drive tip to under collar, for use with mechanized jack hammer	**Power Drive Steel:** 5 ft (1.6 m) drive tip to under collar, for use with mechanized jack hammer

Rootball Kits



Perfect when guy systems are not possible or desirable, such as in playgrounds or where sidewalk plantings are required. A completely underground system designed to hold the root ball firmly in place.

The Advantages

- Fast, easy, safe installation
- No poles or stakes
- Completely underground

**One kit anchors one tree. Drive steel additional.*

Rootball Kit Specifications

Product	Model 40 RBK Kit For trees up to 2 in (50 mm diameter	Model 68 RBK Kit For trees up to 3 in (75 mm) diameter	Model 88 RBK Kit For trees up to 6 in (150 mm diameter
Kit Contents	- 3 DUCKBILL® anchors with D-ring - 1 6ft strap with hand ratchet	- 3 DUCKBILL® anchors with D-ring - 1 20ft strap with hand ratchet	- 3 DUCKBILL® anchors with D-ring - 1 21ft strap with hand ratchet
			
Capacity (Per Anchor)	300 lbs (1.33 kN) in normal soil	1,100 lbs (4.89 kN) in normal soil	3,000 lbs (13.39 kN) in normal soil
Standard Case & Weight	6 units at 6.71 lbs (3 kg)	6 units at 13 lbs (6 kg)	6 units at 32 lbs (14.5 kg)

How to Select Power Drive Steel

1. Determine the Duckbill Anchor to be installed.
2. Measure hex size (**D**) across flats of a shank that fits the hammer
3. Measure shank length (**L**) from top of hex to bottom of collar
4. Call with special shank sizes or if you need more information on determining what drive steel is needed.

Each Duckbill Anchor has unique drive steel determined by the jack hammer and the anchor model.

EXAMPLE: For a Model 88 Anchor with 1 in x 4 ¼ in shank, drive steel is PDS8810.

Part Number:

PDS 88 10

Anchor Size — Shank Code

To get the Shank Code, multiply the hex size (**D**) by the shank length (**L**).

D x L = Shank Code

1 in x 4 ¼ in = 10

Applications >>>

Duckbill Anchors are used worldwide to secure items that can be stolen, moved or blown down. Duckbill Anchors are intended for light duty applications in normal soils.

For highly corrosive environments, Duckbill Anchors can be fabricated with stainless steel wire rope, plastic impregnated wire rope or other corrosion-resistant solutions.

Ideal for:

- Tree Support
- Fences
- Structures
- Tents
- Towers
- Scaffolding
- Tree Revetments
- Turf Reinforcment
- Sheds
- Theft Deterrent
- Vineyards
- And More

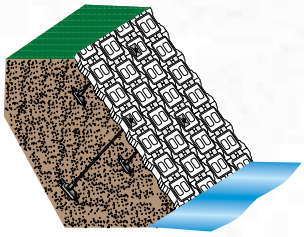
"I would like to inform you as to how the Cleveland Metroparks System utilizes your Duckbill Anchors. They are attached to both ends of a picnic table, preventing park patrons from moving the tables from their designated area. The anchors have also eliminated vandalism problems we have experienced. In the five years we have been using the Duckbill Anchor system, it has virtually solved both of these situations."

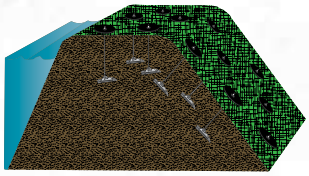
- Metroparks
Cleveland, Ohio USA

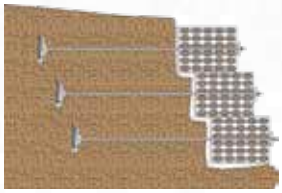
Multi-Purpose

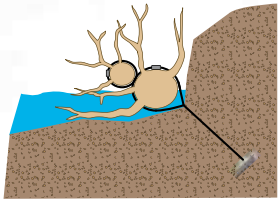



Erosion Control


ACB Mat


TRM Mat


Gabions


Tree Revetment

Multi Purpose Specifications

	Model 40-DB1	Model 68-DB1	Model 88-DB1	Model 138-DB1
Capacity (Per Anchor)	300 lbs (1.33 kN) in normal soil	1,100 lbs (4.89 kN) in normal soil	3,000 lbs (13.39 kN) in normal soil	5,000 lbs (22.24 kN) in normal soil
Wire Rope Length	20 in (0.51 m)	2 ½ ft (0.76 m)	3 ½ ft (1.07 m)	5 ft (1.52 m)
Galvanized Wire Rope	1/16 in (1.6 mm) 7 x 7 GAC	⅛ in (3.2 mm) 7 x 7 GAC	¼ in (6.4 mm) 7 x 19 GAC	5/16 in (7.9 mm) 7 x 19 GAC
Wire Rope Breaking Strength	480 lbs (2.14 kN)	1,700 lbs (7.56 kN)	7,000 lbs (31.13 kN)	9,800 lbs (43.59 kN)
Anchor Weight	1.0 oz (28 gm)	4.5 oz (128 gm)	14 oz (397 gm)	2.5 lbs (1.1 kg)
Standard Case & Weight	50 units at 3.7 lbs (1.7 kg)	24 units at 7 lbs (3.2 kg)	12 units at 11 lbs (5.0 kg)	12 units at 32 lbs (14.5 kg)

Theft Deterrent Specifications

	Wire Rope Anti-Theft Anchors		Chain Anti-Theft Anchors	
Product	Model 68-ATI	Model 88-ATI	Model 68-ATC	Model 88-ATC
Kit Contents	- 1 DUCKBILL® anchor - 5 ft (1.5 m) of 3/16 in (4.8 mm) galvanized wire rope	- 1 DUCKBILL® anchor - 6 ft (1.8 m) of ¼ in (6.4 mm) galvanized wire rope	- 1 DUCKBILL® anchor - 4 ft (1.2 m) of ¼ in (6.4mm) proof coil chain attached to 1 ft (0.3 m) of wire rope	- 1 DUCKBILL® anchor - 4 ft (1.2 m) of ¼ in (6.4 mm) proof coil chain attached to 2 ft (0.6 m) of wire rope
Capacity (Per Anchor)	1,100 lbs (1.33 kN) in normal soil	3,000 lbs (13.34 kN) in normal soil	1,100 lbs (1.33 kN) in normal soil	3,000 lbs (13.34 kN) in normal soil
Standard Case & Weight	12 units at 10 lbs (4.6 kg)	6 units at 10 lbs (4.6 kg)	12 units at 41 lbs (18.6 kg)	6 units at 27 lbs (12.3 kg)

MPS Civil Products - Building Solid Foundations.
MPS Civil Products is part of MacLean-Fogg, a diversified international manufacturing enterprise with more than half a billion dollars in sales. A result of the acquisition and merger of Joslyn, Dixie and Foresight, the three most prominent soil anchor manufacturers, MPS Civil Products is now one of the leading suppliers of steel deep foundation systems for use in residential, commercial and marine applications. Our comprehensive product line for residential and commercial applications includes engineered solutions for tension, compression and structural stabilization in many different soils. When Quality and Service is your focus, Solutions are the result.

NOTE: All underground work requires proper safety and location procedures. Do not install an anchor until you know what is below the surface. It is imperative in all cases that all anchors are fully load locked before being put in service. Foresight Products can custom engineer complete anchoring systems to meet all your specific requirements. **What do you want to anchor?**

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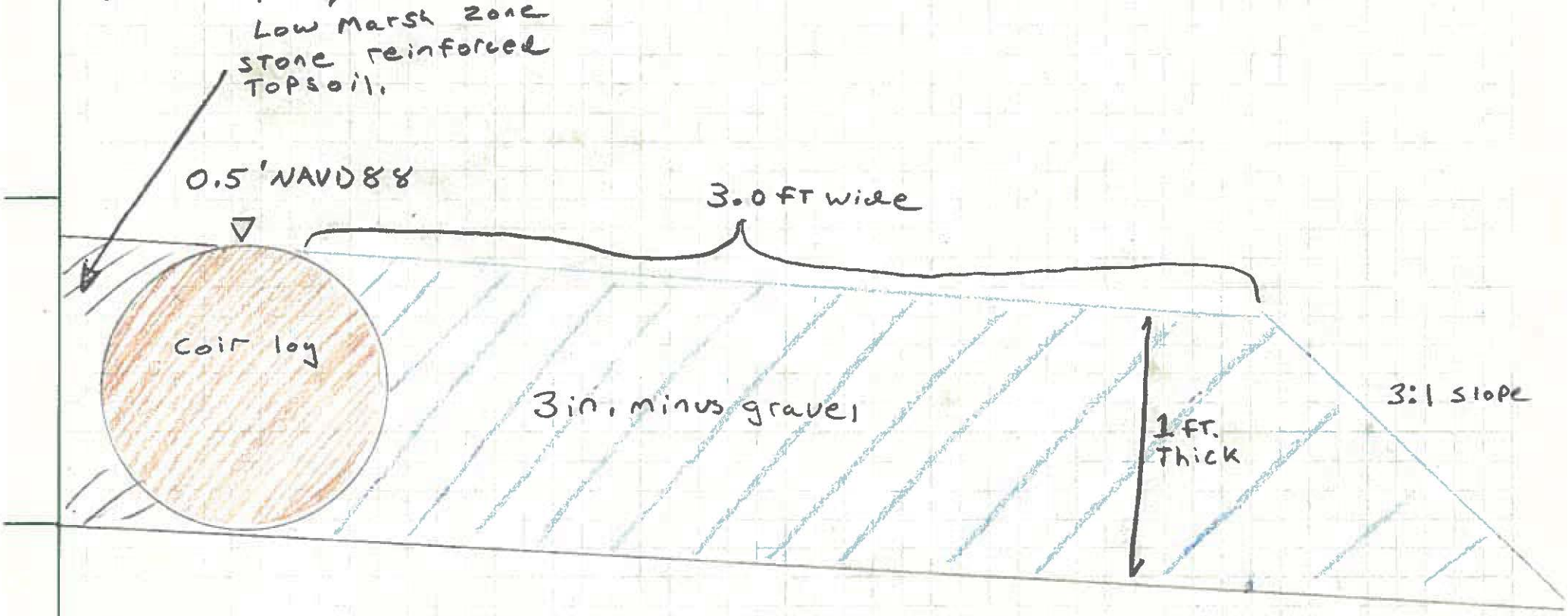
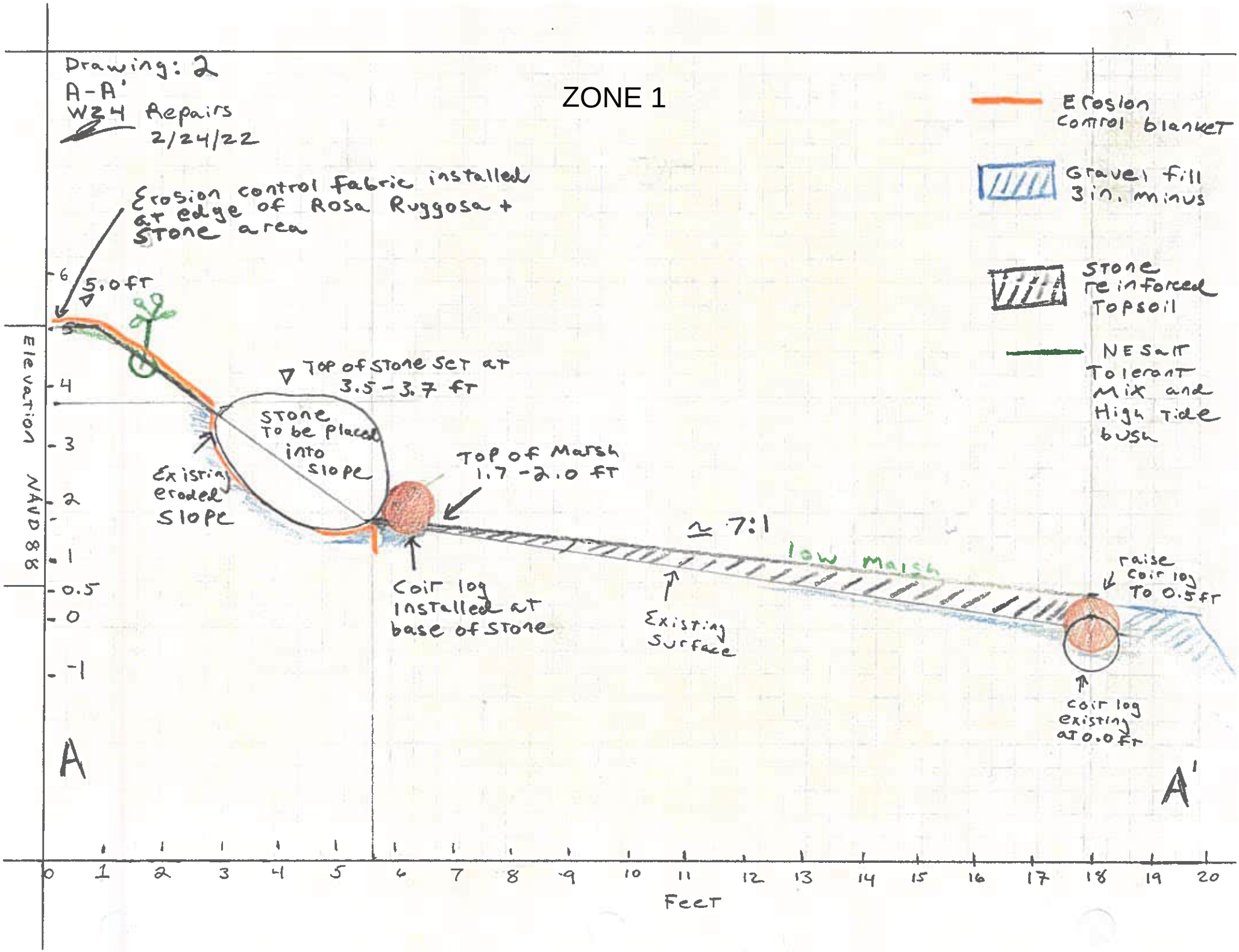
MPS Civil Products

MacLean Power Systems
481 Munn Road - Suite 300
Fort Mill, SC 29715

Drawing: 1
Typical Gravel wedge
WZ4 Repairs
2/24/22

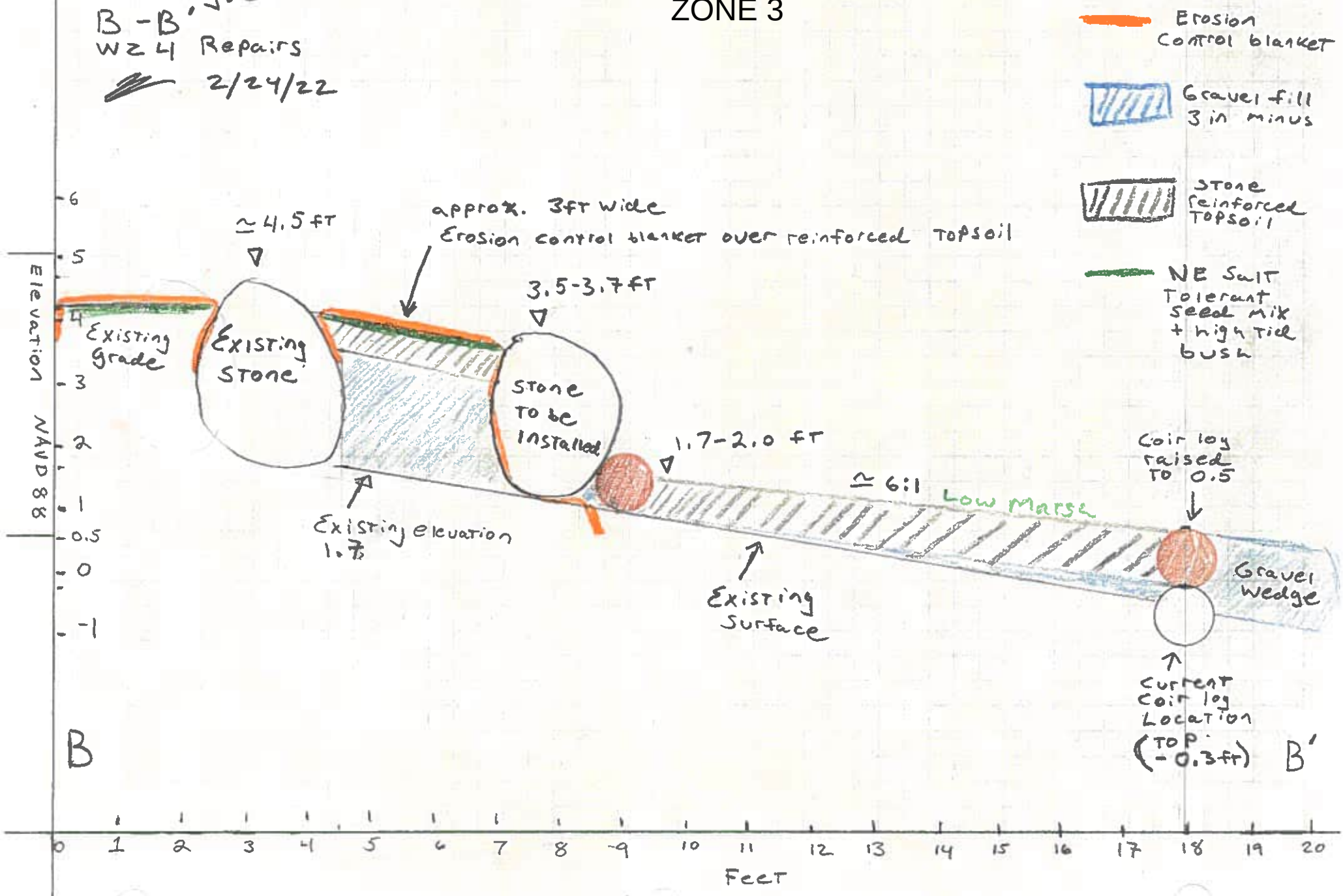
Typical Toe of Marsh coir log
Detail with Gravel Wedge

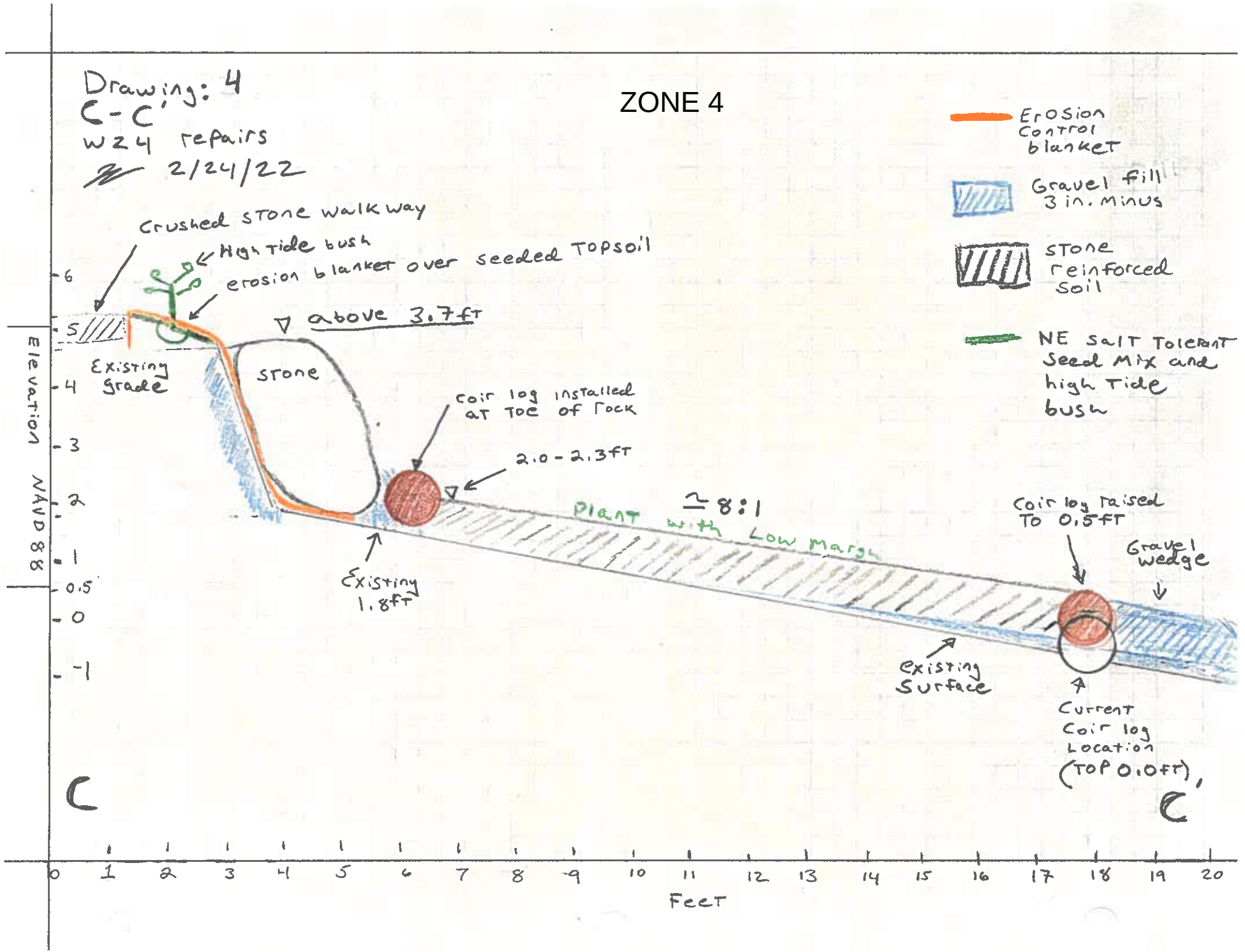



Drawing: 2
A-A'
W24 Repairs
2/24/22
ZONE 1
Erosion control blanket
Gravel fill 3 in. minus
Stone reinforced Topsoil
NE Salt Tolerant Mix and High Tide bush
Erosion control fabric installed at edge of Rosa Rugosa + Stone area
5.0 ft
Top of Stone Set at 3.5 - 3.7 ft
Stone To be Placed into Slope
Existing eroded Slope
Top of Marsh 1.7 - 2.0 ft
≃ 7:1
low marsh
Coir log installed at base of Stone
Existing Surface
raise Coir log To 0.5 ft
Coir log existing at 0.0 ft
Elevation NAVD 88
6
4
3
2
1
0.5
0
-1
A
A'
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Feet

Drawing: 3
B - B'
WZ 4 Repairs
2/24/22

ZONE 3




Drawing: 4
C-C'
WZ4 repairs
2/24/22
ZONE 4
Erosion Control blanket
Gravel fill 3 in. minus
Stone reinforced soil
NE Salt Tolerant Seed Mix and high tide bush
Crushed stone walkway
High tide bush
erosion blanket over seeded Topsoil
above 3.7ft
Existing Grade
Stone
Coir log installed at Toe of Rock
2.0 - 2.3ft
~8:1
Plant with Low Marsh
Existing 1.8ft
Coir log raised To 0.5ft
Gravel wedge
Existing Surface
Current Coir log Location (Top 0.0ft)
C
C'
Elevation NAVD 88
6
5
4
3
2
1
0.5
0
-1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Feet