

CITY OF MARCO ISLAND

RESOLUTION 10-19

A RESOLUTION APPROVING AMENDMENTS TO THE TECHNICAL SPECIFICATION OF THE CITY'S SEAWALL AND REVETMENT REGULATIONS, AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, the City has amended Chapter 6, Article III, Division 2 of the Code of Ordinances of the City of Marco Island, Florida entitled "Seawalls and Revetments"; and

WHEREAS, said ordinance requires that the City will adopt Technical Specifications for the construction and repair of seawalls and revetments; and

WHEREAS, approved amendments to the Seawall and Revetment Regulations require amendment of the Technical Specifications;

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF MARCO ISLAND, FLORIDA, AS FOLLOWS:

SECTION 1. Recitals. The foregoing "Whereas" clauses are hereby ratified and confirmed as being true, correct and incorporated into this Resolution.

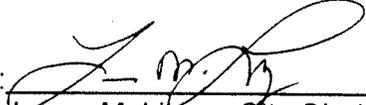
SECTION 2. Adoption. The City of Marco Island Seawall & Revetment Regulations Technical Specification attached as Exhibit 'A' are hereby adopted and shall be the Technical Specifications contemplated under Ordinance 10-02.

SECTION 3. Effective Date. This Resolution shall take effect immediately upon adoption.

The foregoing Resolution was adopted this 3rd day of May 2010.

Attest:

CITY OF MARCO ISLAND, FLORIDA

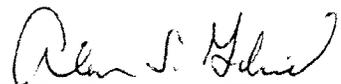
By: 

Laura M. Litzan, City Clerk

By: 

Frank R. Recker, Chairman

Reviewed for legal sufficiency:

By: 

Alan L. Gabriel, City Attorney

EXHIBIT A

CITY OF MARCO ISLAND SEAWALL & REVETMENT REGULATIONS TECHNICAL SPECIFICATION

SECTION 1: DESCRIPTION

The work described herein consists of the design and construction of waterfront upland property and building protection structures such as seawalls and revetments, which serve to protect against wave action and to stabilize the position of the shoreline.

These design and construction standards provide minimum requirements for all seawalls and revetments constructed, reconstructed, repaired or altered.

SECTION 2: DESIGN CONSIDERATIONS

A. General

A Professional Engineer registered in the State of Florida shall prepare and seal all plans and specifications for seawalls and revetments. The Professional Engineer shall be qualified by training and experience to provide seawall and revetment design.

B. Criteria

1. Figure 1 (attached) provides soil and site parameters for structural design.
2. As a minimum, the seawall shall be adequate to sustain the loads shown on Figure 1.
3. Design of seawalls shall be in accordance with generally accepted engineering design methodologies such as those published by the Portland Cement Association, American Concrete Institute, U S Steel Sheet Pile Manual, Aluminum Association, Fiber Reinforced Polymer (FRP) wall manufacturers, and "Pile Buck" sheet pile wall design. New technologies exhibiting acceptable engineering standards are also acceptable for design. Maximum initial panel deflection in inches shall be the exposed face height (feet) divided by 12. For example, 9' exposed face height divided by 12 is 0.75 inches.
4. Seawalls may be designed as cantilever walls without the use of a tieback system. An expansion joint is required where a cantilever wall abuts a tied-back wall. Initial deflection at the top of the cantilever seawall shall not exceed 1".
5. T-pile seawalls shall not be used to replace existing seawalls.
6. Structural repairs to seawalls shall comply with the applicable specifications contained herein.

SECTION 3: GENERAL REQUIREMENTS

A. Location: See Ordinance, SECTION SIX, Paragraph D.

B. Top of Seawall Construction Elevation: See Ordinance, SECTION SIX, Paragraph E.

C. Fill (soil)

The only fill authorized herein shall be for fill behind the seawalls or revetments and shall not exceed any further waterward than the face of the new seawall construction or the face of the existing seawall for repairs or the highest elevation of revetment construction. Fill behind the seawall extending a minimum of 5' from the wall shall be from upland sources and consist of clean granular material (less than 10% passing no. 200 sieve) free from pollutants. The filling of wetlands is not allowed. The toe-berm may be restored after the construction by moving displaced soil under water back into its original position. Fill in the form of small toe-berm rip-rap protection in front of the seawall is allowed as shown on Figure 2.

D. Clean-up after construction/repairs

Upon completion of construction/repairs, restore waterway to pre-construction depths, including the removal of displaced soils from the lot due to sheet pile jetting, and other construction activities, removal of soil that leaked through the seawall joints prior to construction, and removal of construction debris from the waterway. Extent of clean-up shall be all areas impacted, including directly in front of the property and extending as necessary onto the waterway in front of adjacent properties. Restore the toe-berm to its preconstruction depth unless permit specifies otherwise.

SECTION 4: RESTRICTIVE SPECIFICATIONS

A. General

1. The Standard Specifications of the Florida Department of Transportation for Road and Bridge Construction, Latest Edition, shall govern all construction. The American Concrete Institute Standard 318. "Building Code Requirements for Reinforced Concrete", Latest Edition shall govern concrete and reinforcing steel. Concrete Class designated herein refers to Section 346 of the Florida Department of Transportation Specification.

2. References to tie-back rods and anchors in the following sections do not restrict seawall design to tied-back seawall design. Where required, the tieback rods shall be straight between the wall cap and the anchors.

3. Seawall construction shall conform to the following tolerances of construction and placement:

Fabrication Tolerances:

Sheet pile width: + or – 1/4" per 10' length.

Sheet pile length: + or – 2"

Concrete sheet pile thickness: +or - 1/4"

Erection/Placement Tolerances:

Concrete sheet pile reinforcing clear distance to concrete surface: +1/2", -1/2"

Concrete sheet pile reinforcing bar spacing: + or - 1"

Seawall cap top and formed surfaces: + or - 1/2"

Horizontal alignment of front face of sheet pile: + or - 1"

In plane plumbness: 2" per 10' sheet pile length.

Transverse plumbness: 2" per 10' sheet pile length

Key Joint separation: Maximum 1/2" except maximum 3/4" allowed for up to 10% of key joints.

Exposed height: 6"

4. For anchored walls, sheet piling shall penetrate into firm soil a minimum of 40% of the total length of the sheet pile but not less than 4 feet. This penetration may be adjusted if the bottom of the sheet pile can be embedded a minimum of 12 inches into solid bedrock. For cantilevered walls, a minimum embedment of 65% of the total length of the sheet pile is required.

5. The toe-berm of all sheet pile seawalls shall be protected by a rip-rap revetment placed on filter fabric as follows:

- a. At locations where soils will not adequately resist toe-out failure by additional penetration depth alone.
- b. At locations where lateral tidal flows create excessive scour and erosion of the toe-berm.
- c. At any other location where the design Engineer deems it necessary for the preservation of the integrity of the seawall.

6. Acceptable materials for seawall construction are:

- a) Precast reinforced concrete sheet pile units
- b) Prestressed concrete sheet pile units
- c) Aluminum sheet piles
- d) Vinyl (PVC) sheet piles
- e) Fiber reinforced / polymer (FRP) composite sheet piles
- f) Steel sheet piles with protective marine coating (Commercial only-special permit only)

Color of seawalls shall be solid tones of gray.

Timber is unacceptable for seawalls. Steel is unacceptable for residential seawalls.

All seawall caps shall be of reinforced concrete to provide uniformity to the City's seawalls. Provide cap expansion joints at panel tongue and groove joint nearest to a property line.

Tie-back rods shall be Grade 60 reinforcing or hot dipped galvanized as a minimum. Series 300 Stainless steel is also acceptable for use for reinforcing and tie-back rods. Do not use MMFX reinforcing as tie-back rods. Additionally, hot dipped galvanized rods shall be wrapped with polyethylene. Concrete for concrete anchors shall have a 28-day minimum compressive strength of ~~3,000~~ 5,000 psi.

Provide a positive means to reduce the build-up of hydrostatic pressure behind the seawall by the use of weep holes protected by filter fabric and "French drains" consisting of ~~gravel~~ clean stone wrapped with filter fabric.

Figures 1, 2, and 3 provide other minimum requirements for seawalls.

Figure 2A provides general requirements for new seawalls placed in front of existing seawalls. End treatments at property lines indicate the intent of "closure" where the wall abuts an older existing wall. Other arrangements recommended by the Owners' design engineer may be accepted based upon the decision by the City Building Department.

B. Concrete Sheet Pile Seawalls

1. All seawalls and caps shall consist of one of the following combinations of materials:

a) Florida Department of Transportation Class IV concrete (Section 346-extremely aggressive environment) with either or both prestressing strand (ASTM A416 Grade 270) and grade 60 reinforcing steel. For caps only, dense concrete mix with a compressive strength of 5,000 psi, low water/cement ratio (0.4) and smaller aggregate suitable for pumps may be substituted for the FDOT concrete.

b) 5,000 psi minimum 28-day compressive strength concrete with maximum water-cement ratio of 0.45 and ~~MMFX~~ or stainless reinforcing steel.

c) Florida Department of Transportation Class IV concrete (Section 346-extremely aggressive environment) with ~~MMFX~~ or stainless reinforcing steel. The substitution for cap concrete in a) above is applicable here.

2. Each panel shall have tongue and groove side joints, and be a minimum of 6" in thickness with the reinforcing centered. If 8" thickness or greater is required, a double mat of reinforcing is allowed, but with a minimum cover of 2".

3. Provide minimum 2' 12" wide woven filter fabric strip behind each tongue and groove joint from bottom of cap down to 1' below the top of the toe-berm.

4. Do not grout or plaster over keyway joints between the sheet piles.

5. Minimum seawall standards are shown in Figures 2 and 3, attached.

C. Aluminum Sheet Pile Seawalls

1. No aluminum shall be used in contact with non-draining cohesive soils.
2. Use only 6061-T6 structural grade aluminum sheeting that has been demonstrated to be suitable for marine use.
3. Provide protection for the portion of the aluminum sheeting to be embedded into the concrete cap such as coal tar epoxy or mechacrylate lacquer.
4. Provide minimum .125" thick material.
5. All Aluminum sheet piling must have a minimum section modulus of 2.8 in³/ft of wall.

D. Vinyl (PVC) sheet pile seawall panels

1. All vinyl sheet piling shall be manufactured entirely from a rigid, high impact, UV-inhibited, weatherable vinyl compound.
2. All exposed surfaces of the vinyl sheet piling shall be UV resistant, and comprised of virgin material with a minimum ASTM D4216 Cell Classification of 1-41444-33, to ensure reliable performance and color consistency. A certificate of analysis must be provided for all sheet piling used to ensure compliance.
3. All vinyl sheet piling design shall include Section Modulus, Moment of Inertia, Thickness and Depth. All male interlocks must incorporate I-Beam Lock reinforcement to resist lock separation and decrease seepage.
4. All vinyl sheet piling shall have a minimum 0.375" material thickness for PVC.
5. All vinyl sheet piling must have a minimum Section Modulus of 24 in³/ft of wall.
6. All sheet piles damaged during installation, including damage to the side sheet locks, are not acceptable.

E. Fiber Reinforced Polymer (FRP) composite sheet piles

1. All FRP sheet piling shall be manufactured entirely from a glass reinforced polymer FRP and be UV resistant. All male interlocks must incorporate I-Beam Lock reinforcement to resist lock separation and decrease seepage.
2. All FRP sheet piling shall be wholly and completely manufactured in an ISO certified production facility. Certificates of ISO certification must be provided for all sheet piling used to ensure compliance.
3. All FRP sheet piling shall conform dimensionally to ASTM D3917-96, Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes.

4. All FRP sheet piling shall conform to ASTM D4385-02, Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products, Level 1 and 2.
5. All FRP sheet piling shall have a minimum 0.25" material thickness.
6. All FRP sheet piling must have a minimum section modulus of 13 in³/ft of wall.
7. All sheet piles damaged during installation, including damage to the side sheet locks are not acceptable.

F. Revetments

1. The work under this Section includes heavy armoring consisting of large rip-rap placed on a stable sloping sub-grade to protect upland property.
2. The revetment shall be placed on an uneven, possibly stepped compacted slope, with a gradient not exceeding one foot vertical drop for every two feet of horizontal distance (top of revetment stone). The unevenness is intended to restrain the revetment stone from sliding on the fabric.
3. All revetments shall be placed on a woven plastic filter fabric in accordance with FDOT Specifications, Section 514. Filter fabric shall be approved by FDOT for shoreline stabilization use. The fabric shall be folded over and anchored by larger stone at the toe of the revetment slope. A layer of 1" to 4" stone shall be placed directly on the fabric as a cushion for the rip-rap stone.
4. As a minimum, the rip-rap stone shall comply with FDOT Specifications, Section 530, Rubble (Bank and Shore).
5. Other approved armoring systems may be approved by the City on a specific basis. However, the use of sand-cement bags is not approved for revetments.
6. See Figure 4 for revetment standards.
7. The above does not apply to toe-berm protection.

SECTION 5: PERFORMANCE REQUIREMENTS

This specification provides minimum requirements for seawalls and revetments, which are constructed within the City. Individual design is the responsibility of the landowner, based upon specific site conditions, type of shore stabilization structure desired, method of construction, and all other factors affecting the stability of the structure. This specification is not to be considered a final design relating to a specific site or any other affecting conditions.

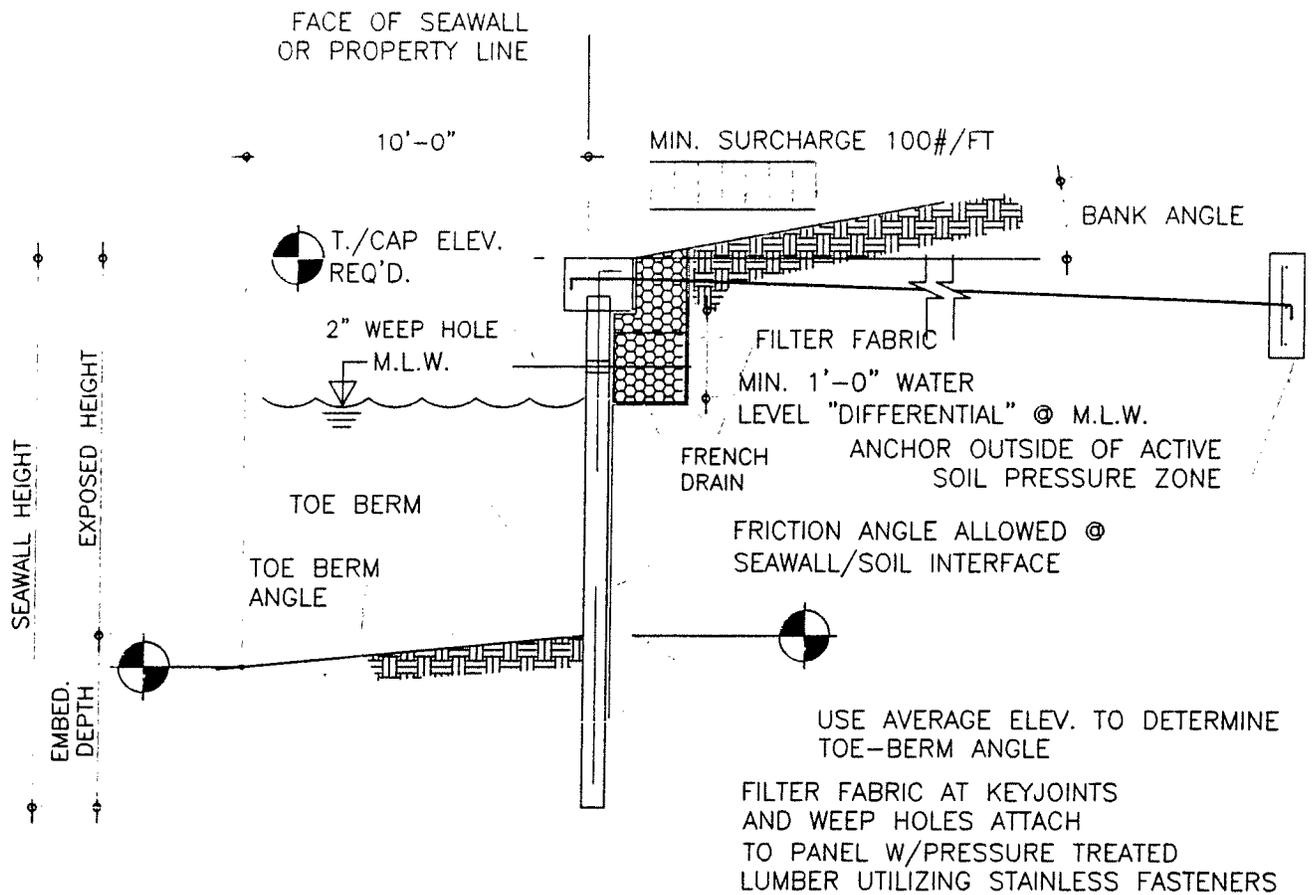
SECTION 6: SEAWALL INSPECTION AND QUALITY CONTROL SCHEDULE

Building and Planning Division personnel shall conduct site visits for observation of seawall construction to determine compliance with permitted construction plans and specifications. These inspections shall occur at the following construction "milestones" (where applicable):

- 1) Prior to construction, recording of exposed height above toe-berm at a minimum of three locations: center and each end at property lines
- 2) Forming of concrete sheet piles and placement of reinforcing prior to concrete placement
- 3) Seawall placement, with filter fabric, including proper length, and weep holes prior to backfilling.
- 4) Anchor reinforcement/tieback placement, and concrete cap forming and reinforcement, including expansion joints.
- 5) Toe-berm riprap, french drains, final grades, final exposed height, and post-construction clean-up.

The contractor shall test all concrete used in seawall sheet pile and cap construction for 28 day compressive cylinder strength as per ASTM C-39, using a minimum of 2 cylinders for testing. Cast an additional cylinder to hold for later testing. Cast a 3 cylinder set for each day's pour. Separate tests shall be performed for concrete sheet piles and seawall cap. Use a qualified independent engineering testing laboratory Provide written test results to the City upon completion.

Alternatively, 7 day tests are acceptable in lieu of 28 day tests of concrete cylinders. The average 7 day compressive strength for each 2 cylinder test shall be a minimum of 70% of the specified 28 day compressive strength.



SHEET PILE WALL SECTION

SOIL PARAMETERS:

DRY DENSITY..... PCF.
 SATURATED DENSITY..... PCF.
 BUOYANT DENSITY..... PCF.
 ANGLE OF INTERNAL FRICTION = DEGREES (ANGLE OF REPOSE).
 SOIL SEAWALL FRICTION ANGLE = DEGREES.

SITE PARAMETERS:

EXPOSED HEIGHT..... FEET.
 ANCHOR LOCATION..... FEET.
 BANK ANGLE..... DEGREES.
 TOE-BERM ANGLE..... DEGREES.
 SURCHARGE..... PSF.
 LAG..... FT.

WORLDWIDE ENGINEERING INC.

DATE: AUGUST 2009
 PROJ. NO: 05FTM405
 DRAWN BY: CEF
 APPD BY: PC
 DRAW. NO: 1/5
 SCALE: NTS

CITY OF MARCO ISLAND
PUBLIC WORKS
 50 BALD EAGLE DRIVE
 MARCO ISLAND, FLORIDA 34145

FIGURE 1
CITY OF MARCO ISLAND
SEAWALL DESIGN CRITERIA

SHEET
8
 OF 12

GRAVEL OR CLEAN COMPACTED
FILL WRAPPED WITH FILTER
FABRIC

(FRENCH DRAIN)

2" WEEP HOLE

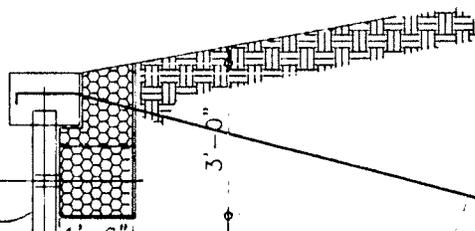
SEAWALL HEIGHT

5'-0" (MAX.)

TOE-BERM RIPRAP
ON FILTER FABRIC

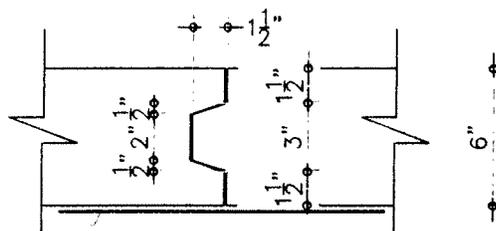
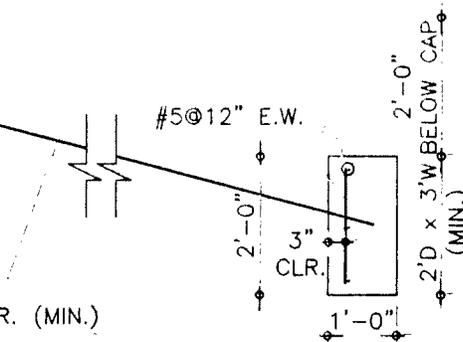
FILTER FABRIC

40% PENETRATION
OR 4' EMBED.
DEPTH (MIN.)



#8 STAINLESS STEEL
OR HDG TIE-BACK
ROD WRAPPED
W/ POLYETHYLENE
12'-0" CLR. (MIN.)

NOTE:
ALUMINUM, VINYL (PVC),
OR COMPOSITE SHEET
PILES MAY BE
SUBSTITUTED FOR THE
CONCRETE SHEETPILES.



24" WIDE FILTER FABRIC TO 12"
MIN. BELOW TOE-BERM ATTACHED
TO CONC. PANEL W/PRESSURE
TREATED LUMBER

SECTION TYPICAL SEAWALL

KEY JOINT

EXISTING
SEAWALL

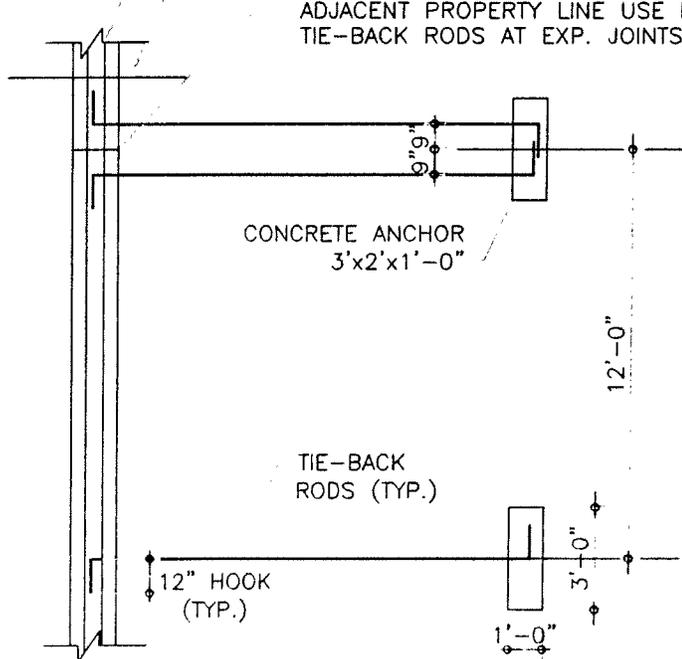
PROPERTY LINE

EXPANSION JOINT AT KEY JOINT NEAREST
ADJACENT PROPERTY LINE USE DOUBLE
TIE-BACK RODS AT EXP. JOINTS

REINFORCED CONCRETE SHEET PILES

REPLACEMENT SEAWALL
AS REQ'D.

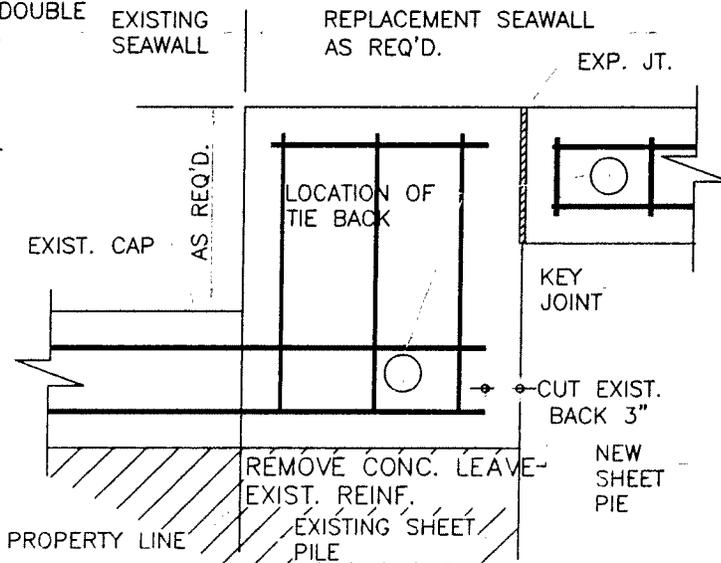
EXP. JT.



CONCRETE ANCHOR
3'x2'x1'-0"

TIE-BACK
RODS (TYP.)

12" HOOK
(TYP.)



EXIST. CAP

AS REQ'D.

LOCATION OF
TIE BACK

KEY
JOINT

CUT EXIST.
BACK 3"

REMOVE CONC. LEAVE
EXIST. REINF.
EXISTING SHEET
PILE

NEW
SHEET
PIE

EXPANSION JOINT DETAIL

PLAN TYPICAL SEAWALL

WORLDWIDE ENGINEERING INC.

DATE: AUGUST 2009
PROJ. NO: USFTM405
DRAWN BY: DEF
APPD. BY: PC
SPAW. NO: 2/5
SCALE: NTS

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PUBLIC WORKS
50 BALD EAGLE DRIVE
MARCO ISLAND, FLORIDA 34145

FIGURE 2
CITY OF MARCO ISLAND
SEAWALL STANDARDS

SHEET
9
OF 12

NEW PILE CAP

3/4"-1" GRAVEL

NEW TIEBACKS

REMOVE OLD CAP

FILTER FABRIC

EXISTING SHEET PILES (TO BE ABANDONED)

1'-6" MAX.
NEW SHEET PILE

1'-0" MAX.

NEW CAP & CAP EXTENSION OVER EXISTING SHEET PILE

TOP OF RETURN WALL (IF REQ'D)

NEW TIEBACK

OLD SEAWALL CAP BEYOND - ADJACENT LOT

CONCRETE PLUG

EXISTING WALL PANEL THAT CROSSES PROPERTY LINE

TYPICAL SECTION

SECTION NEAR PROPERTY LINE

PROPERTY LINE

NEW RETURN SHEET PILE (REQ'D FOR BREAK IN ADJ. GRADE >1'-0")

EXP. JT.

NEW SHEET PILE

1'-0" MIN.
FILTER FABRIC - SEE NOTE BELOW

1'-0" MIN.
CONCRETE PLUG TO 1'-0" BELOW GRADE TO CLOSE END GAP x 1'-0" WIDE MIN.

EXISTING SHEET PILES

NEW 24" WIDE FILTER FABRIC EXT. 1'-0" BELOW TOE-BERM ATTACH TO EXISTING PANEL W/PRESSURE TREATED LUMBER

3/4"-1" GRAVEL BETWEEN SHEET PILES

PROPERTY LINE

EXISTING CAP TO REMAIN

1'-6" MAX.

NEW RETURN SHEET PILE (IF REQ'D)

EXP. JT.

SEE "SECTION NEAR PROPERTY LINE"

NEW TIEBACKS

REMOVE EXIST. CAP AS REQ'D TO CONSTRUCT NEW SEAWALL

* NOTE: IF < 1'-0" PLACE EXP. JT. @ NEXT JOINT PANEL

PARTIAL PLAN SECTION

TOP VIEW

DETAILS-NEW SEAWALL PLACED IN FRONT OF OLD

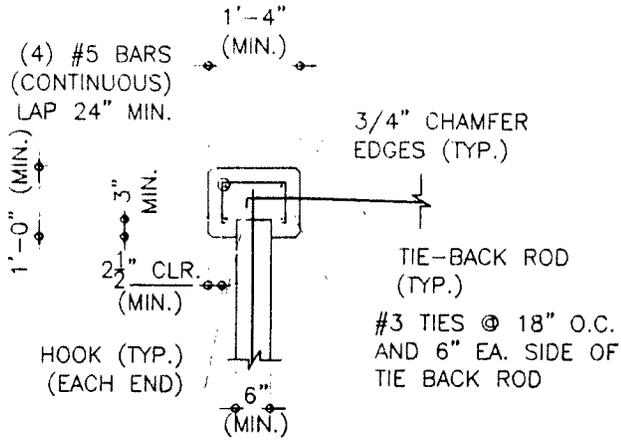
WORLDWIDE ENGINEERING INC.

LATE: AUGUST 2009
PRJ. NO: 05FTM405
DRAWN BY: CAB
APPD. BY: PC
DRAW. NO: 3/3
SCALE: NTS

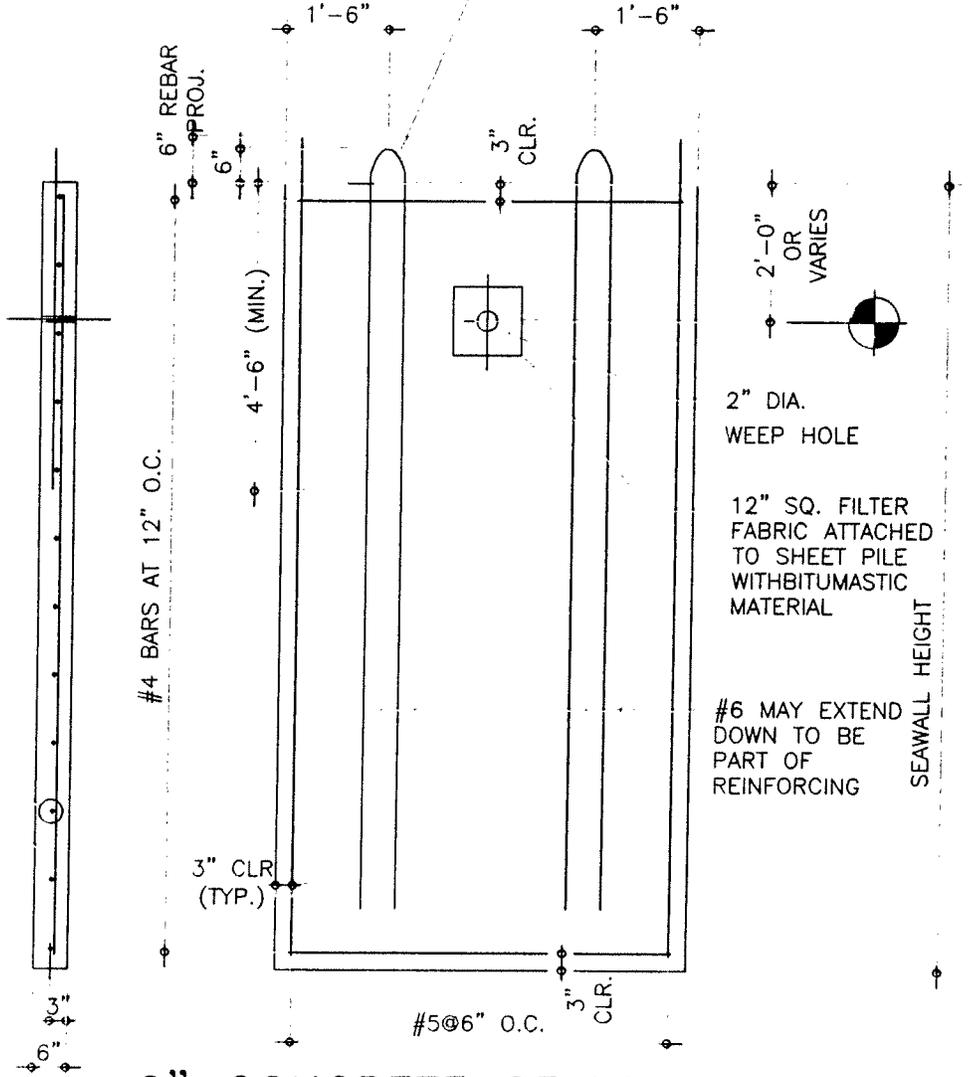
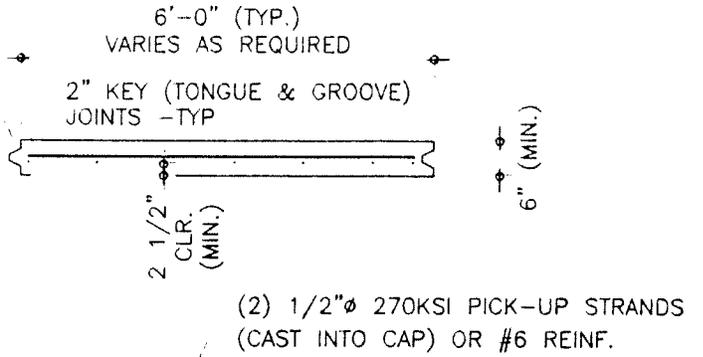
CITY OF MARCO ISLAND
PUBLIC WORKS
50 BALD EAGLE DRIVE
MARCO ISLAND, FLORIDA 34145

FIGURE 2A
CITY OF MARCO ISLAND
SEAWALL STANDARDS

SHEET
10
OF 12



CAP DETAIL



6" CONCRETE SEAWALL PANEL

#4 AT 12" (H)
 #5 AT 6" (V)
 OR #6 @ 10"

SEE TECHNICAL SPECIFICATIONS FOR THE REQUIRED CONCRETE TYPE AND REINFORCEMENT TYPE.

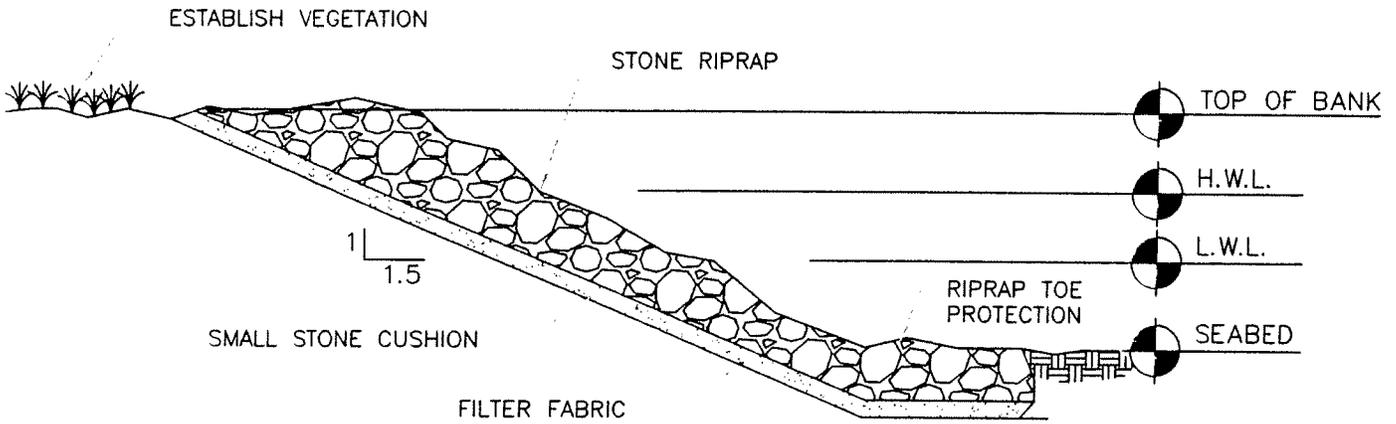
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FIGURE 3
 CITY OF MARCO ISLAND
 SEAWALL STANDARDS

SHEET
 11
 OF 12

DATE: AUGUST 2009
 PROJ. NO. 05FTM405
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 SCALE: NTS



TYPICAL STONE REVETMENT

WORLDWIDE ENGINEERING INC.

DATE: AUGUST 2009
 PROJ. NO: 05FTM405
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 SCALE: NTS

CITY OF MARCO ISLAND
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FIGURE 4
 CITY OF MARCO ISLAND
 REVETMENT STANDARD

SHEET
12
 OF 12