ATLANTIC INTRACOASTAL WATERWAY MAINTENANCE DREDGING

NASSAU COUNTY REACH I, FLORIDA

APPENDIX H

Dredged Material Management Area As-Built Surveys

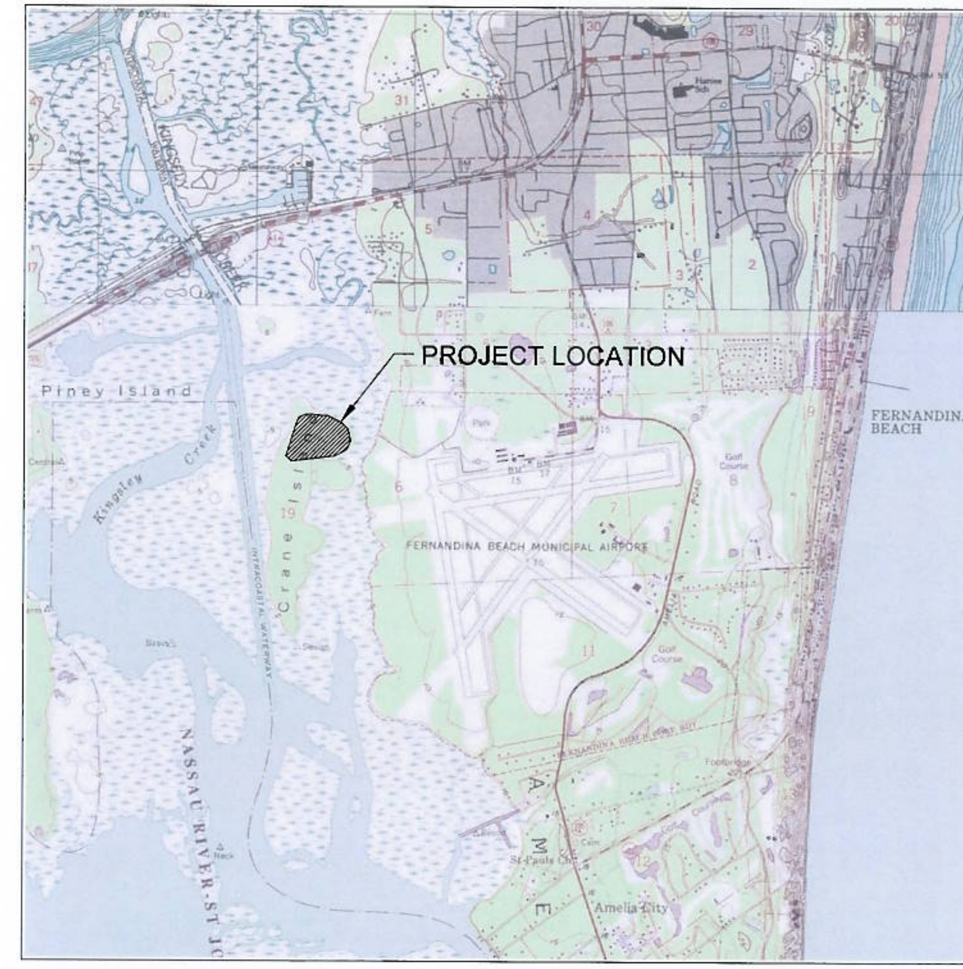
DREDGED MATERIAL MANAGEMENT AREA NA-1 CONSTRUCTION

NASSAU COUNTY, FLORIDA

LOCATION MAP

N.T.S.

DRAWING INDEX



VICINITY MAP

1"= 2000' (22x34)
1"= 4000' (11x17)

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(904)-731-7040
1675 PALM BEACH LAKES, SUITE 210
WEST PALM BEACH, FLORIDA 33401
(561)-640-7310
CERTIFICATE OF AUTHORIZATION # 4815

PROJECT TITLE

DREDGED MATERIAL MANAGEMENT AREA NA-1 CONSTRUCTION
NASSAU COUNTY, FLORIDA

PROJECT NO	C2008-044
DATE	JULY 2012

K. A. KNIGHT LICENSE No 58084 STATE OF FLORIDA PROFESSIONAL ENGINEER SEAL

7-23-12

KEITH A. KNIGHT P.E.# 58084

C-1

SHEET 1 OF 29

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NA-1 DREDGED MATERIAL MANAGEMENT AREA GENERAL NOTES

GENERAL NOTES

1. THE CONTRACTOR SHALL PROVIDE ACCESS TO THE WORK FOR INSPECTION BY THE EOR, ENGINEER, AND OWNER.
2. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION WITH THE EOR AND THE ENGINEER AS NECESSARY FOR CONSTRUCTION INSPECTION AND AS-BUILT CERTIFICATION. THE CONTRACTOR SHALL NOTIFY THE EOR AND THE ENGINEER AT APPROPRIATE AND APPROVED TIMES DURING THE COURSE OF THE WORK THAT THE CONTRACTOR IS READY FOR INSPECTION. WORK THAT IS ASSEMBLED OR COVERED SO THAT THE ENGINEER CANNOT INSPECT THE WORK PROPERLY SHALL BE DISASSEMBLED, UNCOVERED, OR DESTROYED AS NECESSARY FOR INSPECTION. THE COSTS OF REPAIR OR RESTORATION OF THIS WORK SHALL BE BORNE SOLELY BY THE CONTRACTOR.
3. THE CONTRACTOR SHALL PROVIDE PERSONNEL AND EQUIPMENT FOR THE ENGINEER TO OBSERVE AND INQUIRE ABOUT THE WORK. THIS MAY INCLUDE PROJECT MANAGERS, SUPERINTENDENTS, FOREMEN, LABORERS, LADDERS, HARDHATS, BOATS, LIFE JACKETS, LIFTS, SCAFFOLDING, MEASURING DEVICES, SURVEY EQUIPMENT, ETC.
4. ALL REQUIRED SUBMITTALS OR MANUFACTURER'S INFORMATION SHALL BE IN U.S. CUSTOMARY UNITS. ALL SUBMITTALS USING METRIC UNITS WILL BE REJECTED AND RETURNED WITHOUT COMMENT.
5. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
6. THE CONTRACTOR SHALL LOCATE ALL ABOVE-GROUND AND BELOW-GROUND UTILITIES BEFORE BEGINNING WORK.
7. IN THE EVENT OF A CONFLICT BETWEEN THE SPECIFICATIONS AND THE DRAWINGS, THE DRAWINGS SHALL GOVERN.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DAMAGE TO ADJACENT FACILITIES CAUSED BY HIS ACTIVITIES DURING PERFORMANCE OF THE WORK. THE CONTRACTOR SHALL RESTORE ALL SUCH DAMAGES TO THEIR PRE-CONSTRUCTION CONDITION AT NO COSTS TO THE OWNER.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SHORING AND DEWATERING OF ALL OPEN EXCAVATIONS. SHORING AND TRENCHING SHALL COMPLY WITH OSHA STANDARDS AND THE FLORIDA SAFE TRENCH ACT.
10. DRAINAGE SHALL BE CONTROLLED ONSITE. DRAINAGE NOT PREVIOUSLY DISCHARGED OFFSITE SHALL NOT BE DISCHARGED TO ADJACENT PROPERTIES DURING THE COURSE OF THE WORK.
11. ONSITE SOILS SHALL NOT BE ALLOWED TO ERODE OR OTHERWISE MOVE TO ADJACENT PROPERTIES.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING BARRIERS AND SIGNS ADEQUATE TO PREVENT NORMAL PUBLIC ACCESS.
13. THE CONTRACTOR SHALL MAINTAIN A SET OF RECORD DRAWINGS AND SHALL KEEP A RECORD OF ALL DEVIATIONS FROM THE ORIGINAL DRAWINGS MARKED IN RED PENCIL OR PEN. THE RECORD DRAWINGS SHALL BE KEPT ONSITE AND SHALL BE AVAILABLE FOR OBSERVATION BY THE ENGINEER.
14. THE CONTRACTOR IS RESPONSIBLE FOR TEMPORARY SHORING, BRACING, OR OTHER MEANS/METHODS NECESSARY TO STABILIZE THE STRUCTURE UNTIL COMPLETED WITH ALL COMPONENTS INSTALLED. UNLESS SPECIFICALLY STATED IN THE DRAWINGS, THE CONTRACTOR SHALL ASSUME THE EOR HAS ONLY DESIGNED THE STRUCTURE(S) FOR THE FINAL CONSTRUCTED AND ASSEMBLED STATE AS SHOWN ON THE DRAWINGS.
15. ALL PERMANENT MATERIAL SHALL BE NEW. USED, RECONDITIONED, OR REMANUFACTURED MATERIAL SHALL NOT BE USED UNLESS APPROVED BY THE OWNER IN WRITING.
16. ALL STORAGE OR STOCKPILING OF TOOLS AND MATERIAL AND OPERATION OF HEAVY EQUIPMENT ASSOCIATED WITH CONSTRUCTION SHALL BE LIMITED AREAS AUTHORIZED BY THE ENGINEER.
17. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE FLORIDA BUILDING CODE, COUNTY, AND MUNICIPAL RULES AND REGULATIONS.
18. THE CONTRACTOR SHALL COORDINATE WITH THE FEDERAL AVIATION ADMINISTRATION AND THE FERNANDINA MUNICIPAL AIRPORT REGARDING EQUIPMENT HEIGHT RESTRICTIONS FOR THIS PROJECT.

PERMITS AND PERMIT CONDITIONS

1. THE OWNER WILL SUPPLY THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION PERMIT AND THE U.S. ARMY CORPS OF ENGINEERS PERMIT. THE CONTRACTOR SHALL COMPLY WILL ALL PERMIT CONDITIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS NOT SUPPLIED BY THE OWNER. COSTS OF OBTAINING PERMITS NOT SUPPLIED BY THE OWNER SHALL BE BORNE BY THE CONTRACTOR. THIS SHALL INCLUDE BUT NOT BE LIMITED TO: NPDES PERMIT (OR NOI), CLEARING OR LAND DISTURBANCE PERMITS, TREE IMPACT PERMITS, CITY OR COUNTY BUILDING PERMITS, DRIVEWAY OR ENTRANCE PERMITS, TEMPORARY UTILITIES PERMITS, ETC.
3. THE CONTRACTOR SHALL IMPLEMENT AND MAINTAIN EROSION CONTROL MEASURES AS NECESSARY TO COMPLY WITH LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS. ALL WETLAND AREAS AND WATER BODIES OUTSIDE THE SPECIFIC LIMITS OF CONSTRUCTION AUTHORIZED BY THIS PERMIT SHALL BE PROTECTED FROM EROSION, SILTATION, SCOURING, AND/OR DEWATERING. WITHIN 7 DAYS OF ANY CONSTRUCTION ACTIVITY, EROSION BARRIERS SHALL BE INSTALLED PRIOR TO ANY EXCAVATION OR PLACEMENT OF FILL MATERIAL. ALL EROSION CONTROL MEASURES SHALL BE MAINTAINED IN EFFECTIVE CONDITION AT ALL LOCATIONS UNTIL CONSTRUCTION IS COMPLETED AND DISTURBED AREAS ARE STABILIZED.
4. EROSION CONTROL MEASURES SHOWN ON THE DRAWINGS ARE A MINIMUM. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED BY PERMIT AUTHORITIES. ANY ADDITIONAL EROSION CONTROL MEASURES SHALL BE SUPPLIED AND INSTALLED BY THE CONTRACTOR AT NO ADDITIONAL COSTS TO THE OWNER.
5. IF HISTORICAL OR ARCHAEOLOGICAL ARTIFACTS ARE DISCOVERED AT ANY TIME ON THE PROJECT SITE, THE CONTRACTOR SHALL IMMEDIATELY CONTACT THE ENGINEER OF RECORD AND CEASE WORK IN THE AREA THE ARTIFACTS WERE IDENTIFIED.

AS-BUILT SURVEYS

1. THE CONTRACTOR SHALL INCLUDE THE COST OF AN AS-BUILT SURVEY IN THE BID PRICE. THE AS-BUILT SURVEY SHALL BE SIGNED AND SEALED BY A PROFESSIONAL SURVEY LICENSED IN THE STATE THE PROJECT IS IN AND SHALL SHOW THE LOCATION AND ELEVATION OF ALL CONSTRUCTED FEATURES.

SITE CONDITIONS

1. THE SITE CONDITIONS AS DESCRIBED BELOW SHOULD BE CONSIDERED AN INCOMPLETE AND ABBREVIATED SUMMARY TO ADVISE THE CONTRACTOR OF SIGNIFICANT CONDITIONS THAT COULD AFFECT THE BID PRICE. THE CONTRACTOR SHALL REVIEW ALL PROJECT BID DOCUMENTS INCLUDING THE GEOTECHNICAL REPORTS, SURVEYS AND SURVEY REPORTS, AND THE SPECIFICATIONS BEFORE PLACING A BID.
2. THE EXISTING GRADE SHOWN IN THE DRAWINGS IS BASED ON AERIAL LIDAR DATA AND VARIES FROM ACTUAL GRADE. A PARTIAL SITE TOPOGRAPHIC GROUND-TRUTHING SURVEY IS PROVIDED IN APPENDIX F OF THE CONTRACT DOCUMENTS.
3. THE ENGINEER HAS ADJUSTED THE ESTIMATED QUANTITIES LISTED ON THE DRAWINGS AFTER COMPARING THE LIDAR DATA VERSUS THE GROUND-TRUTHING SURVEY.
4. THE NA-1 SITE WILL BE CONSTRUCTED OVER A RELIC DREDGED MATERIAL DISPOSAL AREA. CONSTRUCTION DRAWINGS OF THIS HISTORIC SITE, IF ANY EXIST, ARE NOT AVAILABLE. SOIL CONDITIONS VARY DRASTICALLY FROM ONE LOCATION ON THE SITE TO ANOTHER, WITH A SIGNIFICANT LAYER OF COMPRESSIBLE SOIL PRESENT ON THE EAST SIDE AND THE SOUTHWEST CORNER OF THE PROPOSED DIKE. IN ORDER TO REDUCE THE RISK OF DIKE DAMAGE DUE TO DIFFERENTIAL SETTLEMENT IN THESE AREAS, THE CONTRACTOR SHALL BE REQUIRED TO RESTRICT THE RATE OF DIKE MATERIAL PLACEMENT ACCORDING TO THE REMAINING NOTES IN THIS SECTION.
5. ALONG THE LENGTH OF THE DIKE CENTERLINE WHERE WICK DRAINS ARE INSTALLED (ALONG THE EASTERN PORTION OF THE SITE AND THE SOUTHWEST CORNER, SEE DRAWINGS), THE DIKE SHALL BE CONSTRUCTED FOR ITS' ENTIRE WIDTH AS FOLLOWS:
   A. CONSTRUCTION OF THE DIKE SHALL NOT EXCEED 3 VERTICAL FEET PER WEEK UP TO ELEVATION +15.0 FT.
   B. UPON REACHING ELEVATION +15.0, NO ADDITIONAL MATERIAL SHALL BE PLACED UNTIL THE ENGINEER HAS DETERMINED THAT 30% CONSOLIDATION HAS BEEN REACHED. ONCE 30% CONSOLIDATION HAS BEEN REACHED AS DETERMINED BY THE ENGINEER, THE CONTRACTOR MAY AGAIN COMMENCE DIKE CONSTRUCTION.
   C. IN A SIMILAR MANNER, THE CONTRACTOR SHALL BE REQUIRED TO STOP DIKE CONSTRUCTION AT ELEVATION +17.0 FT, AND ELEVATION +19.0 FT AND WAIT FOR THE SOIL TO REACH 30% CONSOLIDATION. THE CONTRACTOR SHALL NOT BE ALLOWED TO PLACE DIKE MATERIAL IN THIS AREA OF THE DIKE UNTIL 30% CONSOLIDATION HAS BEEN REACHED AS DETERMINED BY THE ENGINEER.
6. THE ENGINEER ANTICIPATES DIVIDING THE DIKE INTO ZONES BASED ON THE LOCATION OF SETTLEMENT AND PORE WATER PRESSURE INSTRUMENTATION AND ALLOWING THE CONTRACTOR TO WORK IN OTHER ZONES WHILE CONSOLIDATION OF THE UNDERLYING SOILS IS OCCURRING. UNAVOIDABLE DELAYS HOWEVER, SHOULD BE ANTICIPATED BY THE CONTRACTOR AND INCLUDED IN THE BID PRICE.
7. THE DIKE SHALL BE CONSTRUCTED IN LIFTS PLACED THROUGHOUT THE ENTIRE DIKE FOOTPRINT AND PERIMETER. THE MAXIMUM ELEVATION DIFFERENCE BETWEEN LIFTS ANYWHERE ON THE DIKE DURING CONSTRUCTION SHALL BE 3 FT.
8. THE ENGINEER SHALL MAKE THE FINAL DETERMINATION OF THE PERCENT OF CONSOLIDATION REACHED BASED ON FIELD MEASUREMENTS PROVIDED BY THE CONTRACTOR INCLUDING SETTLEMENT MEASUREMENTS, PORE PRESSURE READINGS, PIEZOMETER READINGS, ETC.

WORK SEQUENCE

1. FOR BIDDING PURPOSES THE CONTRACTOR SHALL ASSUME THAT ALL ON-SITE MATERIAL SHALL BE PLACED/COMPACTED BEFORE ANY OFF-SITE MATERIAL IS PLACED/COMPACTED.

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WEST PALM BEACH, FLORIDA 33401
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CERTIFICATE OF AUTHORIZATION # 4815

SEAL

K. A. KNIGHT LICENSE No 58084 STATE OF FLORIDA PROFESSIONAL ENGINEER

K.A. Knight
7-23-12

KEITH A. KNIGHT P.E. # 58084

PROJECT TITLE

DREDGED MATERIAL MANAGEMENT AREA NA-1 CONSTRUCTION
NASSAU COUNTY, FLORIDA

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NO	ZONE	REVISIONS / SUBMISSIONS	DATE

PROJECT NO	C2008-044
DATE	JULY 2012
DESIGNED	LJB/KAK/RJD
DRAWN	AF
CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE

GENERAL NOTES

C-2

PROJECT OVERVIEW

22X34: 1" = 300'
11X17: 1" = 600'

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REVIEWED	JA/JTA
SCALE	AS SHOWN

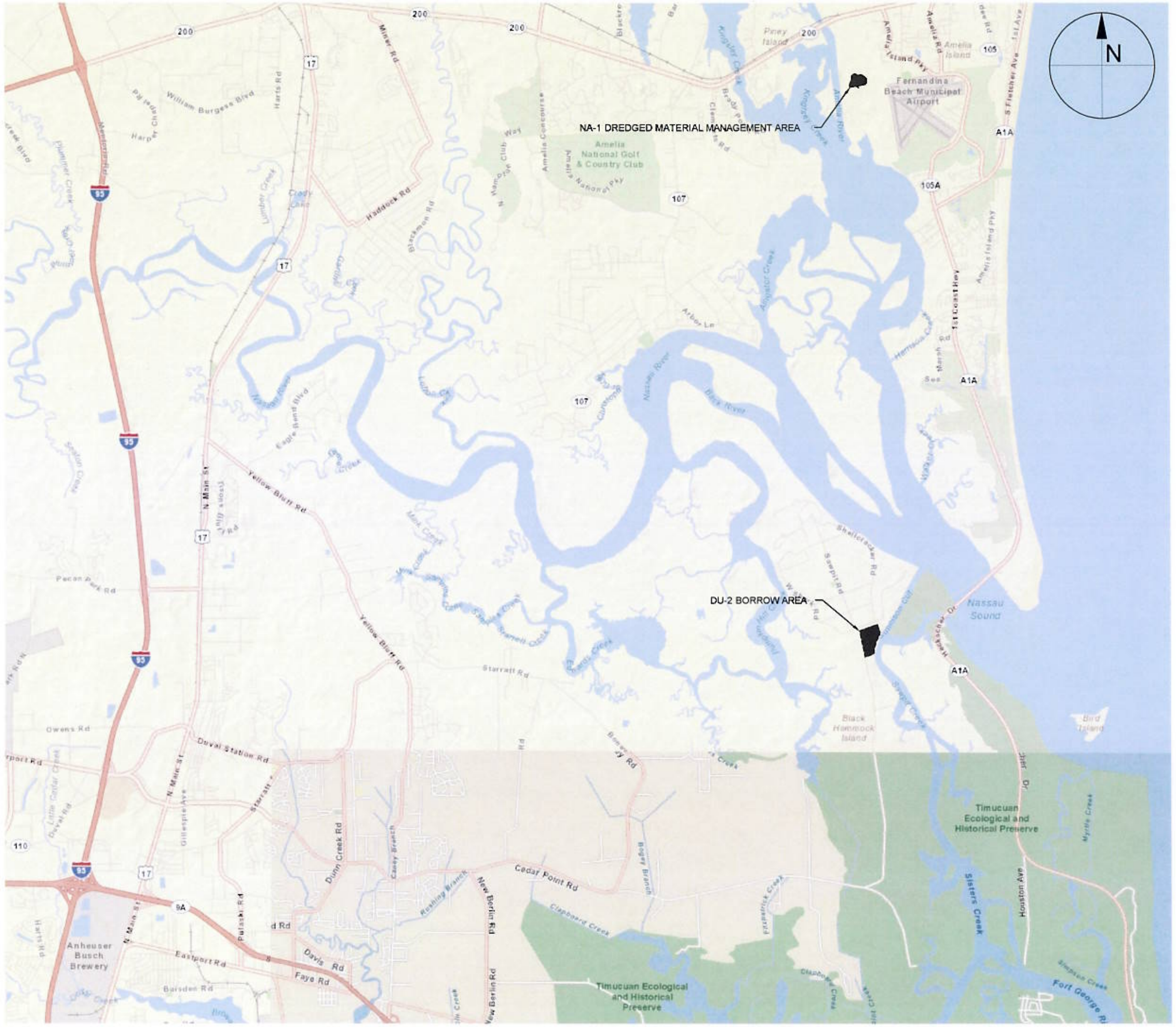
DRAWING TITLE

PROJECT OVERVIEW

C-3

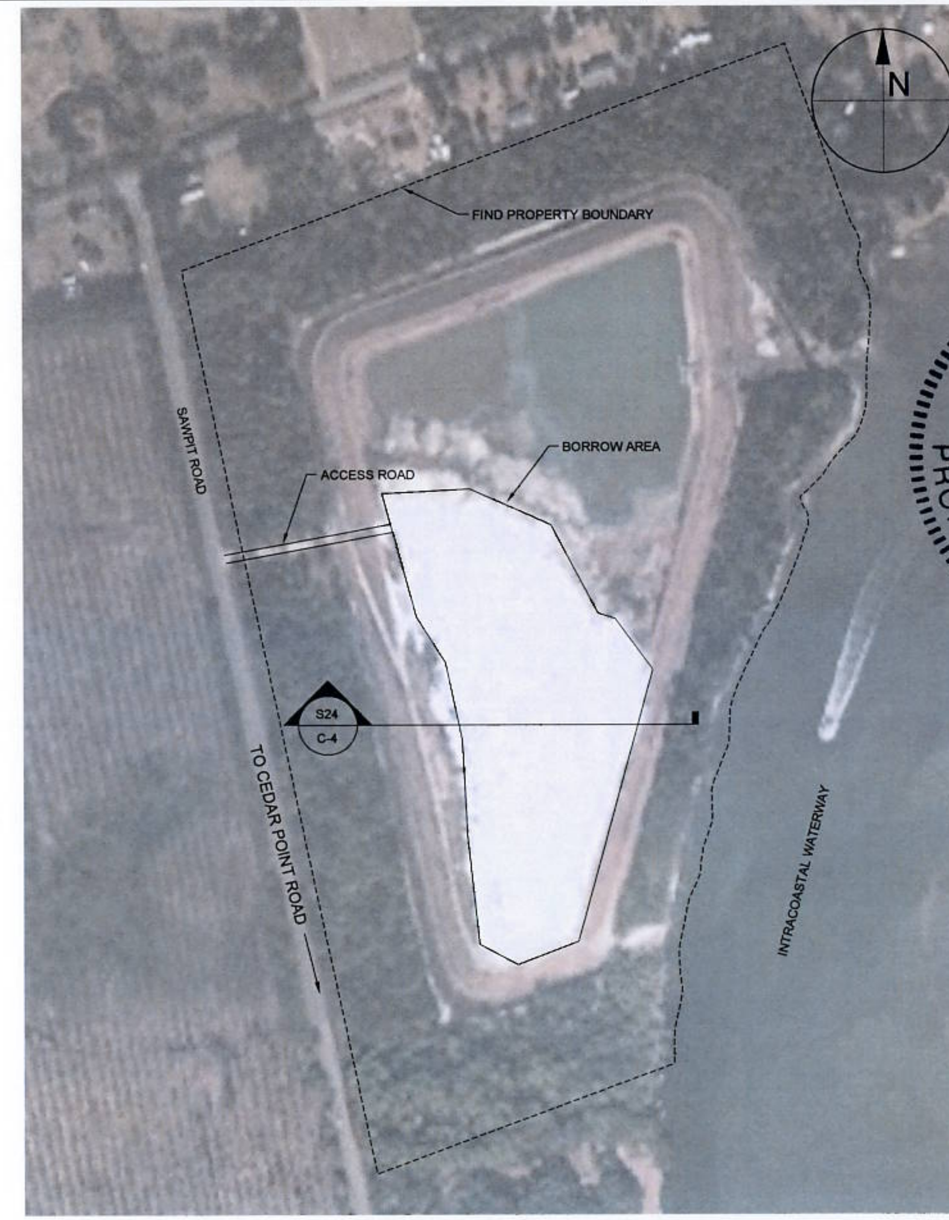
SHEET 3 OF 29

ANTON FLEWELLING . 7/20/2012 1:43:23 PM . X:\sys\Vault_Projects\c2008-044 NA-1 DMMA\Construction\c2008-044-C-General Notes and Overview.dwg



LOCATION MAP DU-2 BORROW AREA

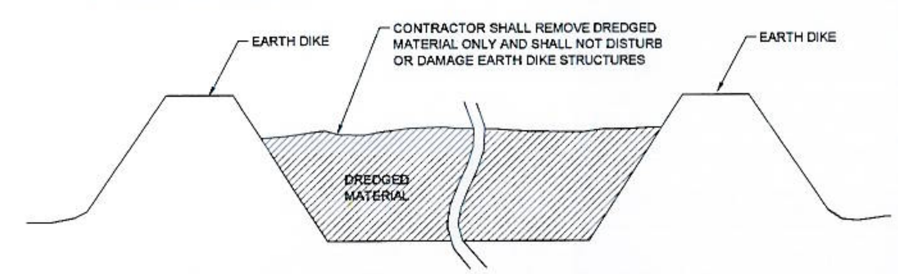
22X34: 1" = 5,000'
11X17: 1" = 10,000'
0 5,000' 10,000'



DU-2 BORROW AREA

22X34: 1" = 200'
11X17: 1" = 400'
0 200' 400'

NOTE: A GEOTECHNICAL INVESTIGATION IS REQUIRED FOR OFF-SITE BORROW AREA. SEE SPECIFICATIONS FOR DETAILS



DU-2 TYPICAL SECTION

S24
C-4

NOT TO SCALE

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PROFESSIONAL ENGINEER

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REVIEWED	JA/JTA
SCALE	AS SHOWN

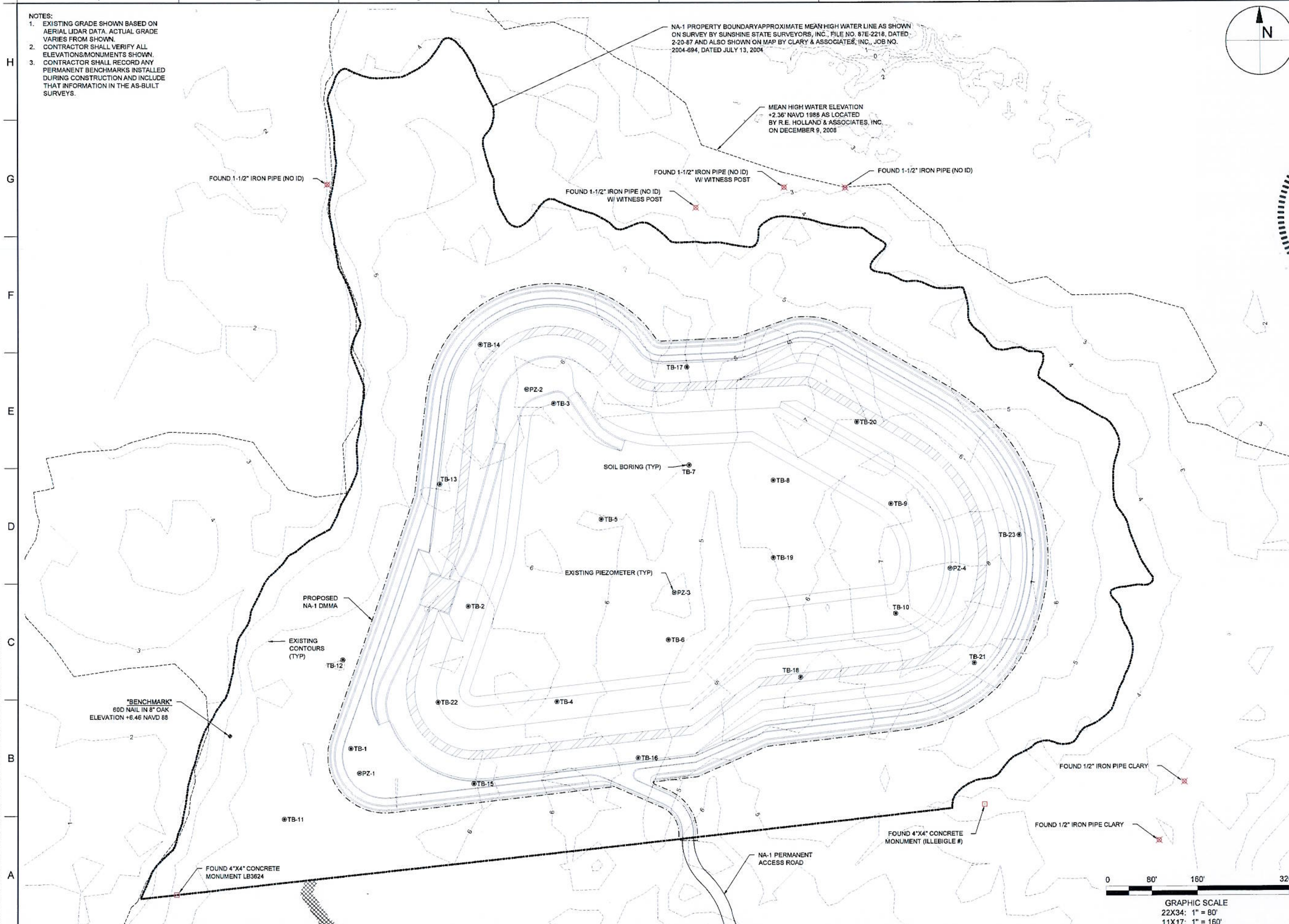
DRAWING TITLE
DU-2 BORROW AREA
OVERVIEW AND SITE PLAN

C-4

SHEET 4 OF 29

ANTON FLEWELLING , 7/20/2012 1:43:34 PM , X:\tays\Vault_Projects\c2008-044 NA-1 DMMA\Construction\c2008-044-C-DU2.dwg

NOTES:
1. EXISTING GRADE SHOWN BASED ON AERIAL LIDAR DATA. ACTUAL GRADE VARIES FROM SHOWN.
2. CONTRACTOR SHALL VERIFY ALL ELEVATIONS/MONUMENTS SHOWN.
3. CONTRACTOR SHALL RECORD ANY PERMANENT BENCHMARKS INSTALLED DURING CONSTRUCTION AND INCLUDE THAT INFORMATION IN THE AS-BUILT SURVEYS.



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SCALE	AS SHOWN

DRAWING TITLE
EXISTING SITE TOPOGRAPHY

C-5
SHEET 5 OF 29

ANTON FLEWELLING, 7/20/2012 1:43:52 PM, X:\taylor\vault_Projects\c2008-044 NA-1 DMMA\Construction\c2008-044-C-Existing Conditions.dwg

NOTES:
1. CONTRACTOR TO PERFORM LIGHT CLEARING AND GRUBBING OF PREVIOUSLY CLEARED AND GRASSED AREA WITHIN LIMITS OF CONSTRUCTION.
2. CONTRACTOR SHALL REMOVE PIEZOMETERS PZ-2, PZ-3, AND PZ-4.

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CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE

DMMA SITE PLAN WITH AERIAL

C-6

SHEET 6 OF 29

ANTON FLEWELLING , 7/20/2012 1:44:30 PM , X:\sys\Vault_Projects\c2008-044 NA-1 DMMA\Construction\c2008-044C-DMMA Site Plan.dwg

NOTES:
1. CONTRACTOR TO PERFORM LIGHT CLEARING AND GRUBBING OF PREVIOUSLY CLEARED AND GRASSED AREA WITHIN LIMITS OF CONSTRUCTION
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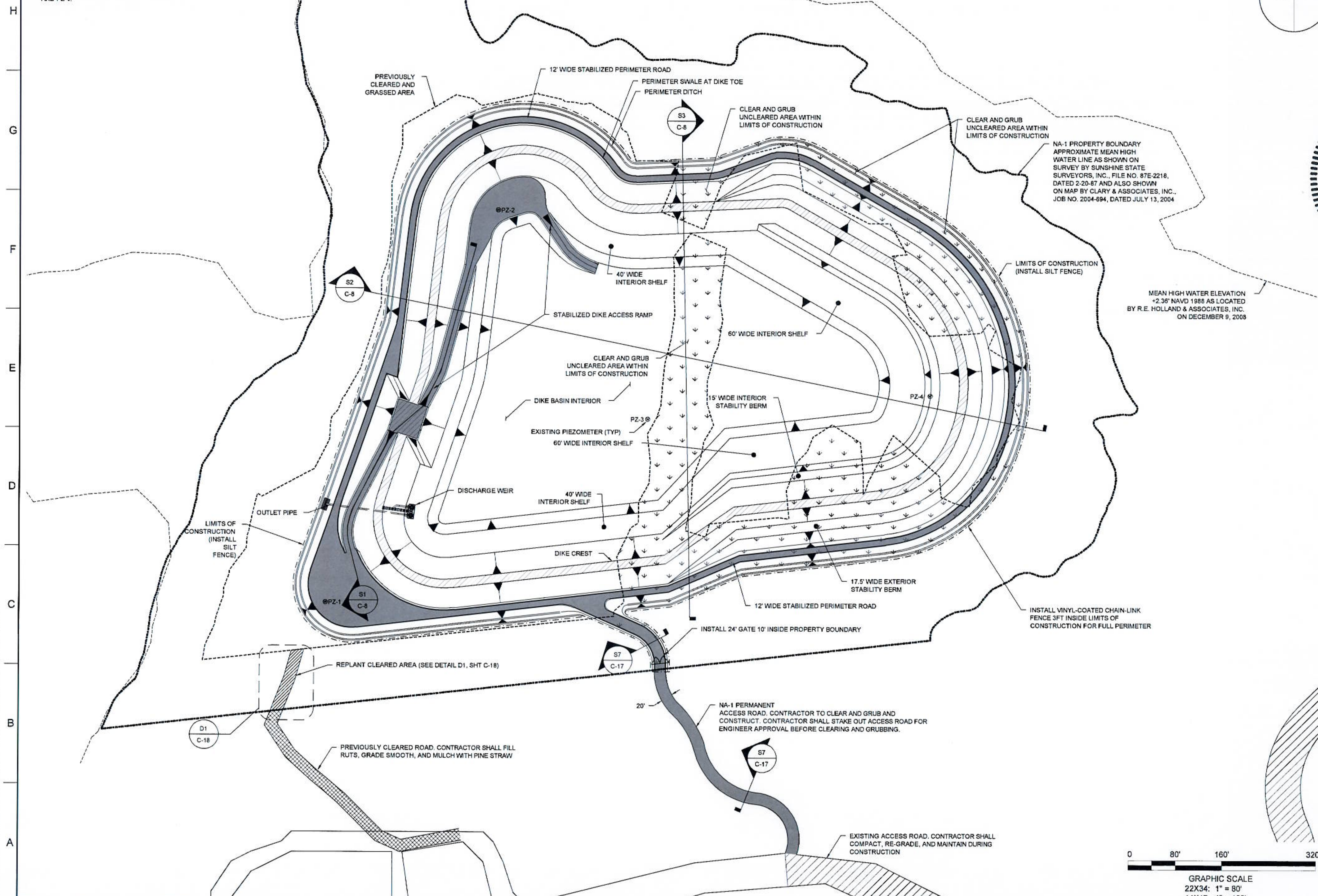

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CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

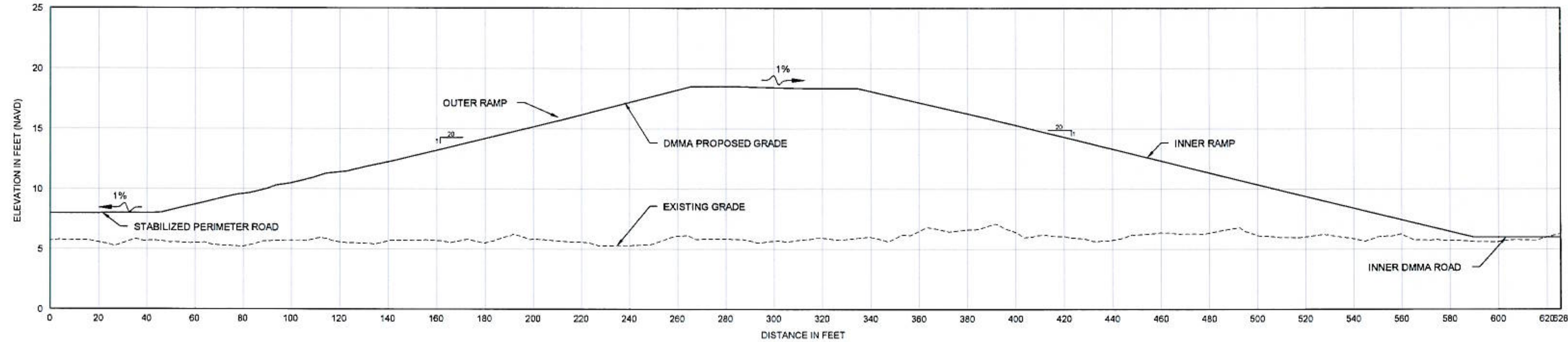
DRAWING TITLE

DMMA SITE PLAN WITHOUT AERIAL

C-7

SHEET 7 OF 29

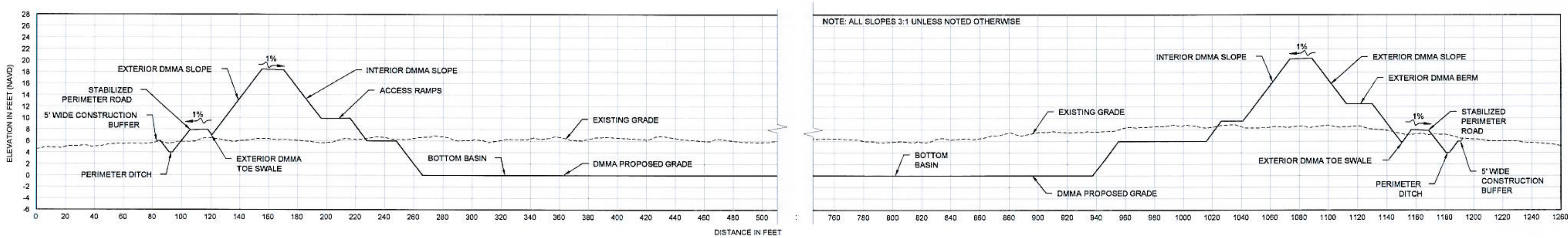
ANTON FLEWELLING , 7/20/2012 1:44:34 PM , X:\pw\Vault_Projects\c2008-044 NA-1 DMMA\Construction\c2008-044-C-DMMA Site Plan.dwg



S1 C-6

SECTION ALONG ACCESS RAMP

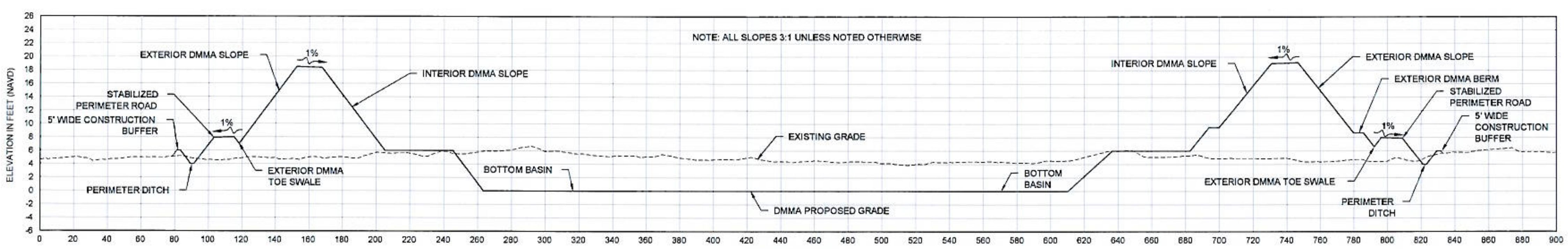
22X34: 1" = 30'
11X17: 1" = 60'
V-SCALE: 1" = 6' (22X34)
V-SCALE: 1" = 12' (11X17)



S2 C-6

EAST-WEST SECTION

22X34: 1" = 40'
11X17: 1" = 80'
V-SCALE: 1" = 10' (22X34)
V-SCALE: 1" = 20' (11X17)



S3 C-6

NORTH-SOUTH SECTION

22X34: 1" = 40'
11X17: 1" = 80'
V-SCALE: 1" = 10' (22X34)
V-SCALE: 1" = 20' (11X17)

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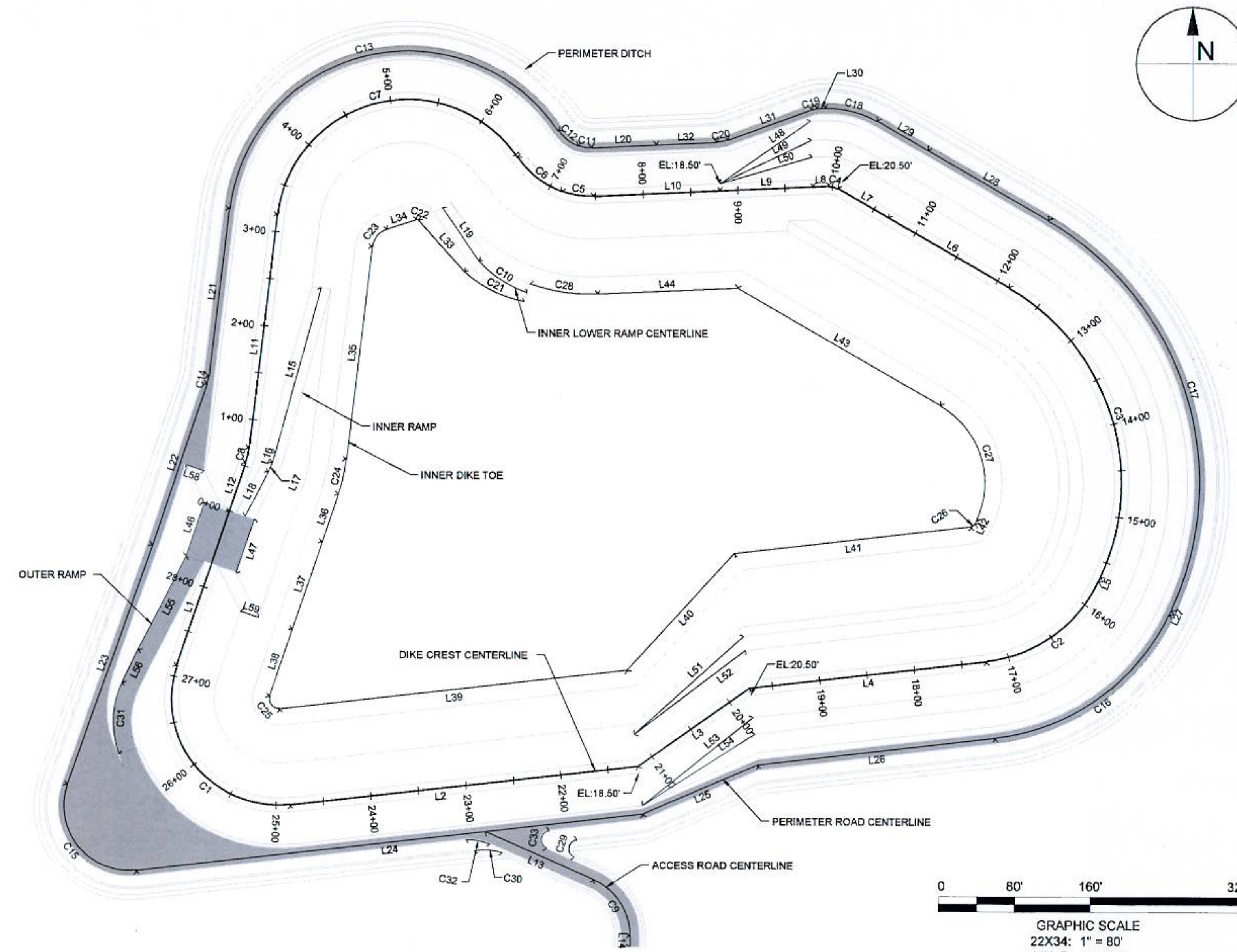
SCALE	AS SHOWN

DRAWING TITLE
DMMA TYPICAL SECTIONS

C-8
SHEET 8 OF 29

ANTON FLEWELLING , 7/20/2012 1:44:57 PM , X:\sys\Want_Projects\c2008-044 NA-1 DMMA Construction\c2008-044-P-DMMA Typical Sections.dwg

CURVE TABLE							
CURVE #	LENGTH (FT)	RADIUS (FT)	DELTA	CHORD DIRECTION	CHORD LENGTH	START POINT	END POINT
C1	227.02	113.00	115.11	N39° 07' 44"W	190.72	E:506157.1, N:2284438.0	E:506036.8, N:2284585.9
C2	151.81	149.00	58.38	S54° 07' 45"W	145.33	E:507005.3, N:2284678.4	E:506887.5, N:2284593.2
C3	352.83	238.00	84.94	S17° 31' 47"E	321.40	E:506910.5, N:2284989.2	E:507007.3, N:2284682.8
C4	9.97	17.50	32.63	S76° 18' 47"E	9.83	E:506721.0, N:2285095.5	E:506730.6, N:2285093.1
C5	34.02	90.92	21.44	S81° 54' 26"E	33.82	E:506439.1, N:2285088.8	E:506472.5, N:2285084.1
C6	59.66	92.00	37.15	S52° 27' 31"E	58.62	E:506392.6, N:2285124.5	E:506439.1, N:2285088.8
C7	335.82	138.00	139.43	N76° 24' 19"E	258.88	E:506141.0, N:2285063.7	E:506392.6, N:2285124.5
C8	16.89	82.50	11.73	N12° 33' 28"E	16.87	E:506108.4, N:2284800.9	E:506112.1, N:2284817.3
C9	74.92	64.96	66.09	N33° 02' 37"W	70.84	E:506514.1, N:2284300.7	E:506475.5, N:2284360.1
C10	61.68	113.54	31.12	S58° 29' 42"E	60.92	E:506351.8, N:2285015.5	E:506402.6, N:2284981.9
C11	14.95	39.92	21.46	S81° 53' 44"E	14.86	E:506455.5, N:2285137.1	E:506470.2, N:2285135.0
C12	26.44	41.00	36.94	S52° 21' 09"E	25.98	E:506434.9, N:2285153.0	E:506455.5, N:2285137.1
C13	459.92	189.00	139.43	N76° 24' 19"E	354.55	E:506090.3, N:2285069.6	E:506434.9, N:2285153.0
C14	8.40	41.00	11.73	N12° 33' 28"E	8.38	E:506067.7, N:2284884.4	E:506069.5, N:2284892.6
C15	139.60	69.00	115.92	N38° 43' 16"W	116.98	E:505995.4, N:2284367.7	E:505922.2, N:2284458.9
C16	235.36	231.00	58.38	S54° 07' 45"W	225.31	E:507079.6, N:2284643.8	E:506897.0, N:2284511.8
C17	474.40	320.00	84.94	S17° 31' 47"E	432.13	E:506951.5, N:2285060.3	E:507081.7, N:2284648.2
C18	56.66	99.50	32.63	S76° 18' 47"E	55.90	E:506717.3, N:2285177.4	E:506771.6, N:2285164.1
C19	4.90	16.02	17.51	N78° 36' 33"E	4.88	E:506703.4, N:2285176.0	E:506708.2, N:2285177.0
C20	12.52	40.95	17.51	N78° 36' 39"E	12.47	E:506602.4, N:2285141.1	E:506614.6, N:2285143.5
C21	70.98	128.94	31.54	S63° 12' 47"E	70.09	E:506336.8, N:2285004.0	E:506399.4, N:2284972.4
C22	2.61	2.00	74.80	S70° 54' 29"E	2.43	E:506286.8, N:2285058.8	E:506289.1, N:2285058.0
C23	24.96	22.00	65.00	N39° 11' 28"E	23.64	E:506240.7, N:2285030.2	E:506255.7, N:2285048.5
C24	37.99	185.50	11.73	N12° 33' 28"E	37.92	E:506206.1, N:2284768.3	E:506214.4, N:2284805.3
C25	20.09	10.00	115.11	N39° 07' 44"W	16.88	E:506145.2, N:2284540.3	E:506134.5, N:2284553.4
C26	5.09	5.00	58.38	S54° 07' 45"W	4.88	E:506874.7, N:2284739.1	E:506870.7, N:2284736.2
C27	139.35	94.00	84.94	S17° 31' 47"E	126.94	E:506838.5, N:2284864.5	E:506876.7, N:2284743.5
C28	72.56	191.71	21.69	S81° 50' 51"E	72.13	E:506405.9, N:2284991.3	E:506477.3, N:2284981.1
C29	26.07	10.00	149.36	N8° 35' 44"E	19.29	E:506454.5, N:2284383.6	E:506457.4, N:2284402.7
C30	30.04	57.53	29.92	N66° 04' 06"W	29.70	E:506379.3, N:2284388.5	E:506349.7, N:2284390.5
C31	79.54	97.84	46.58	S1° 55' 46"W	77.37	E:505978.8, N:2284568.1	E:505976.2, N:2284490.7
C32	26.25	54.04	27.83	N79° 45' 10"W	25.99	E:506366.4, N:2284397.5	E:506340.9, N:2284402.1
C33	25.78	10.07	146.74	N8° 36' 55"E	19.29	E:506425.3, N:2284393.3	E:506428.2, N:2284412.3



0 80' 160' 320'

GRAPHIC SCALE
22X34: 1" = 80'
11X17: 1" = 160'

LINE TABLE				
LINE #	LENGTH	DIRECTION	START POINT	END POINT
L1	173.13	N18° 25' 28.63"E	E:506036.8, N:2284585.9	E:506091.5, N:2284750.2
L2	366.89	S83° 19' 02.79"W	E:506521.5, N:2284480.7	E:506157.1, N:2284438.0
L3	144.01	S54° 35' 46.65"W	E:506638.9, N:2284564.1	E:506521.5, N:2284480.7
L4	250.28	S83° 19' 02.79"W	E:506887.5, N:2284593.2	E:506638.9, N:2284564.1
L5	4.85	S24° 56' 26.85"W	E:507007.3, N:2284682.8	E:507005.3, N:2284678.4
L6	146.17	S60° 00' 00.00"E	E:506783.9, N:2285062.3	E:506910.5, N:2284989.2
L7	61.59	S60° 00' 00.00"E	E:506730.6, N:2285093.1	E:506783.9, N:2285062.3
L8	16.33	N87° 22' 25.58"E	E:506704.7, N:2285094.7	E:506721.0, N:2285095.5
L9	98.51	N87° 22' 25.69"E	E:506606.3, N:2285090.2	E:506704.7, N:2285094.7
L10	133.90	N87° 22' 25.58"E	E:506472.5, N:2285084.1	E:506606.3, N:2285090.2
L11	248.06	N6° 41' 28.10"E	E:506112.1, N:2284817.3	E:506141.0, N:2285063.7
L12	53.35	N18° 25' 28.63"E	E:506091.5, N:2284750.2	E:506108.4, N:2284800.9
L13	124.62	N66° 05' 13.21"W	E:506475.5, N:2284360.1	E:506361.6, N:2284410.6
L14	12.04	N0° 00' 00.00"E	E:506514.1, N:2284288.6	E:506514.1, N:2284300.7
L15	180.29	N15° 09' 21.02"E	E:506140.1, N:2284812.3	E:506187.2, N:2284986.3

LINE TABLE				
LINE #	LENGTH	DIRECTION	START POINT	END POINT
L16	11.13	N17° 55' 51.62"E	E:506136.6, N:2284801.7	E:506140.1, N:2284812.3
L17	10.99	N23° 55' 19.64"E	E:506132.2, N:2284791.7	E:506136.6, N:2284801.7
L18	52.76	N27° 11' 54.39"E	E:506108.1, N:2284744.7	E:506132.2, N:2284791.7
L19	67.83	S34° 11' 59.43"E	E:506313.7, N:2285071.6	E:506351.8, N:2285015.5
L20	68.36	N87° 22' 25.58"E	E:506470.2, N:2285135.0	E:506538.5, N:2285138.1
L21	178.24	N6° 41' 28.10"E	E:506069.5, N:2284892.6	E:506090.3, N:2285069.6
L22	179.76	N18° 25' 28.63"E	E:506010.9, N:2284713.9	E:506067.7, N:2284884.4
L23	269.92	N19° 10' 33.74"E	E:505922.2, N:2284458.9	E:506010.9, N:2284713.9
L24	534.81	S83° 19' 02.79"W	E:506526.6, N:2284429.9	E:505995.4, N:2284367.7
L25	131.95	S66° 29' 11.20"W	E:506647.6, N:2284482.6	E:506526.6, N:2284429.9
L26	251.16	S83° 19' 02.79"W	E:506897.0, N:2284511.8	E:506647.6, N:2284482.6
L27	4.85	S24° 56' 26.85"W	E:507081.7, N:2284648.2	E:507079.6, N:2284643.8
L28	146.17	S60° 00' 00.00"E	E:506824.9, N:2285133.3	E:506951.5, N:2285060.3
L29	61.59	S60° 00' 00.00"E	E:506771.6, N:2285164.1	E:506824.9, N:2285133.3
L30	9.10	N87° 22' 25.58"E	E:506708.2, N:2285177.0	E:506717.3, N:2285177.4

LINE TABLE				
LINE #	LENGTH	DIRECTION	START POINT	END POINT
L31	94.50	N69° 54' 42.73"E	E:506614.6, N:2285143.5	E:506703.4, N:2285176.0
L32	63.95	N87° 22' 25.58"E	E:506538.5, N:2285138.1	E:506602.4, N:2285141.1
L33	72.09	S41° 26' 50.60"E	E:506289.1, N:2285058.0	E:506336.8, N:2285004.0
L34	32.81	N71° 41' 28.10"E	E:506255.7, N:2285048.5	E:506286.8, N:2285058.8
L35	226.40	N6° 41' 28.10"E	E:506214.4, N:2284805.3	E:506240.7, N:2285030.2
L36	53.35	N18° 25' 28.63"E	E:506189.2, N:2284717.7	E:506206.1, N:2284768.3
L37	97.50	N18° 25' 28.63"E	E:506158.4, N:2284625.2	E:506189.2, N:2284717.7
L38	75.70	N18° 25' 28.63"E	E:506134.5, N:2284553.4	E:506158.4, N:2284625.2
L39	366.89	S83° 19' 02.79"W	E:506509.5, N:2284583.0	E:506145.2, N:2284540.3
L40	167.62	S42° 12' 34.31"W	E:506622.2, N:2284707.1	E:506509.5, N:2284583.0
L41	250.28	S83° 19' 02.79"W	E:506870.7, N:2284736.2	E:506622.2, N:2284707.1
L42	4.85	S24° 56' 26.85"W	E:506876.7, N:2284743.5	E:506874.7, N:2284739.1
L43	246.63	S60° 00' 00.00"E	E:506624.9, N:2284987.9	E:506838.5, N:2284864.5
L44	147.80	N87° 22' 25.58"E	E:506477.3, N:2284981.1	E:506624.9, N:2284987.9
L46	60.00	S18° 25' 28.63"W	E:506065.4, N:2284758.9	E:506046.5, N:2284702.0

LINE TABLE				
LINE #	LENGTH	DIRECTION	START POINT	END POINT
L47	60.00	N18° 25' 28.63"E	E:506098.7, N:2284684.6	E:506117.6, N:2284741.5
L48	116.26	N55° 17' 32.72"E	E:506606.0, N:2285097.7	E:506701.5, N:2285163.9
L49	106.89	N64° 31' 44.51"E	E:506606.0, N:2285097.7	E:506702.5, N:2285143.7
L50	101.39	N73° 40' 53.20"E	E:506606.0, N:2285097.7	E:506703.3, N:2285126.2
L51	155.20	N47° 46' 53.35"E	E:506517.5, N:2284514.9	E:506632.5, N:2284619.2
L52	146.99	N52° 32' 41.47"E	E:506517.5, N:2284514.9	E:506634.2, N:2284604.3
L53	149.34	N51° 03' 40.80"E	E:506526.4, N:2284439.0	E:506642.6, N:2284532.8
L54	140.78	N57° 05' 43.53"E	E:506526.4, N:2284439.0	E:506644.6, N:2284515.4
L55	111.47	S27° 03' 20.75"W	E:506046.5, N:2284702.0	E:505995.8, N:2284602.7
L56	38.59	S26° 02' 49.81"W	E:505995.8, N:2284602.7	E:505978.8, N:2284568.1
L58	20.00	N71° 34' 31.37"W	E:506064.5, N:2284792.5	E:506045.5, N:2284798.8
L59	20.00	S71° 34' 31.37"E	E:506103.4, N:2284643.5	E:506122.4, N:2284637.2

TAYLOR ENGINEERING INC.
10151 DEERWOOD PARK BLVD.
BLDG. 300, SUITE 300
JACKSONVILLE, FLORIDA 32256

SEAL

KEITH A. KNIGHT P.E. #58084

LICENSE No 58084 STATE OF FLORIDA PROFESSIONAL ENGINEER

7-23-12

PROJECT TITLE

DREDGED MATERIAL MANAGEMENT AREA NA-1 CONSTRUCTION
NASSAU COUNTY, FLORIDA

Call (2) Business Days Before you Dig. It's the Law!!!

Sunshine State One Call of Florida, Inc.
1-800-432-4770

NO	ZONE	REVISIONS / SUBMISSIONS	DATE

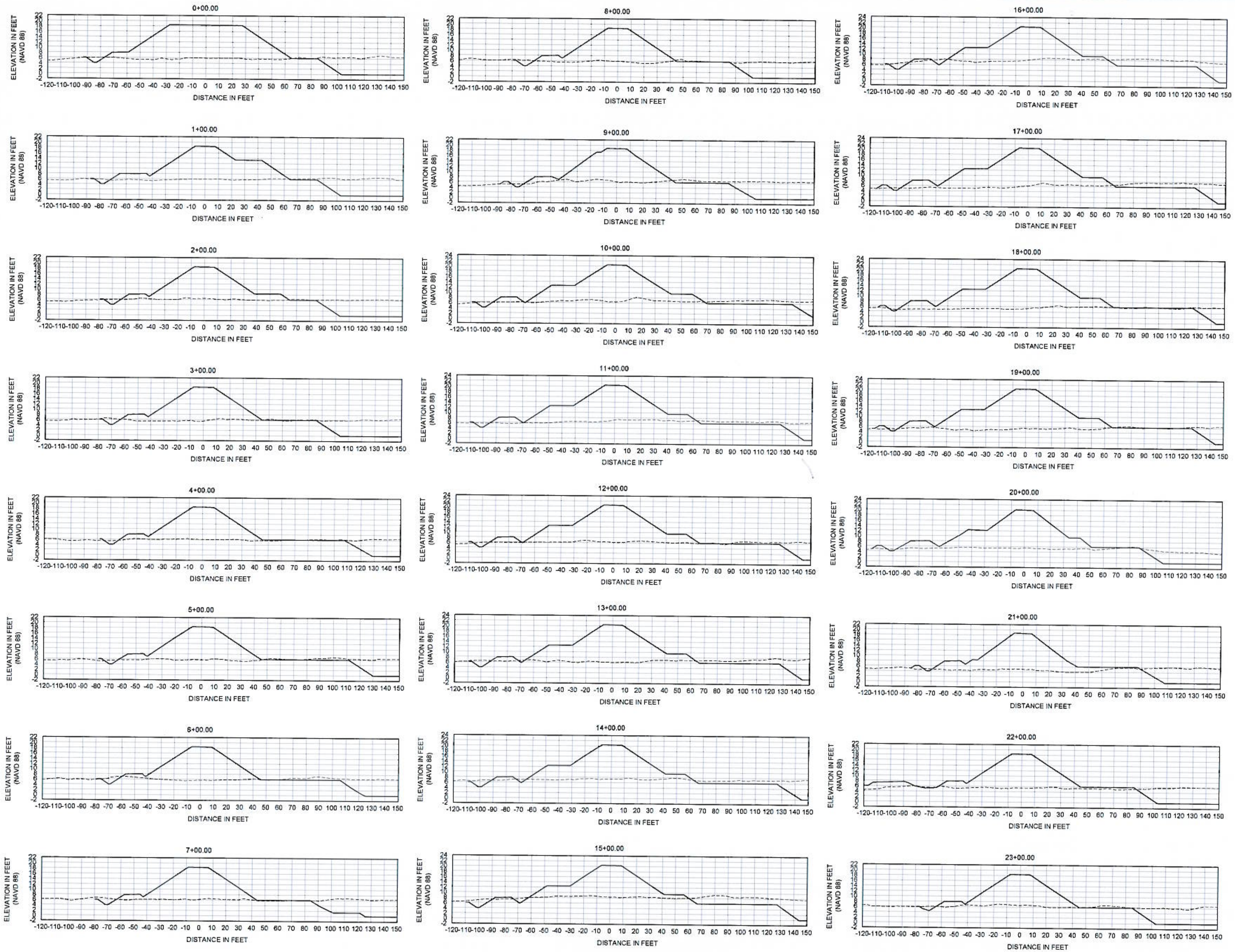
PROJECT NO	C2008-044
DATE	JULY 2012
DESIGNED	LJB/KAK/RJD
DRAWN	AF
CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE

DMMA STAKING AND GRADING PLAN

C-9

SHEET 9 OF 29



DMMA SECTIONS

22X34: 1" = 40'
11X17: 1" = 80'
V-SCALE: 1" = 20' (22X34)
V-SCALE: 1" = 40' (11X17)

0 40' 80'

LEGEND:
---- EXISTING GRADE
—— PROPOSED GRADE

TAYLOR ENGINEERING INC.
10151 DEERWOOD PARK BLVD.
BLDG. 300, SUITE 300
JACKSONVILLE, FLORIDA 32256
(904)-731-7040
1675 PALM BEACH LAKES, SUITE 210
WEST PALM BEACH, FLORIDA 33401
(561)-640-...

SEAL

K. A. KNIGHT
LICENSE
No 58084
7-23-12
STATE OF FLORIDA
PROFESSIONAL ENGINEER

KEITH A. KNIGHT P.E. 58084

PROJECT TITLE
DREDGED MATERIAL MANAGEMENT AREA NA-1 CONSTRUCTION
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DATE	JULY 2012
DESIGNED	LJB/KAK/RJD
DRAWN	AF
CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE
DMMA CROSS-SECTIONS 1

C-10
SHEET 10 OF 29

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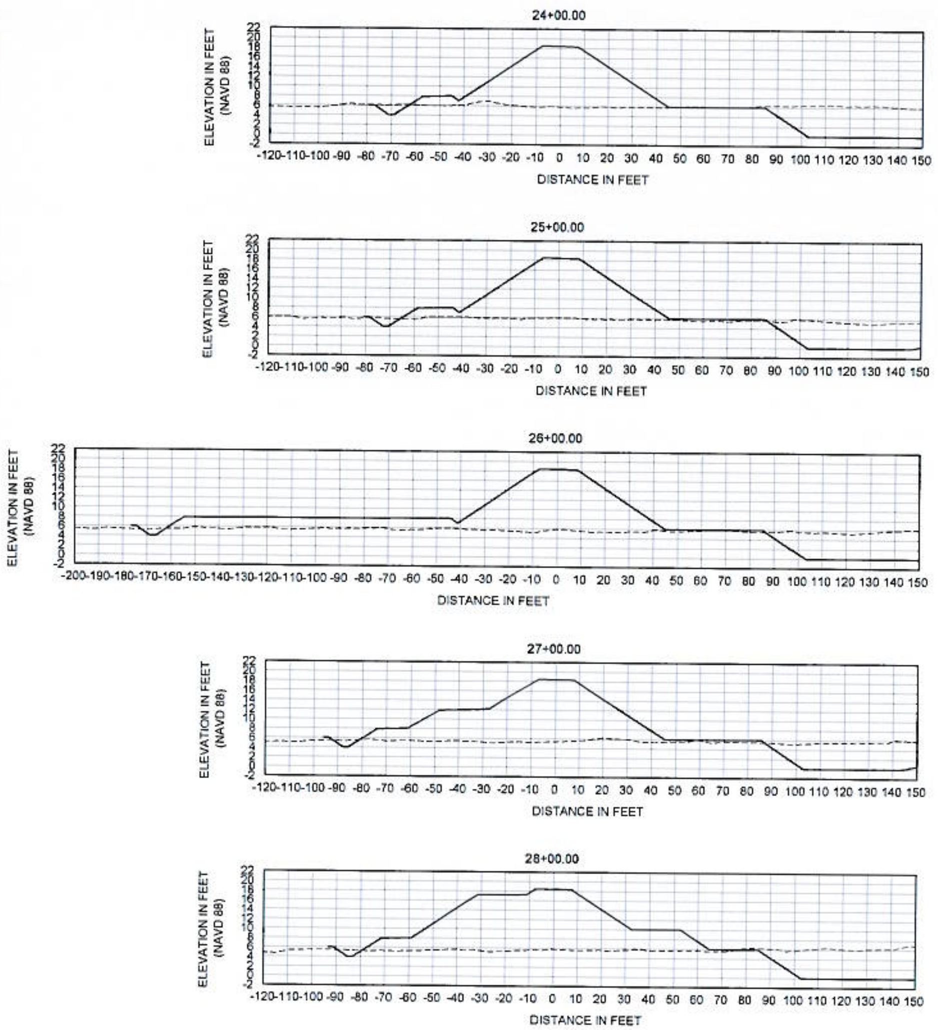

DMMA SECTIONS

22X34: 1" = 40'
11X17: 1" = 80'
V-SCALE: 1" = 20' (22X34)
V-SCALE: 1" = 40' (11X17)

0 40' 80'

LEGEND:
----- EXISTING GRADE
—— PROPOSED GRADE

TAYLOR ENGINEERING INC.
10151 DEERWOOD PARK BLVD.
BLDG 300, SUITE 300
JACKSONVILLE, FLORIDA 32256
(904) 731-7040
1675 PALM BEACH LAKES, SUITE 210
WEST PALM BEACH, FLORIDA 33401
(561) 640-7180
CERTIFICATE OF AUTHORIZATION #4815

SEAL

K. A. KNIGHT
LICENSE
No. 58084
7-23-12
STATE OF FLORIDA
PROFESSIONAL ENGINEER

KEITH A. KNIGHT P.E.# 58084

PROJECT TITLE

DREDGED MATERIAL MANAGEMENT AREA NA-1 CONSTRUCTION
NASSAU COUNTY, FLORIDA

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NO	ZONE	REVISIONS / SUBMISSIONS	DATE

PROJECT NO	C2008-044
DATE	JULY 2012
DESIGNED	LJB/KAK/RJD
DRAWN	AF
CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE

DMMA CROSS-SECTIONS 2

C-11

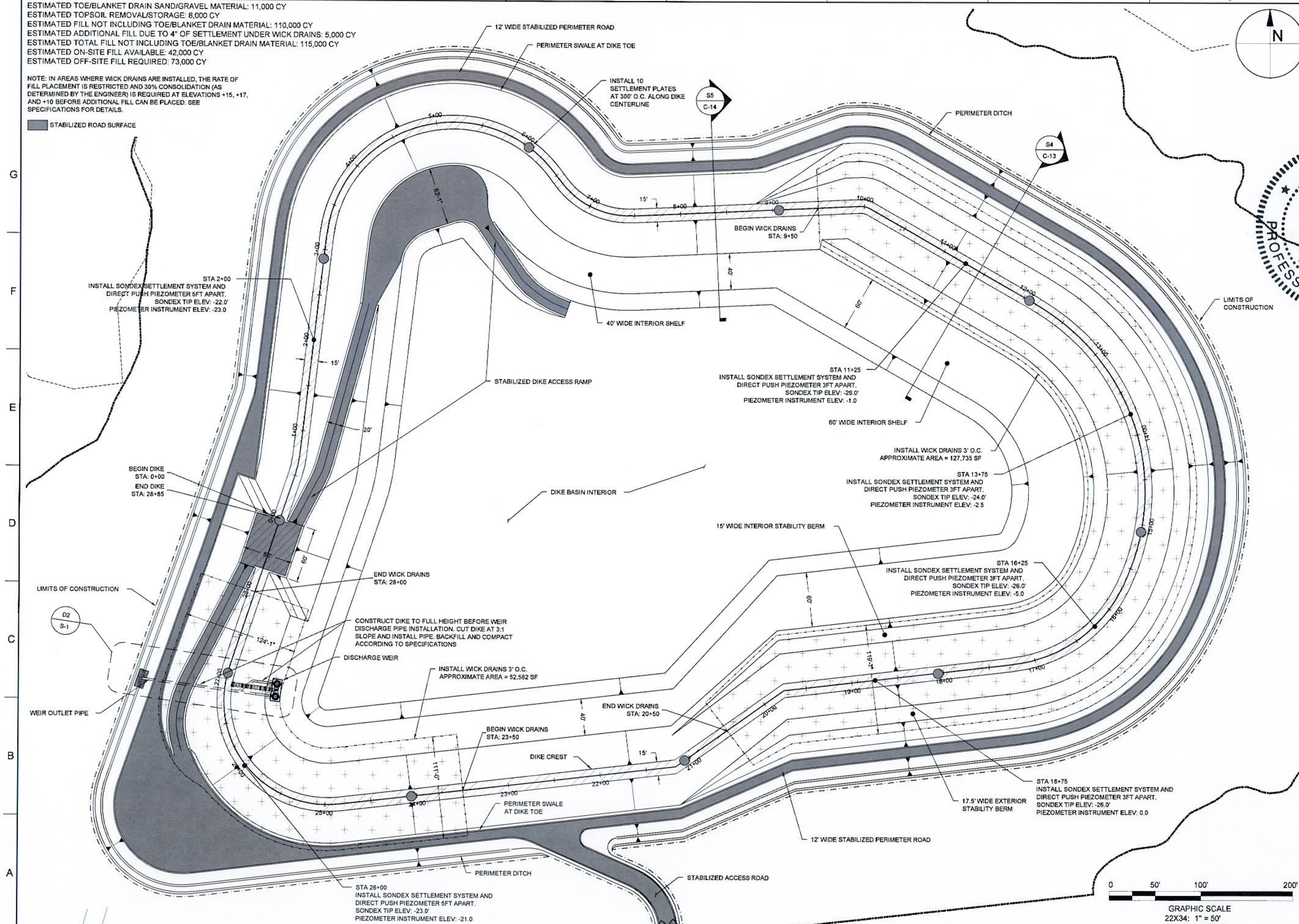
SHEET 11 OF 29

ANTON FLEWELLING . 7/20/2012 1:45:11 PM . X:\sys\Vault_Projects\c2008-044 NA-1 DMMA Construction\c2008-044-P-DMMA Sections.dwg

ESTIMATED TOE/BLANKET DRAIN SAND/GRAVEL MATERIAL: 11,000 CY
ESTIMATED TOPSOIL REMOVAL/STORAGE: 8,000 CY
ESTIMATED FILL NOT INCLUDING TOE/BLANKET DRAIN MATERIAL: 110,000 CY
ESTIMATED ADDITIONAL FILL DUE TO 4" OF SETTLEMENT UNDER WICK DRAINS: 5,000 CY
ESTIMATED TOTAL FILL NOT INCLUDING TOE/BLANKET DRAIN MATERIAL: 115,000 CY
ESTIMATED ON-SITE FILL AVAILABLE: 42,000 CY
ESTIMATED OFF-SITE FILL REQUIRED: 73,000 CY

NOTE: IN AREAS WHERE WICK DRAINS ARE INSTALLED, THE RATE OF FILL PLACEMENT IS RESTRICTED AND 30% CONSOLIDATION (AS DETERMINED BY THE ENGINEER) IS REQUIRED AT ELEVATIONS +15, +17, AND +10 BEFORE ADDITIONAL FILL CAN BE PLACED. SEE SPECIFICATIONS FOR DETAILS.

STABILIZED ROAD SURFACE



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(561)-640-7310

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7-23-12
STATE OF FLORIDA
PROFESSIONAL ENGINEER

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NASSAU COUNTY, FLORIDA

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NO	ZONE	REVISIONS / SUBMISSIONS	DATE

PROJECT NO	C2008-044
DATE	JULY 2012
DESIGNED	LJB/KAK/RJD
DRAWN	AF
CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE
DMMA DETAILED SITE PLAN

C-12
SHEET 12 OF 29

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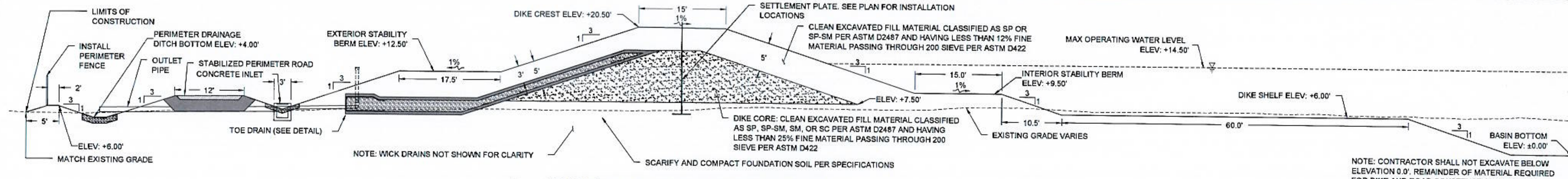
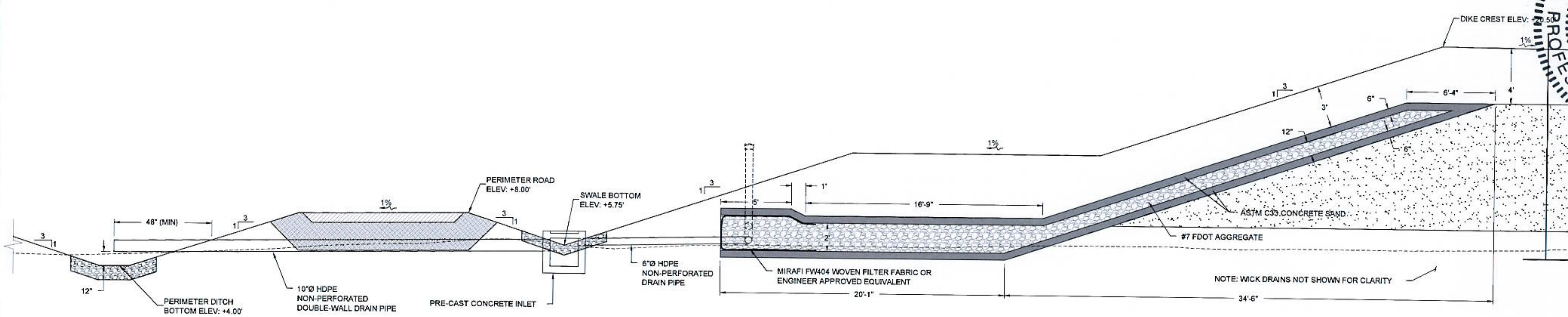


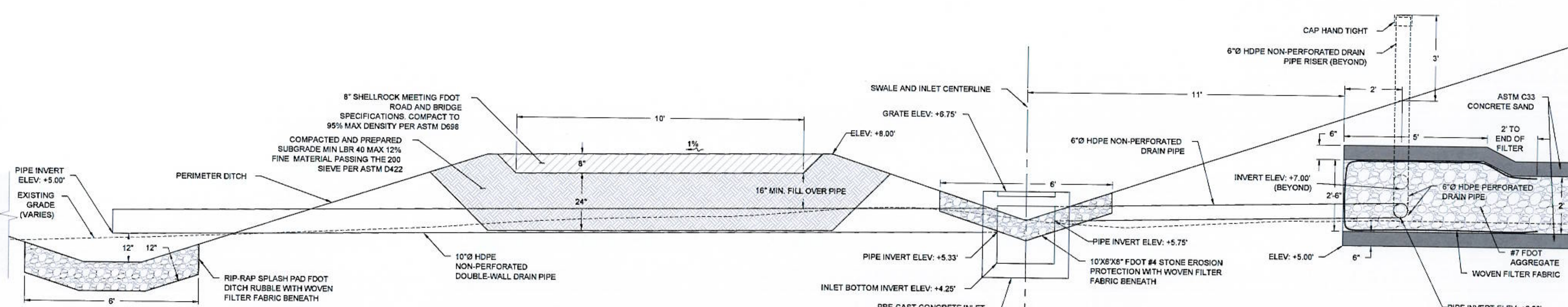
S4 / C-12 TYPICAL EAST DIKE SECTION

22X34: 1" = 10'
11X17: 1" = 20'



TYPICAL EAST DIKE SECTION - BLANKET DRAIN, TOE DRAIN, AND OUTLET PIPE

22X34: 1" = 4'
11X17: 1" = 8'



TYPICAL EAST DIKE SECTION - TOE DRAIN AND OUTLET PIPE

22X34: 1" = 2'
11X17: 1" = 4'

TAYLOR ENGINEERING INC.
10151 DEERWOOD PARK BLVD.
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WEST PALM BEACH, FLORIDA 33401
(561)-640-7210

K. A. KNIGHT LICENSE No 58084 STATE OF FLORIDA PROFESSIONAL ENGINEER
7-23-12
KEITH A KNIGHT P.E. # 58084

PROJECT TITLE
DREDGED MATERIAL MANAGEMENT AREA NA-1 CONSTRUCTION
NASSAU COUNTY, FLORIDA

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Sunshine State One Call of Florida, Inc.
1-800-432-4770

NO	ZONE	REVISIONS / SUBMISSIONS	DATE

PROJECT NO	C2008-044
DATE	JULY 2012
DESIGNED	LJB/KAK/RJD
DRAWN	AF
CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE
EASTERN DMMA TYPICAL SECTIONS

C-13

SHEET 13 OF 29

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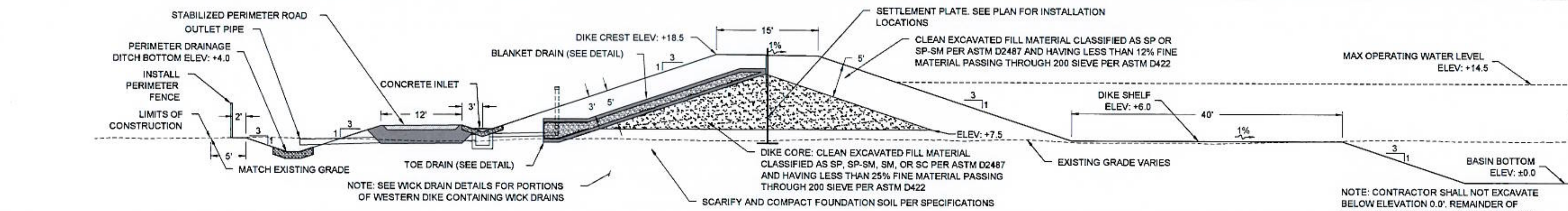
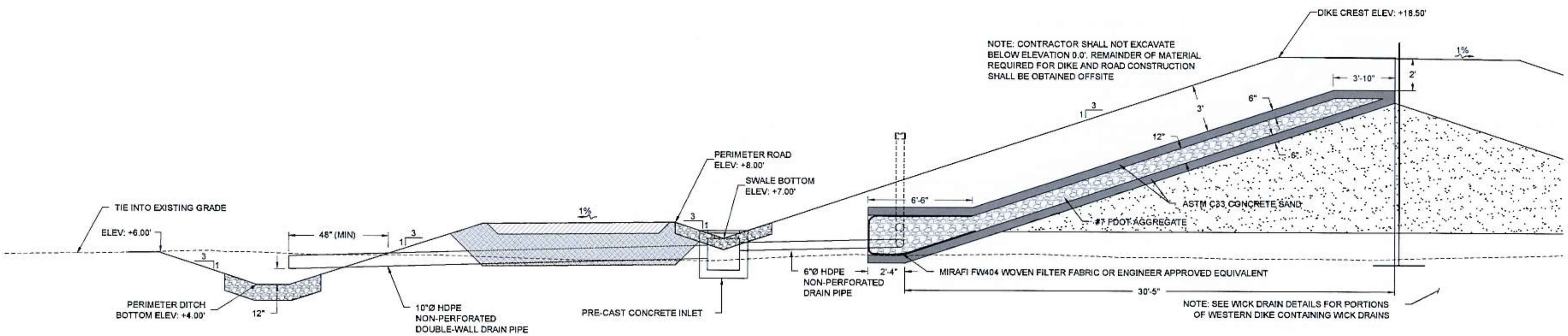


S5 / C-12

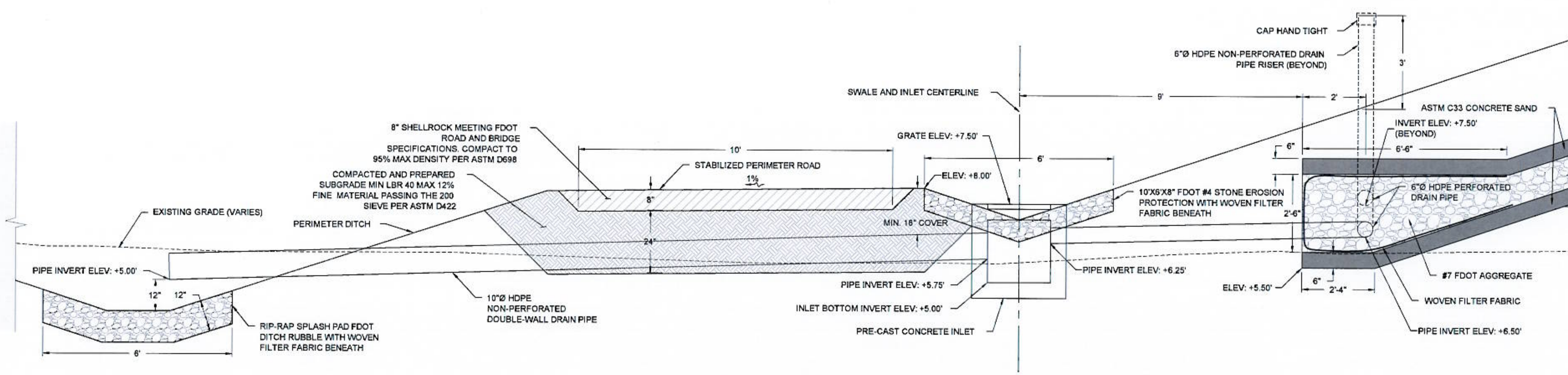
TYPICAL WEST DIKE SECTION

22X34: 1" = 10'
11X17: 1" = 20'



TYPICAL WEST DIKE SECTION - BLANKET DRAIN, TOE DRAIN, AND OUTLET PIPE

22X34: 1" = 4'
11X17: 1" = 8'



TYPICAL WEST DIKE SECTION - TOE DRAIN AND OUTLET PIPE

22X34: 1" = 2'
11X17: 1" = 4'

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JACKSONVILLE, FLORIDA 32256
(904) 731-7040

SEAL: K. KNIGHT LICENSE No 58084 STATE OF FLORIDA PROFESSIONAL ENGINEER 7-23-12

PROJECT TITLE
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NASSAU COUNTY, FLORIDA

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1-800-432-4770

NO	ZONE	REVISIONS / SUBMISSIONS	DATE

PROJECT NO	C2008-044
DATE	JULY 2012
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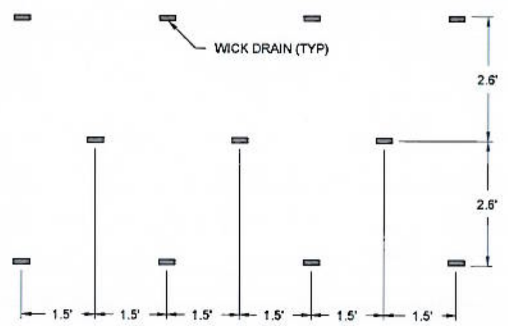
DRAWN	AF
CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE
WESTERN DMMA TYPICAL SECTIONS

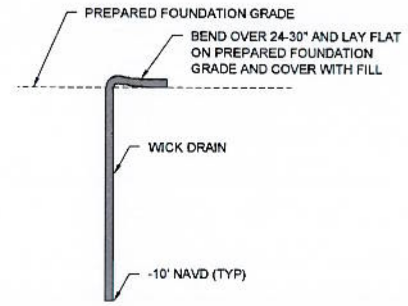
C-14
SHEET 14 OF 29

ANTON FLEWELLING , 7/20/2012 1:45:52 PM , X:\sys\Vault_Projects\C2008-044 NA-1 DMMA\Construction\C2008-044-F-DMMA Typical Sections.dwg



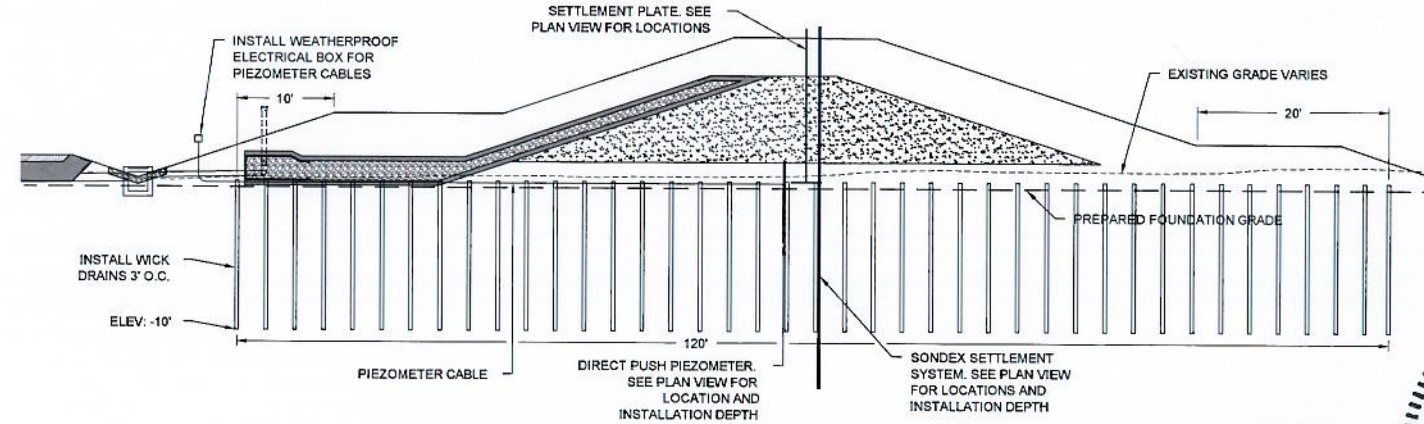
WICK DRAIN SPACING DETAIL

22X34: 1" = 2'
11X17: 1" = 4'



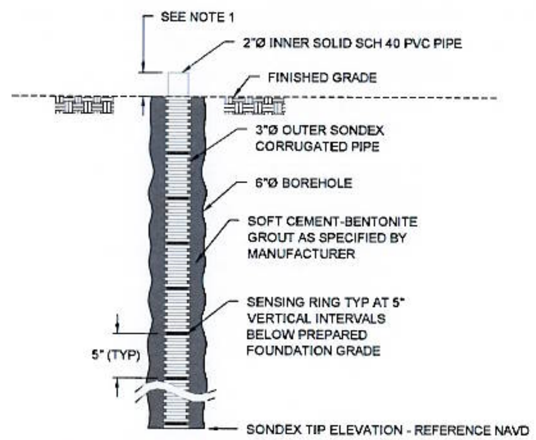
WICK DRAIN TYPICAL SECTION

NOT TO SCALE



EAST DIKE SECTION WICK DRAINS STA 9+50 TO STA 20+50

22X34: 1" = 10'
11X17: 1" = 20'

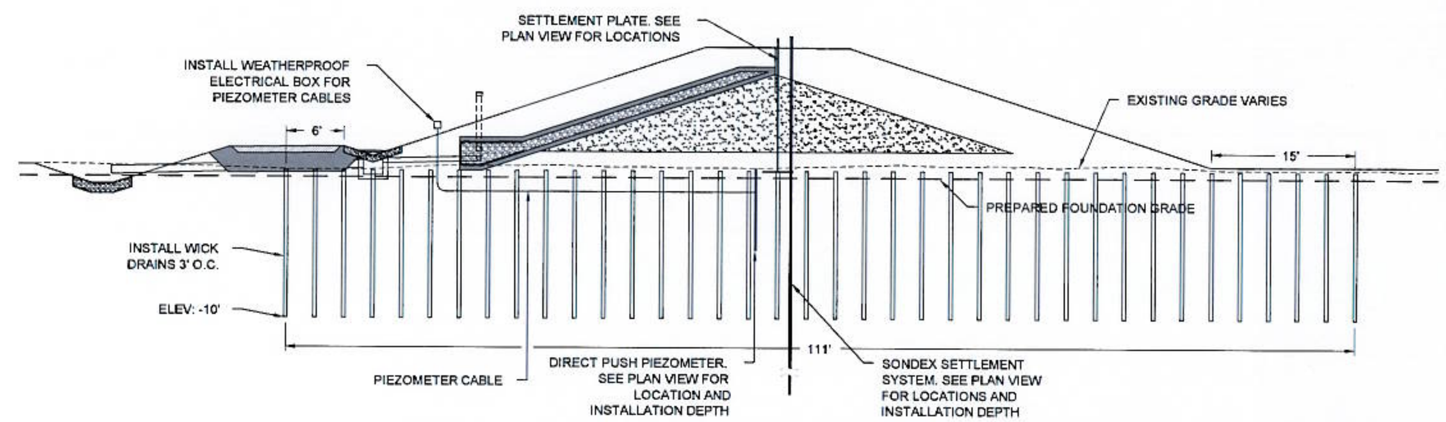


NOTES:

1. CONTRACTOR TO PROVIDE SUFFICIENT SONDEX CORRUGATED PIPE AND SOLID PVC INNER PIPE TO EXTEND VERTICALLY TO TOP OF FINISHED PRELOAD ELEVATION IN 5' INCREMENTS.
2. ALL JOINTS SHALL BE WATER-TIGHT IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. BELOW-GRADE CORRUGATED PIPE AND SENSING RINGS SHALL BE PRE-FABRICATED BY SONDEX AND SHIPPED TO THE PROJECT SITE.

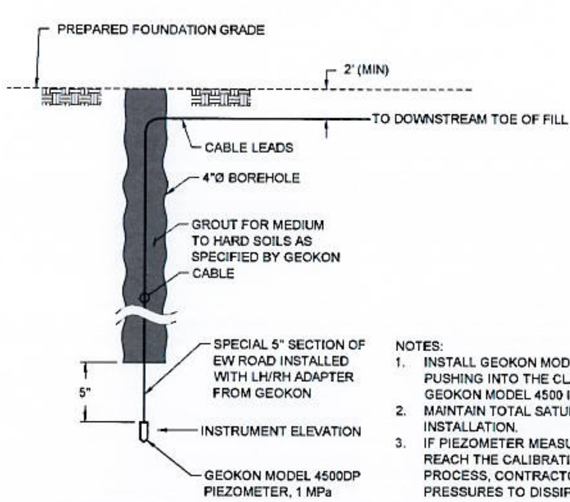
TYPICAL SONDEX SETTLEMENT SYSTEM DETAIL

NOT TO SCALE



WEST DIKE SECTION WICK DRAINS STA 23+50 TO STA 28+00

22X34: 1" = 10'
11X17: 1" = 20'

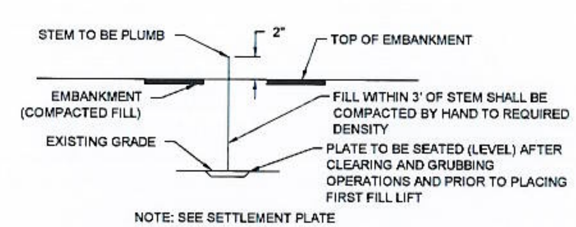


NOTES:

1. INSTALL GEOKON MODEL 4500DP PIEZOMETER BY DIRECTLY PUSHING INTO THE CLAY LAYER IN ACCORDANCE WITH THE GEOKON MODEL 4500 INSTRUCTION MANUAL.
2. MAINTAIN TOTAL SATURATION OF THE PIEZOMETER TIP DURING INSTALLATION.
3. IF PIEZOMETER MEASUREMENT PRESSURES APPROACH OR REACH THE CALIBRATION RANGE DURING THE DRIVING PROCESS, CONTRACTOR SHALL STOP DRIVING AND ALLOW THE PRESSURES TO DISSIPATE BEFORE CONTINUING.

PIEZOMETER INSTALLATION DETAIL

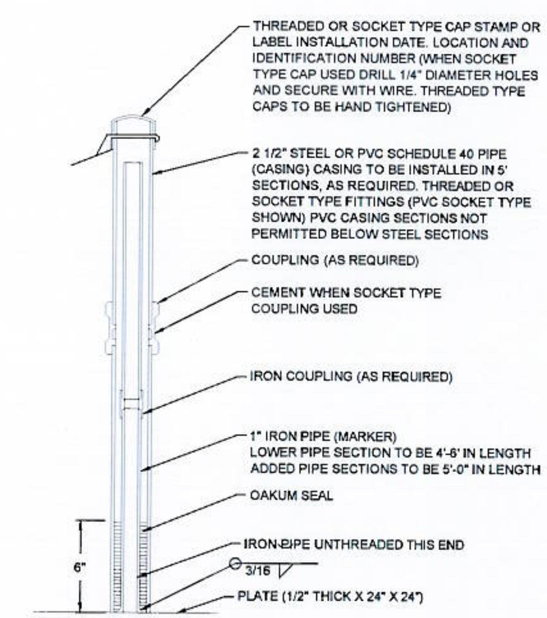
NOT TO SCALE



NOTE: SEE SETTLEMENT PLATE DETAIL, THIS SHEET

SETTLEMENT PLATE INSTALLATION

NOT TO SCALE



SETTLEMENT PLATE DETAIL

NOT TO SCALE

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WEST PALM BEACH, FLORIDA 33401

SEAL
K. A. KNIGHT
LICENSE
No 58084
7-23-12
STATE OF FLORIDA
PROFESSIONAL ENGINEER
KEITH A. KNIGHT P.E. 58084

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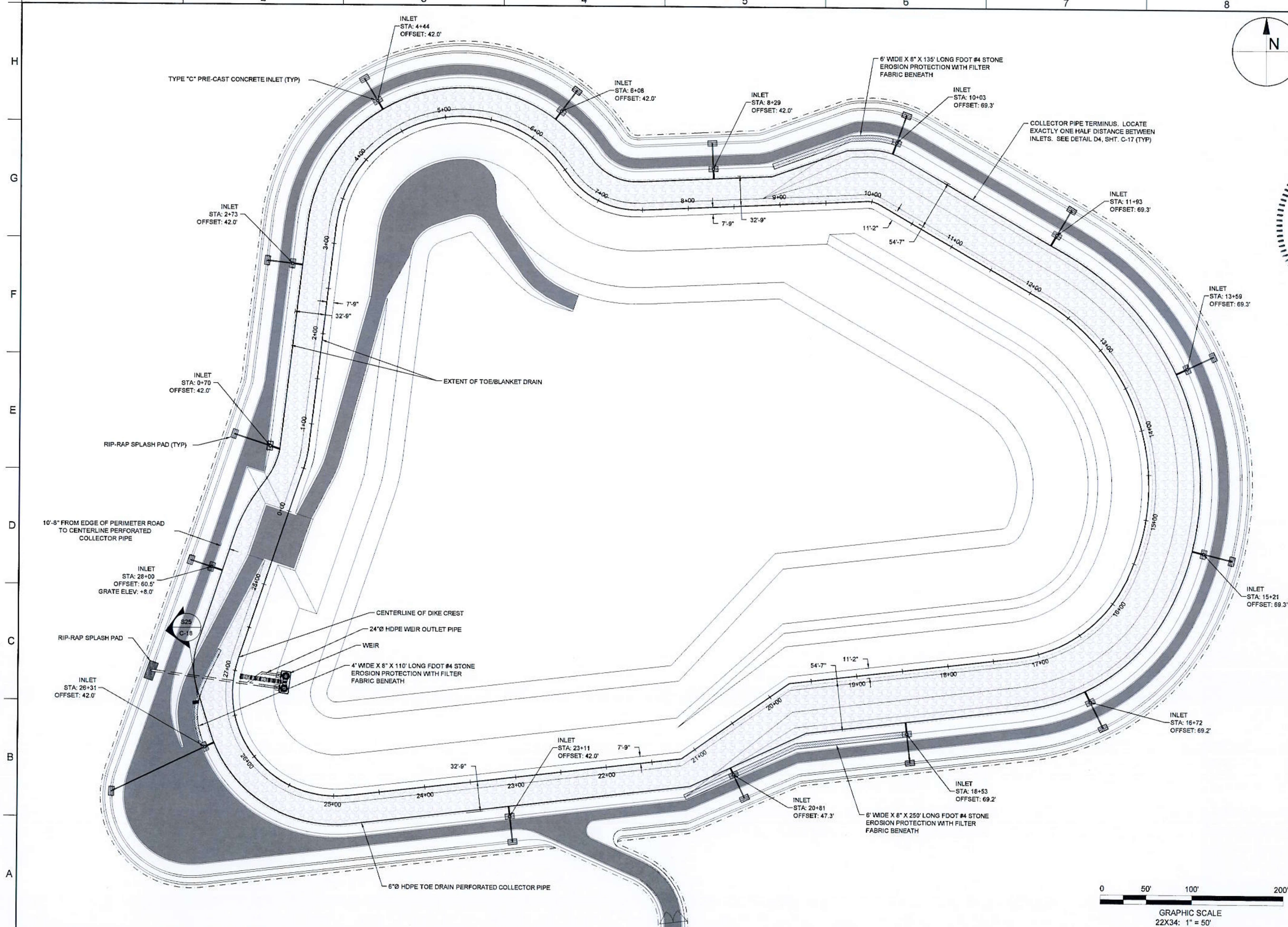
DRAWING TITLE
WICK DRAIN DETAILS

C-15

SHEET 15 OF 29

ANTON FLEWELLING , 7/20/2012 1:46:00 PM , X:\sysWault_Projects\2008-044 NA-1 DMMA\Construction\2008-044-P-DMMA Typical Sections.dwg



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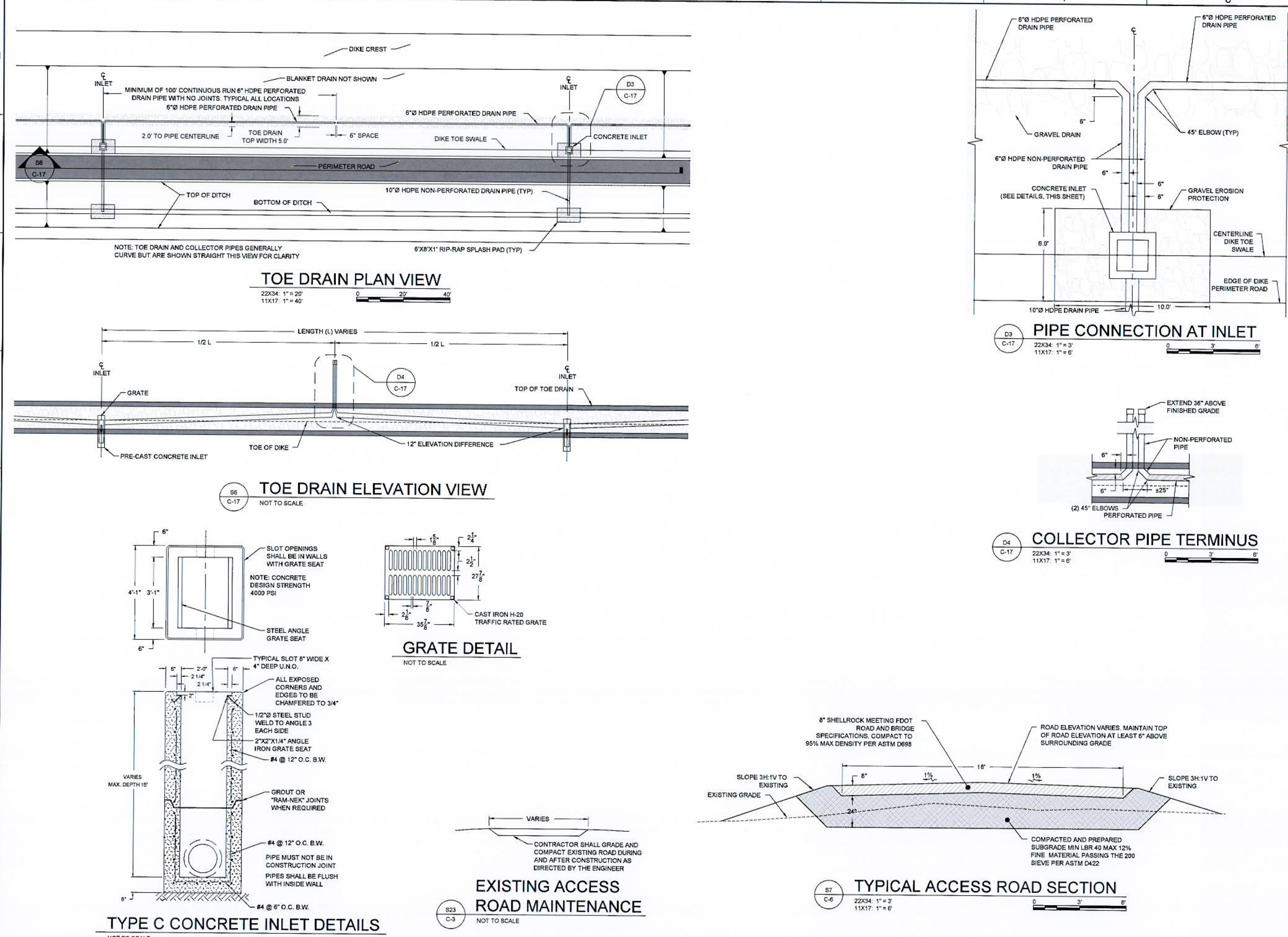
DRAWING TITLE

TOE DRAIN PLAN

C-16

SHEET 16 OF 29

ANTON FLEWELLING , 7/20/2012 1:46:15 PM , X:\qy\Vault_Projects\c2008-044 NA-1 DMMA\Construction\2008-044-C-Toe Drain Plan.dwg



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No 58084
STATE OF FLORIDA
PROFESSIONAL ENGINEER
7-23-12

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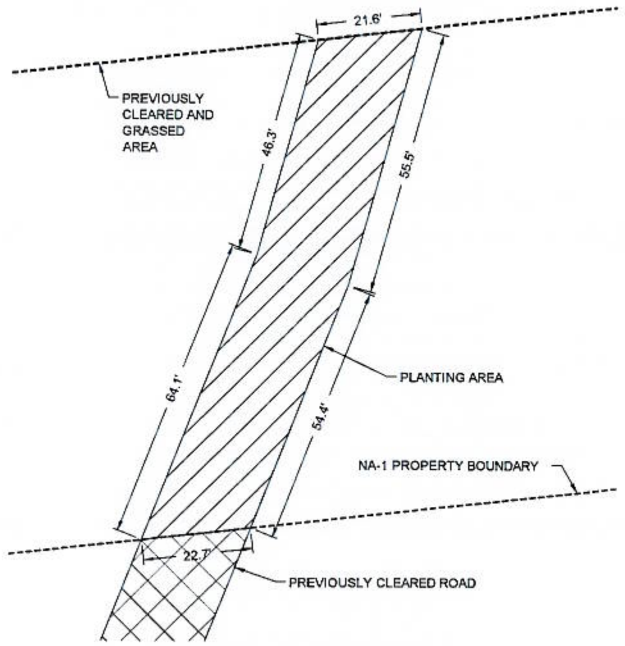
SCALE	AS SHOWN

DRAWING TITLE
TOE DRAIN DETAILS

C-17
SHEET 17 OF 29

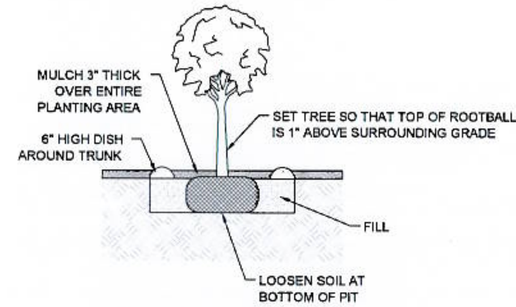
ANTON FLEWELLING , 7/20/2012 1:46:31 PM , X:\tsysVault_Projects\c2008-044 NA-1 DMMA\Construction\2008-044-C-Toe Drain Details.dwg



D1 / C-6 **PLANTING PLAN**

22X34: 1" = 20'
11X17: 1" = 40'

0 20' 40'



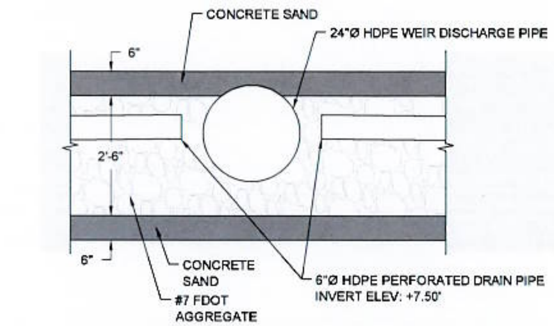
PLANTING DETAIL

NOT TO SCALE

NOTE: ALL TREES ARE TO BE POSITIONED VERTICALLY REGARDLESS OF THE SLOPE OF THE GROUND IN WHICH THEY ARE PLANTED. WATER RINGS ARE TO BE CONSTRUCTED AT RIGHT ANGLES TO THE TREE OR SHRUB OR IN A MANNER IN WHICH THEY WILL MOST EFFECTIVELY SERVE THE PURPOSE OF RETAINING WATER AT THE BASE OF THE PLANT.

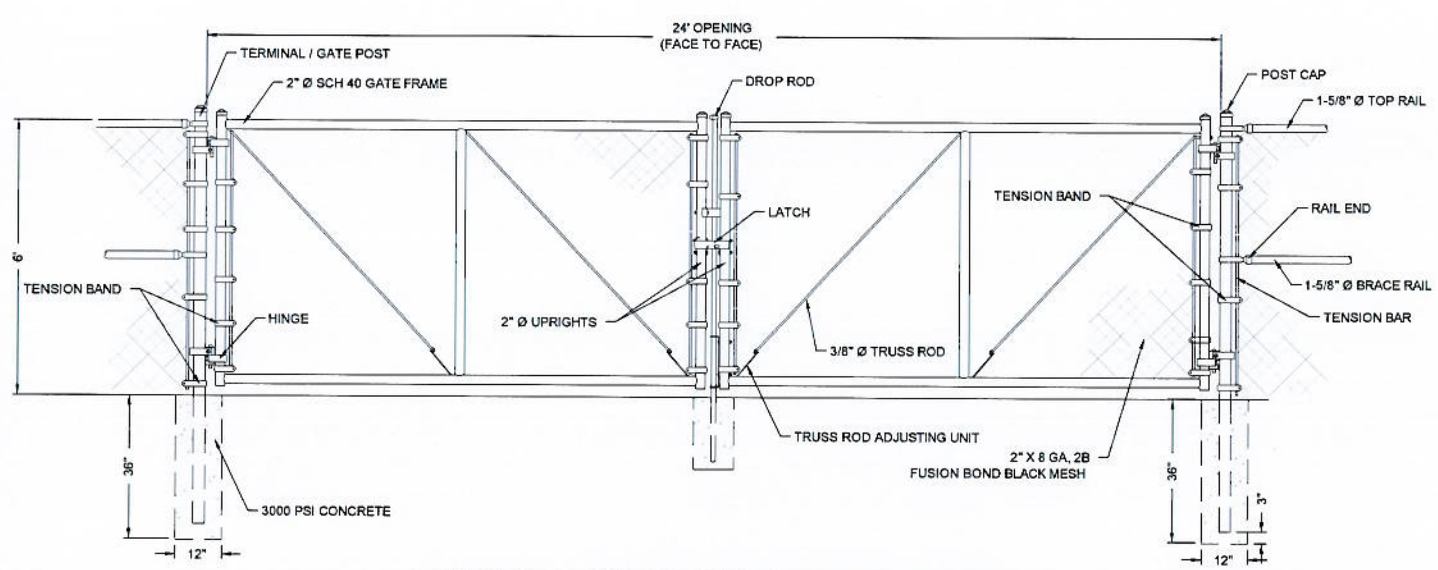
Common Name	Scientific Name	Plant Spacing	Total Units	Size
Live oak	*Quercus virginiana*	Approximately 10 ft (intermixed)	15	3 gal
Southern magnolia	*Magnolia grandiflora*		8	3 gal
Pignut hickory	*Carya glabra*		8	3 gal
Youpon holly	*Ilex vomitoria*	Intermittent among trees (random distribution)	12	1 gal
Saw palmetto	*Serenoa repens*		25	1 gal
American beautyberry	*Callicarpa americana*		25	1 gal

PLANTING SCHEDULE



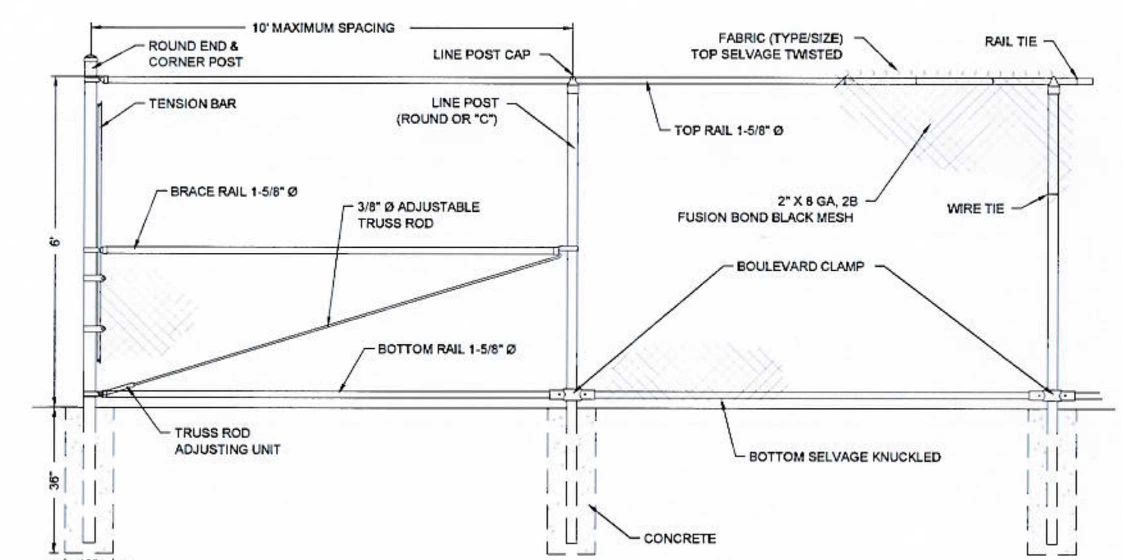
S25 / C-16 **PIPE CROSSING DETAIL**

NOT TO SCALE



24' WIDE DOUBLE HINGE GATE DETAIL

NOT TO SCALE



TYPICAL FENCE DETAIL

NOT TO SCALE

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WEST PALM BEACH, FLORIDA 33401
(561) 640-7510
CERTIFICATE OF AUTHORIZATION # 4815

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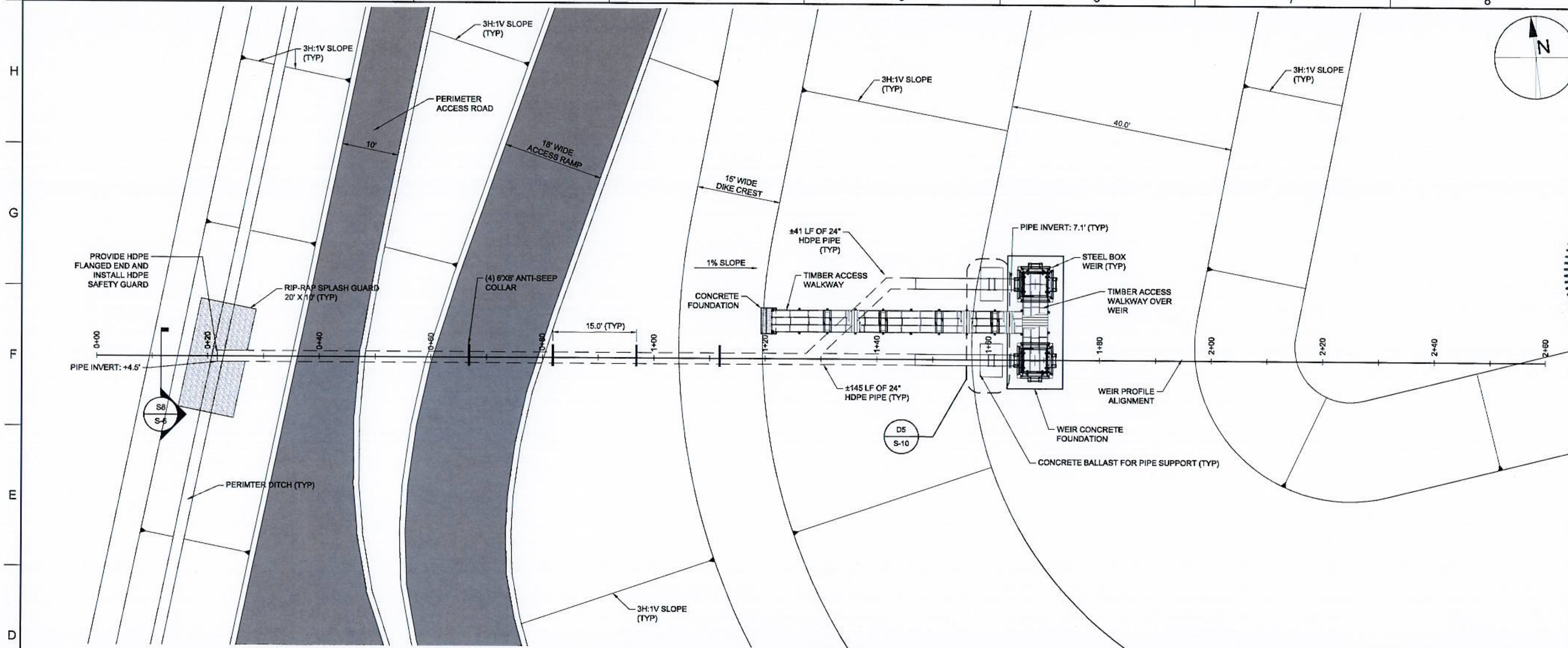
DRAWING TITLE
PLANTING PLAN AND FENCE DETAILS

C-18

SHEET 18 OF 29

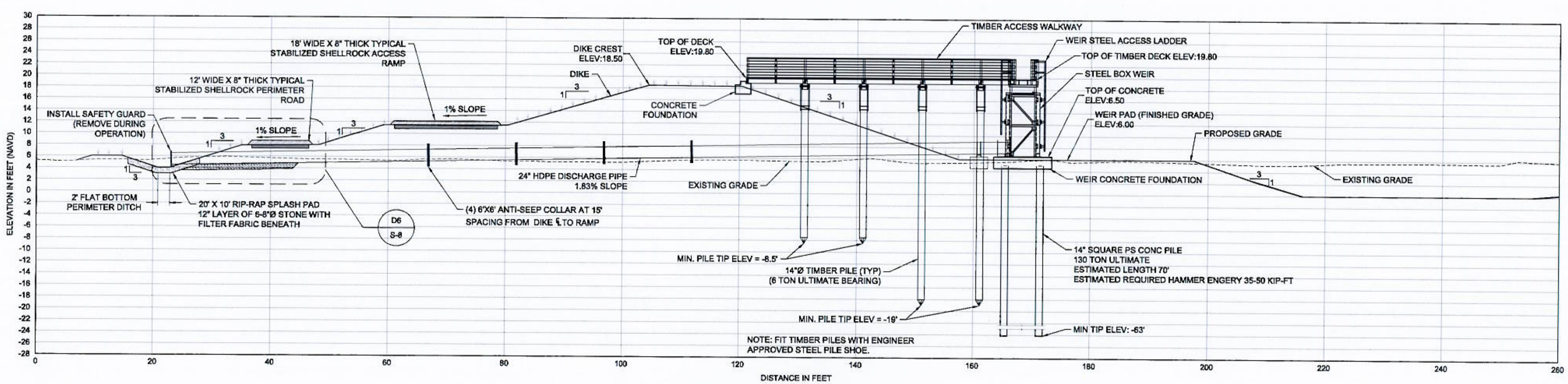
ANTON FLEWELLING , 7/20/2012 1:48:40 PM , X:\sysWaut_Projects\2008-044 NA-1 DMMA\Construction\2008-044-C-Fence Details.dwg



D2 C-12

WEIR - PLAN

22X34: 1" = 10'
11X17: 1" = 20'



WEIR - PROFILE

22X34: 1" = 10'
11X17: 1" = 20'

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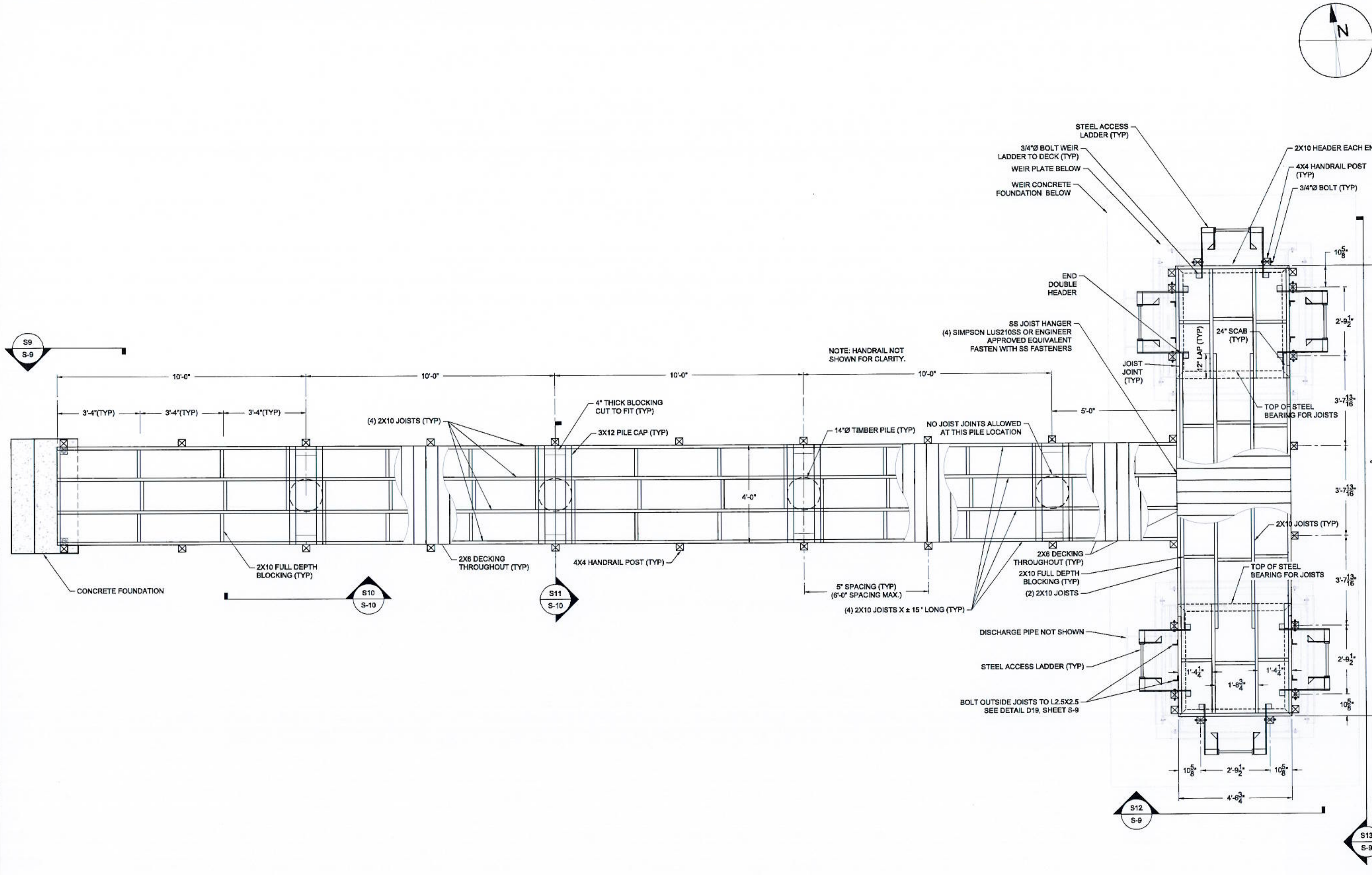
DRAWING TITLE
WEIR PLAN AND PROFILE

S-1
SHEET 19 OF 29

ANTON FLEWELLING , 7/20/2012 1:47:04 PM , X:\sys\Vault_Projects\c2008-044 NA-1 DMMA\Construction\c2008-044-C-Weir Plan.dwg



WEIR WALKWAY PLAN

22X34: 1" = 2'
11X17: 1" = 4'

0 2' 4'

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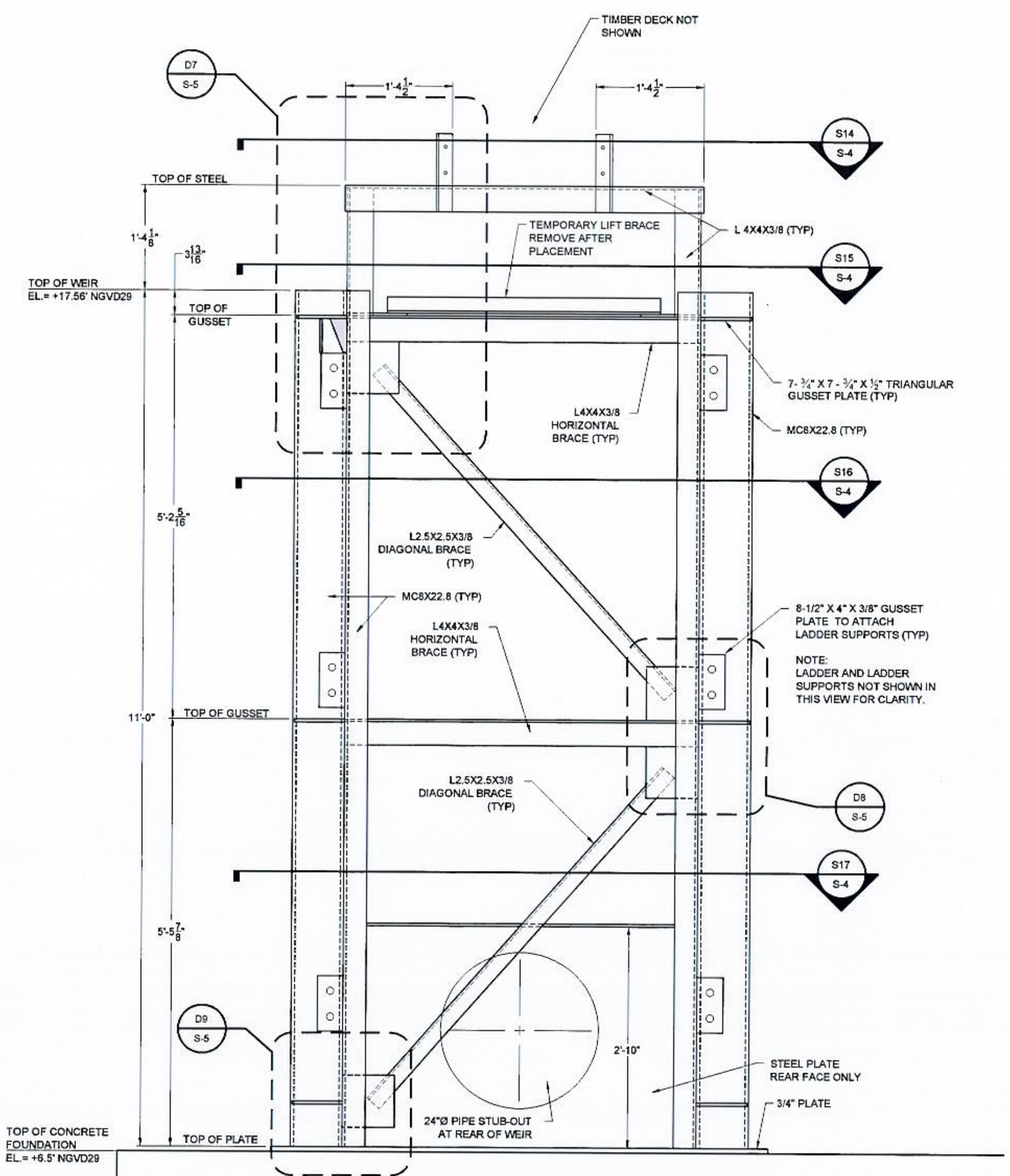
DRAWING TITLE
WEIR WALKWAY PLAN

S-2

SHEET 20 OF 29

ANTON FLEWELLING , 7/20/2012 1:47:14 PM , X:\sysVault_Projects\c2008-044 NA-1 DMMA\Construction\c2008-044-C-Weir Walkway Plan.dwg

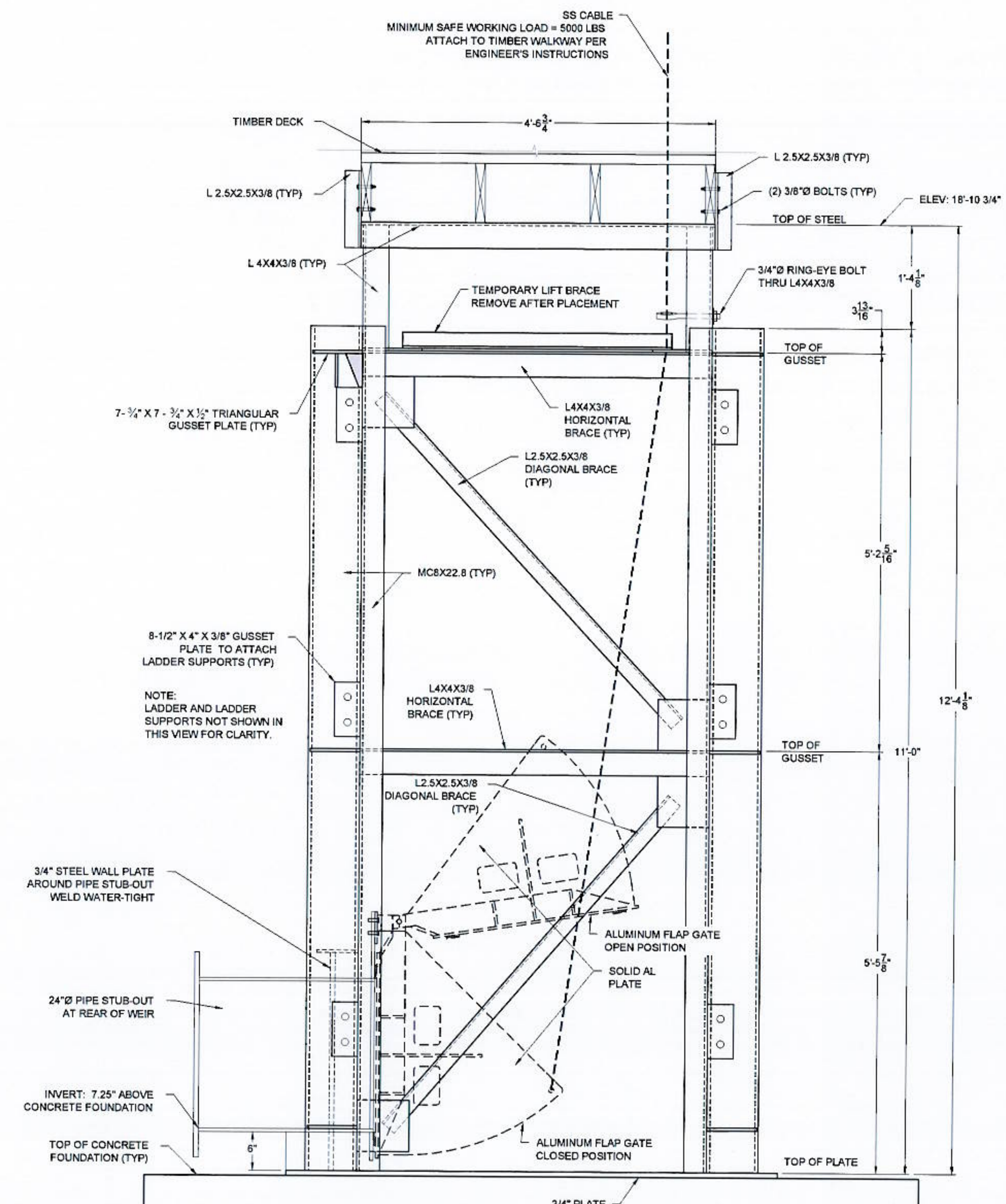


S19
S-4

WEIR FRONT ELEVATION (TYP)

22X34: 1" = 1'
11X17: 1/2"= 1'

0 1/2' 1' 2'



S-20
S-4

WEIR SIDE ELEVATION (TYP)

22X34: 1" = 1'
11X17: 1/2"= 1'

0 1/2' 1' 2'

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(561)-640-7...

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DRAWING TITLE
STEEL BOX WEIR DETAILS 1

S-3

SHEET 21 OF 29

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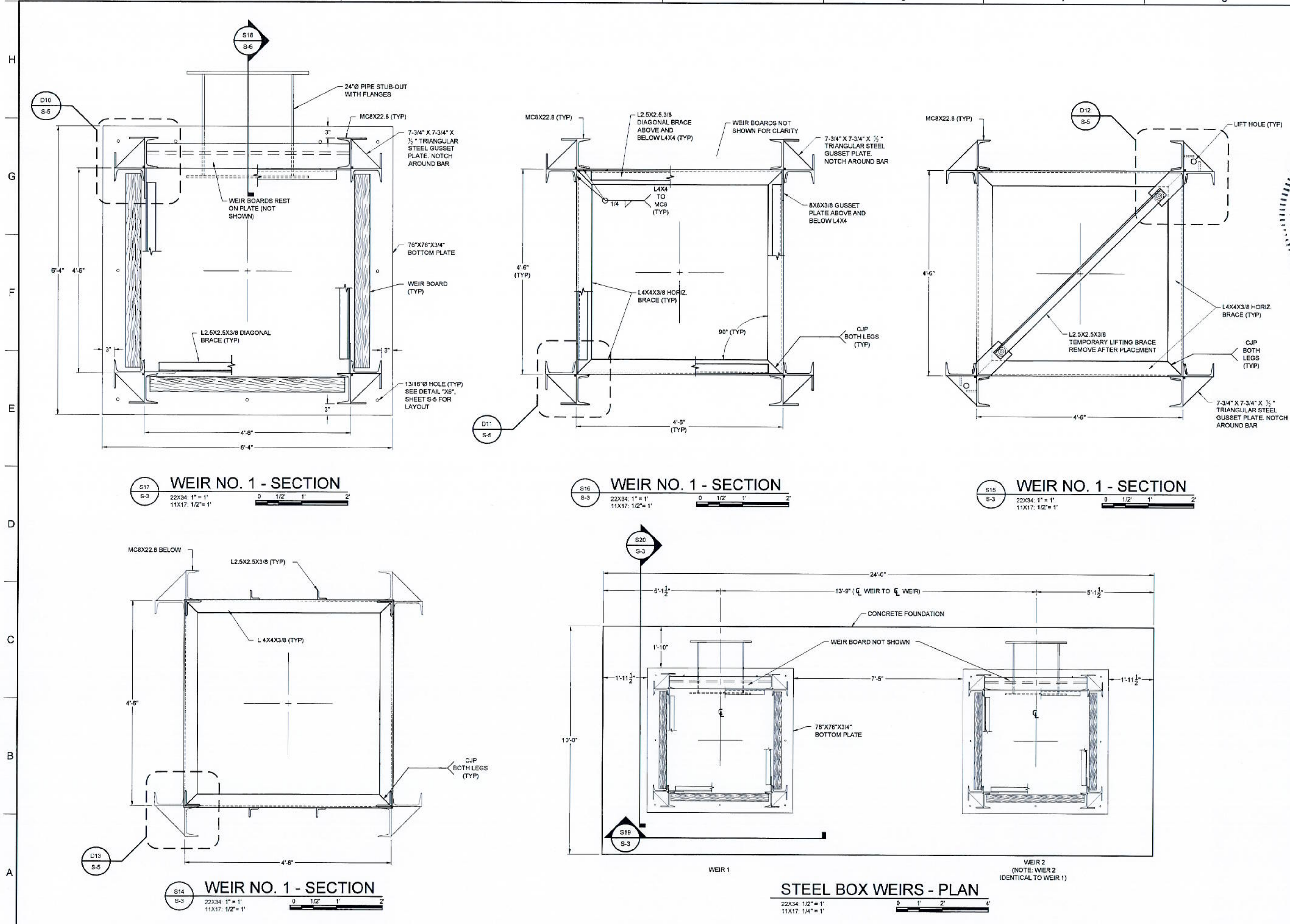

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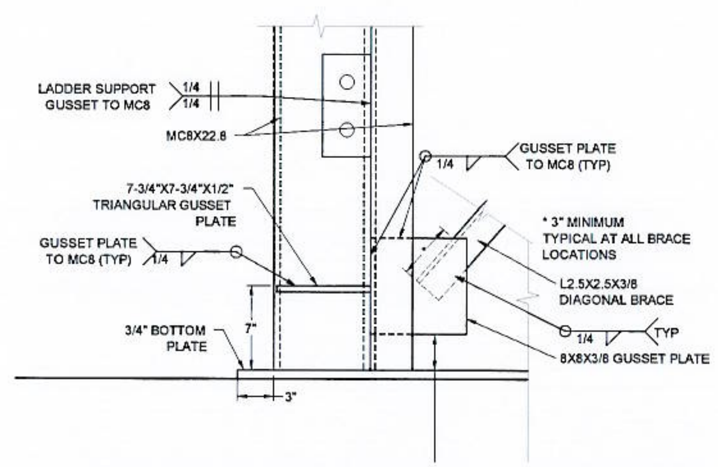
DRAWING TITLE

STEEL BOX WEIR DETAILS 2

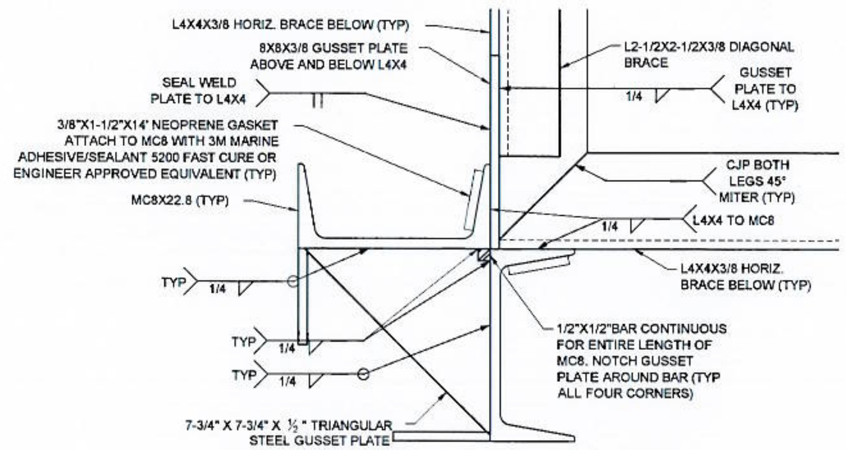
S-4

SHEET 22 OF 29

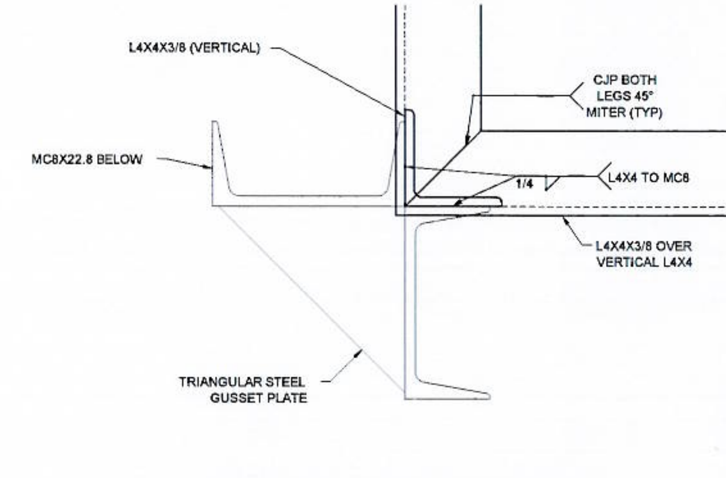
ANTON FLEWELLING , 7/20/2012 1:47:27 PM , X:\sys\Vault_Projects\c2008-044 NA-1 DMMA\Construction\c2008-044-C-Weir Details.dwg



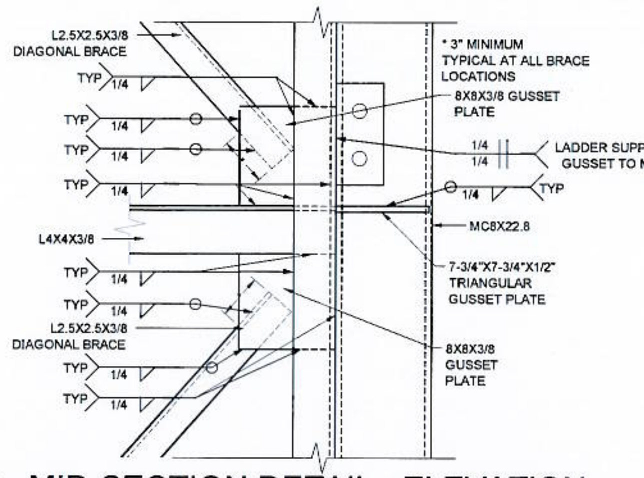
D9 S-3 BOTTOM CORNER DETAIL - ELEVATION
22X34: 1-1/2" = 1'
11X17: 3/4" = 1'



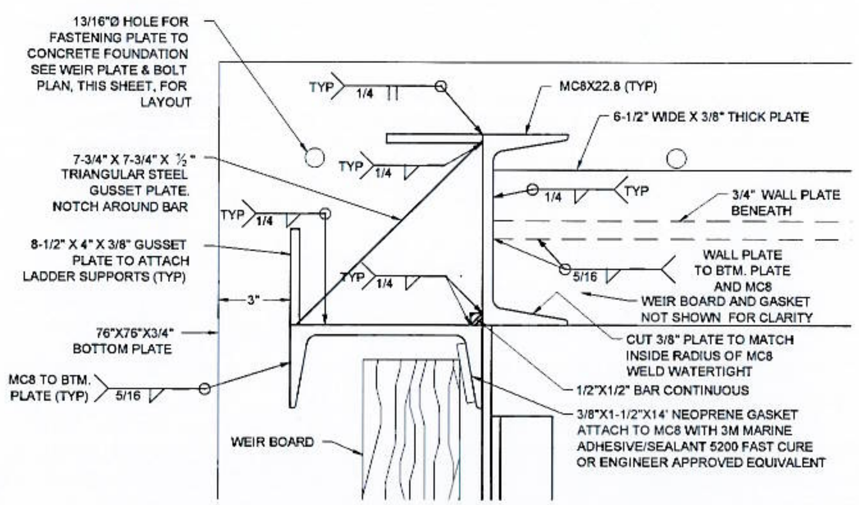
D11 S-4 MID-SECTION DETAIL - PLAN
22X34: 3" = 1'
11X17: 1-1/2" = 1'



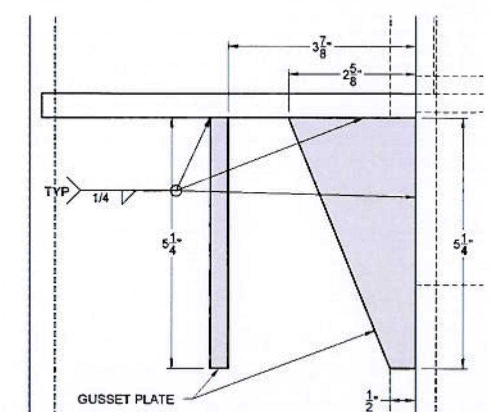
D13 S-4 CORNER DETAIL - PLAN
22X34: 3" = 1'
11X17: 1-1/2" = 1'



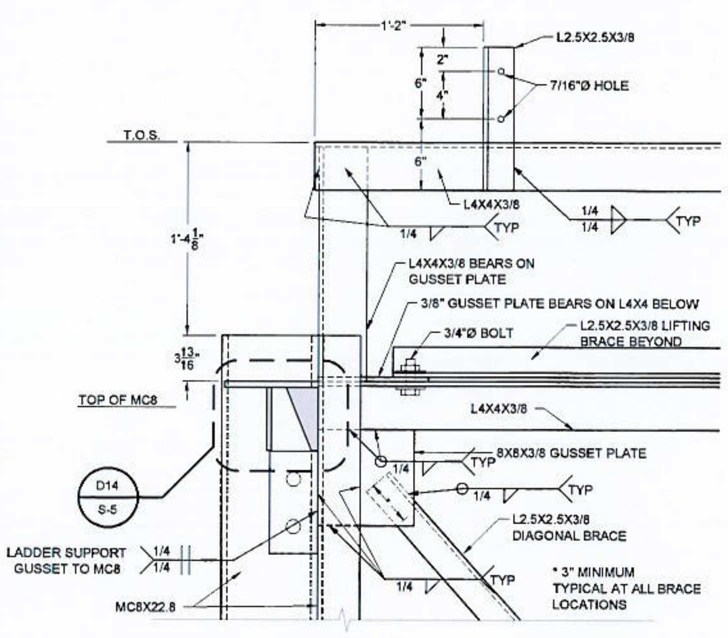
D8 S-3 MID-SECTION DETAIL - ELEVATION
22X34: 1-1/2" = 1'
11X17: 3/4" = 1'



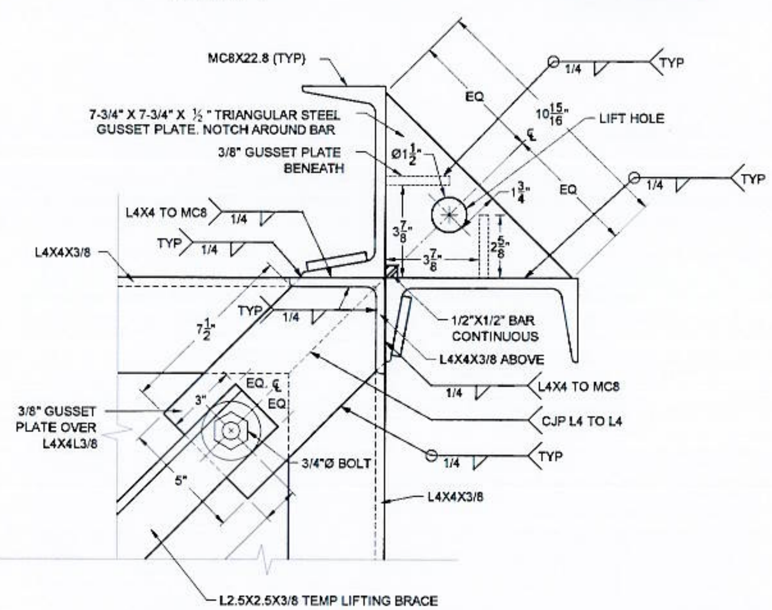
D10 S-4 BOTTOM CORNER DETAIL - PLAN
22X34: 3" = 1'
11X17: 1-1/2" = 1'



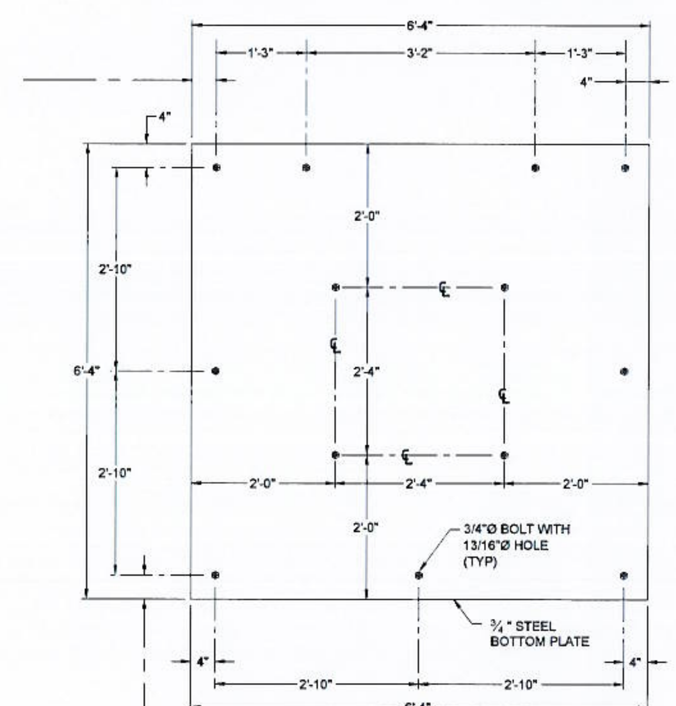
D14 S-5 TOP CORNER GUSSET PLATE - DETAIL
22X34: 6" = 1'
11X17: 3" = 1'



D7 S-3 TOP CORNER DETAIL - ELEVATION
22X34: 1-1/2" = 1'
11X17: 3/4" = 1'



D12 S-4 CORNER DETAIL AT LIFT HOLE - PLAN
22X34: 3" = 1'
11X17: 1-1/2" = 1'



WEIR PLATE & BOLT PLAN
22X34: 3/4" = 1'
11X17: 3/8" = 1'

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CHECKED	KAK
REVIEWED	JA/JTA
SCALE	AS SHOWN

DRAWING TITLE
STEEL BOX WEIR DETAILS 3

S-5
SHEET 23 OF 29

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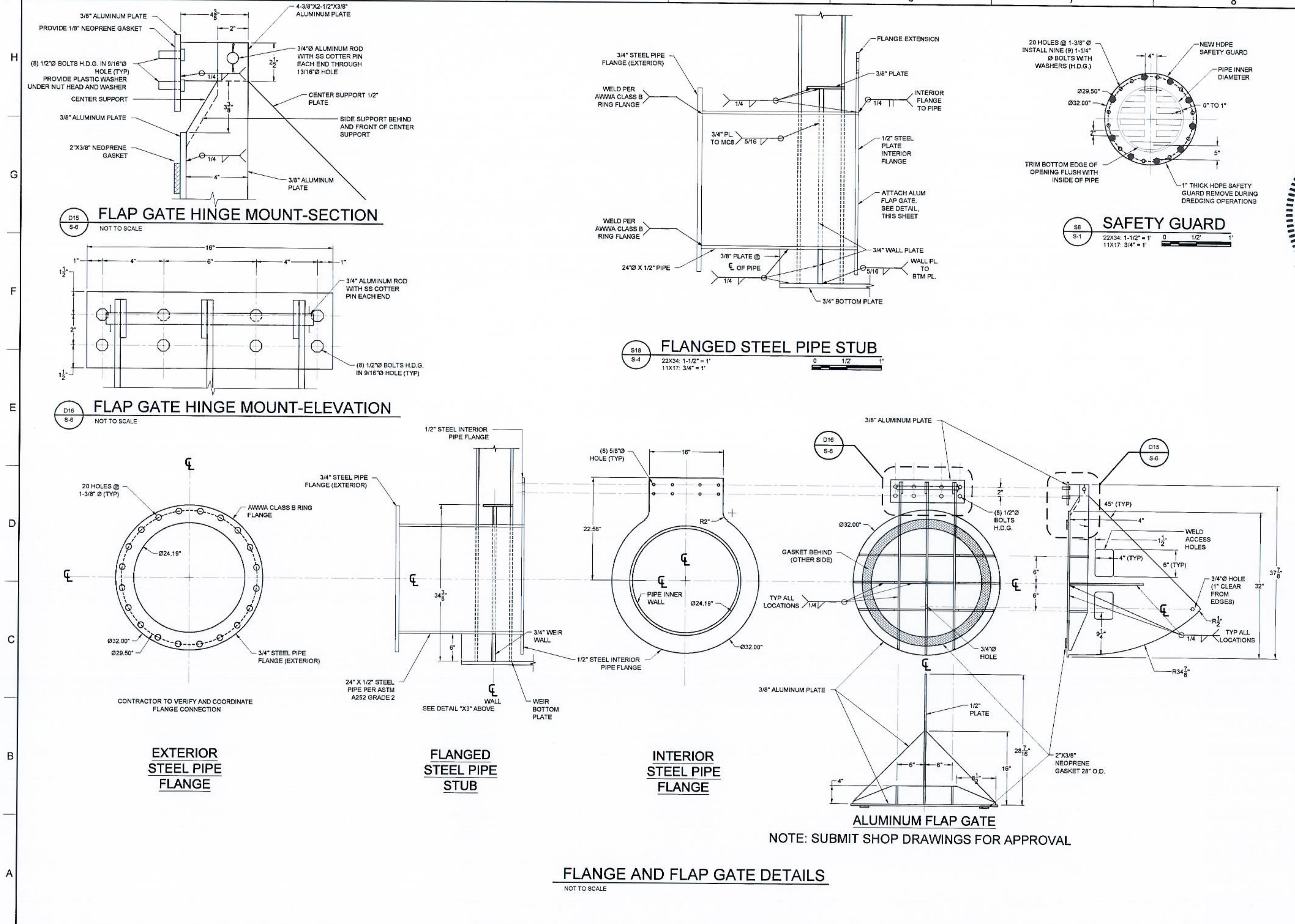

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DRAWING TITLE
STEEL BOX WEIR PIPE AND FLAP GATE DETAILS

S-6

SHEET 24 OF 29

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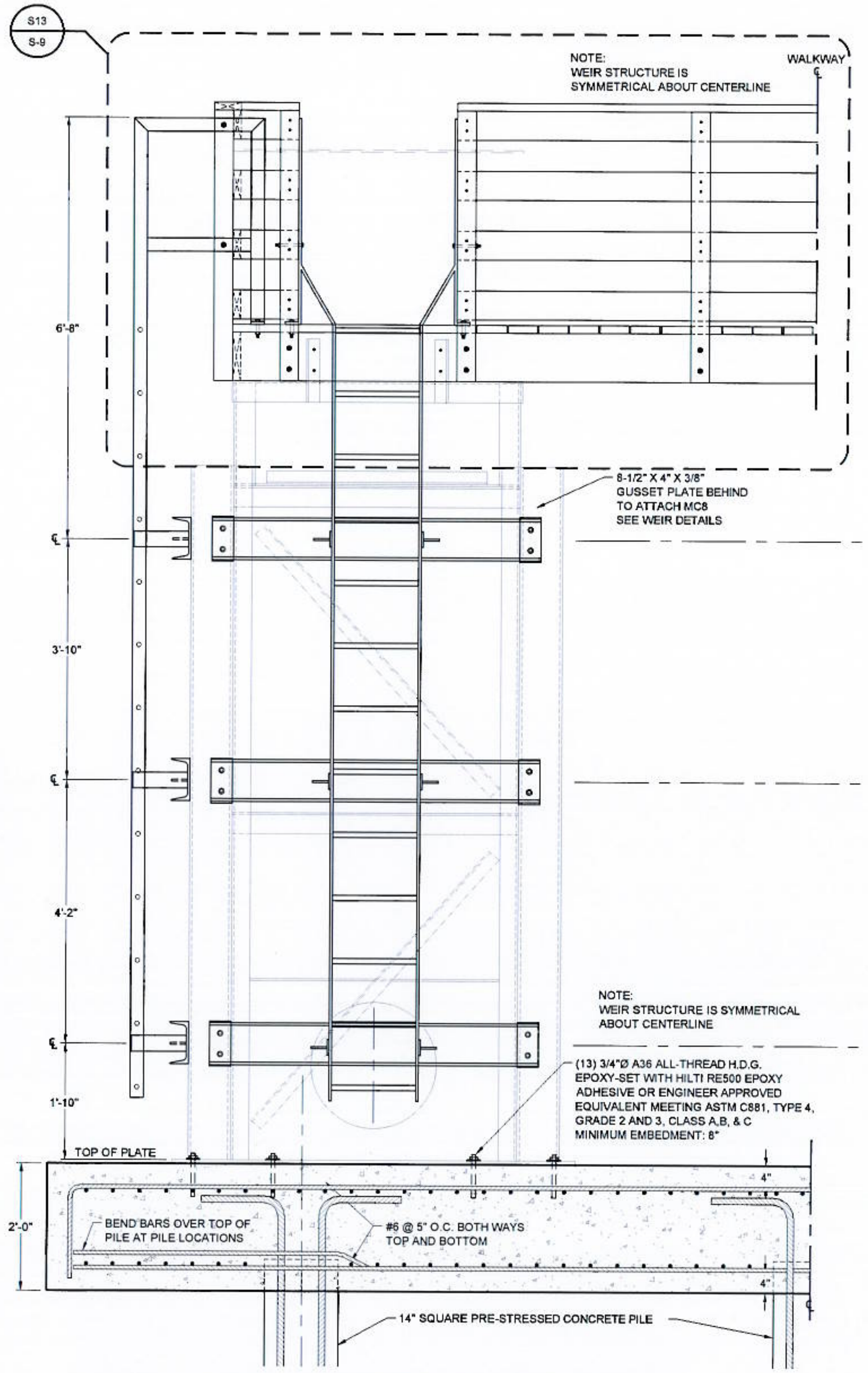
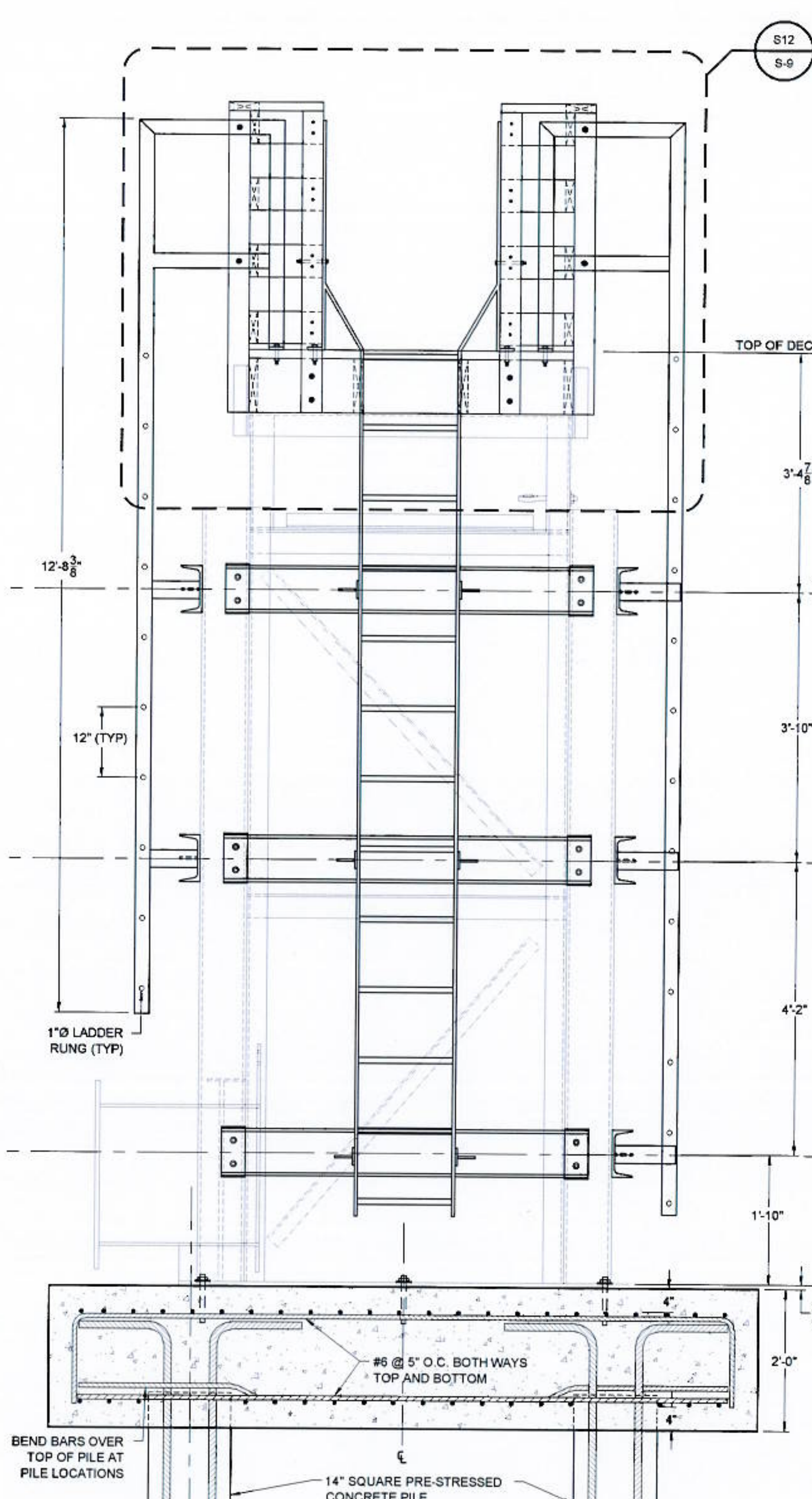


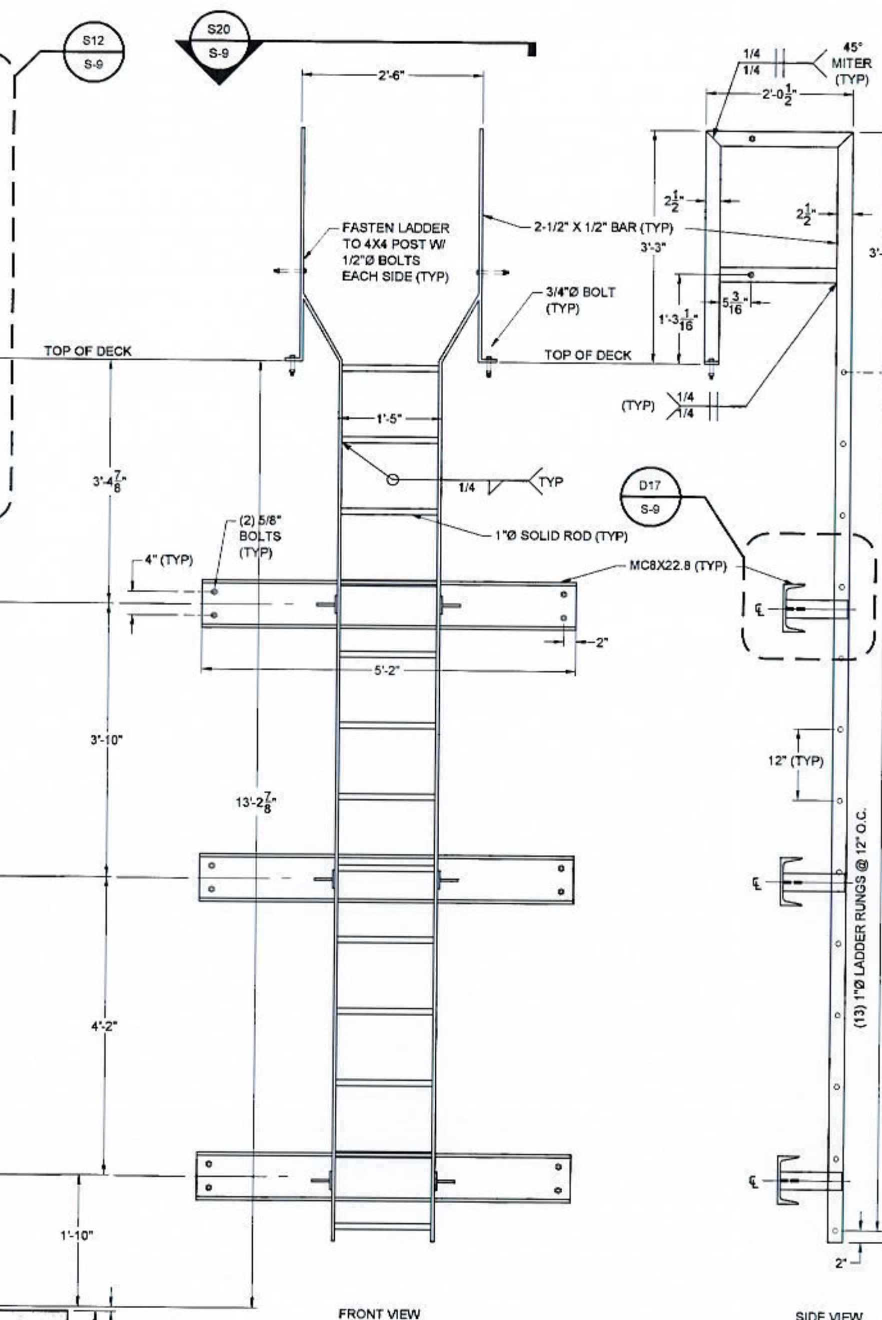
WEIR LADDER - FRONT ELEVATION (TYP)

22X34: 3/4" = 1'
11X17: 3/8" = 1'



WEIR LADDER - SIDE ELEVATION (TYP)

22X34: 3/4" = 1'
11X17: 3/8" = 1'



WEIR LADDER
FRONT AND SIDE VIEW (TYP)

22X34: 3/4" = 1'
11X17: 3/8" = 1'

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DRAWING TITLE
STEEL BOX WEIR LADDER AND FOUNDATION DETAIL

S-7

SHEET 25 OF 29

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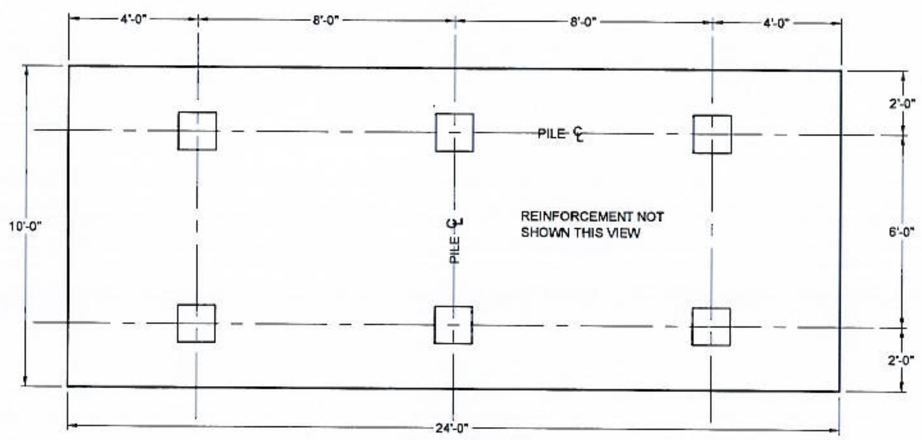
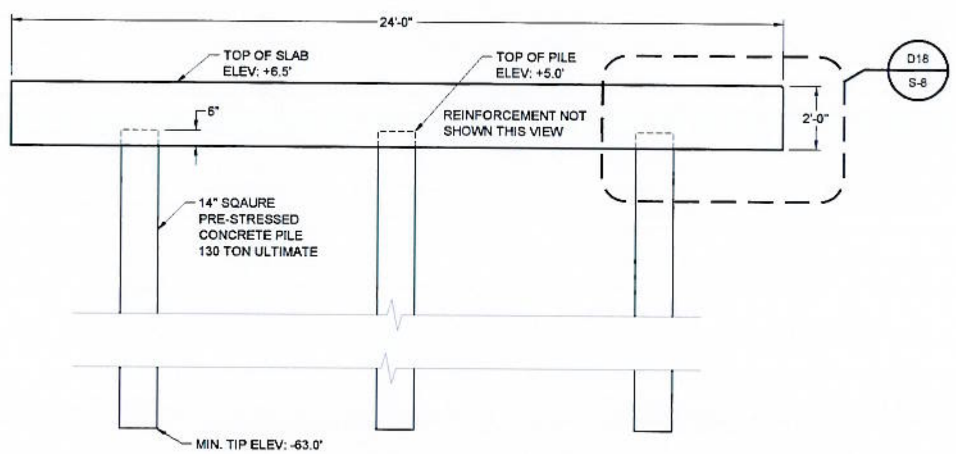


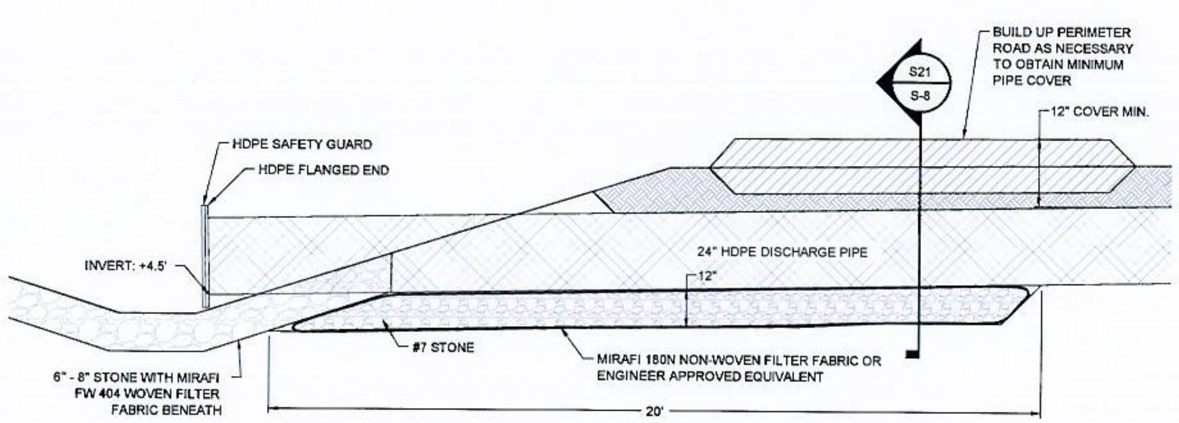
PLAN VIEW



ELEVATION VIEW

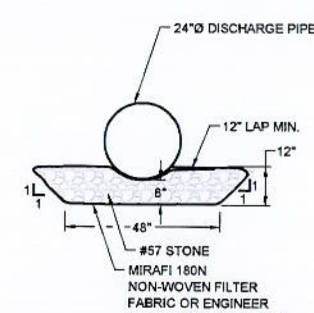
WEIR SLAB TYPICAL PILE LAYOUT

22X34: 1" = 3'
11X17: 1" = 6'



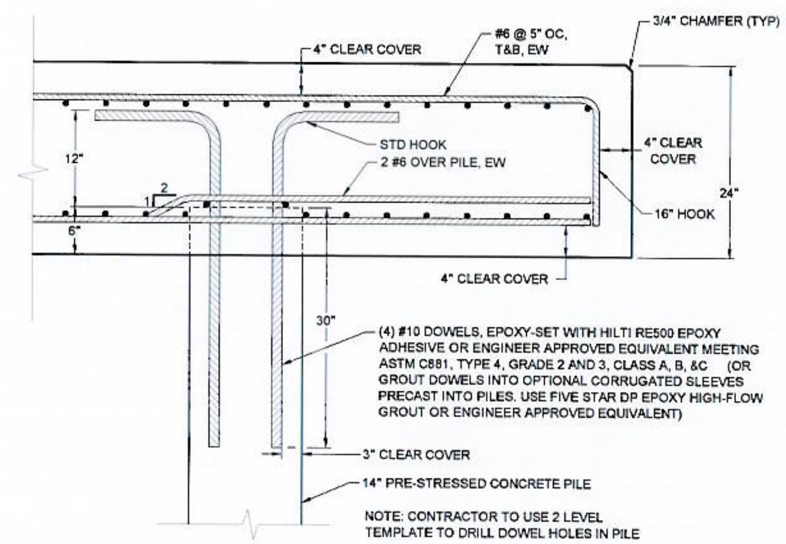
D6 S-1 DISCHARGE PIPE DETAIL

22X34: 1" = 30'
11X17: 1" = 60'



S21 S-8 SECTION A

22X34: 1" = 30'
11X17: 1" = 60'



D18 S-8 PILE TO SLAB TYPICAL CONNECTION

22X34: 1" = 1'
11X17: 1" = 2'

PRE-STRESSED PILING NOTES:

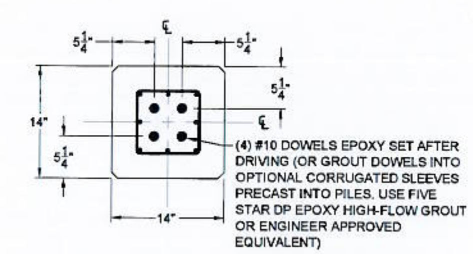
CONCRETE STRENGTH SHALL BE 6000 PSI MINIMUM AT 28 DAYS.

PILES WILL BE USED IN A SALT WATER ENVIRONMENT. THE CONCRETE MIX DESIGN REQUIRES SILICA FUME. SEE SPECIFICATIONS FOR DETAILED CONCRETE MATERIAL AND MIX DESIGN REQUIREMENTS.

PRE-STRESSED PILING SHALL HAVE 700 PSI (MIN.) PRE-STRESS. PRE-STRESSED PILINGS SHALL BE DESIGNED BY A FLORIDA LICENSED PROFESSIONAL ENGINEER AND SHALL BE CAPABLE OF RESISTING THE FOLLOWING FACTORED LOADS:

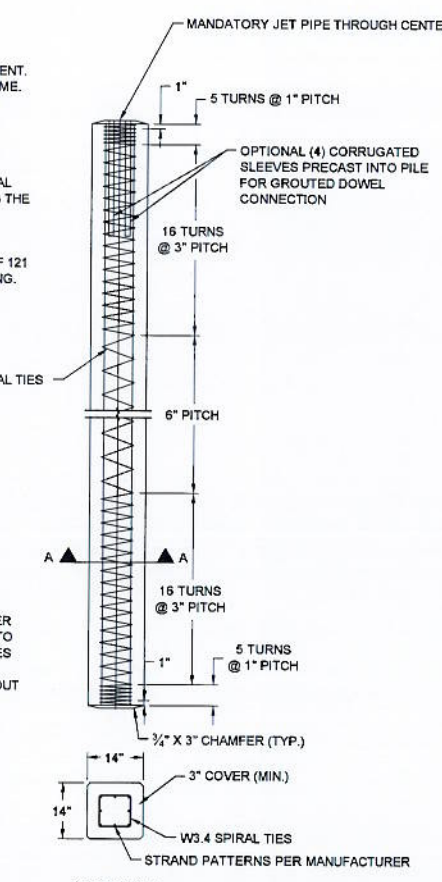
14 INCH PILES:
COMBINED AXIAL LOAD AND BENDING MOMENT OF 121 KIPS AXIAL (COMPRESSION) AND 37 KIP-FT BENDING.

h/r=50



PILE DOWEL LOCATION

22X34: 1" = 1'
11X17: 1" = 2'



14" PRE-STRESSED CONCRETE PILE

22X34: 1" = 2'
11X17: 1" = 4'

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DRAWING TITLE
WEIR PILE LAYOUT AND DETAILS

S-8

SHEET 26 OF 29

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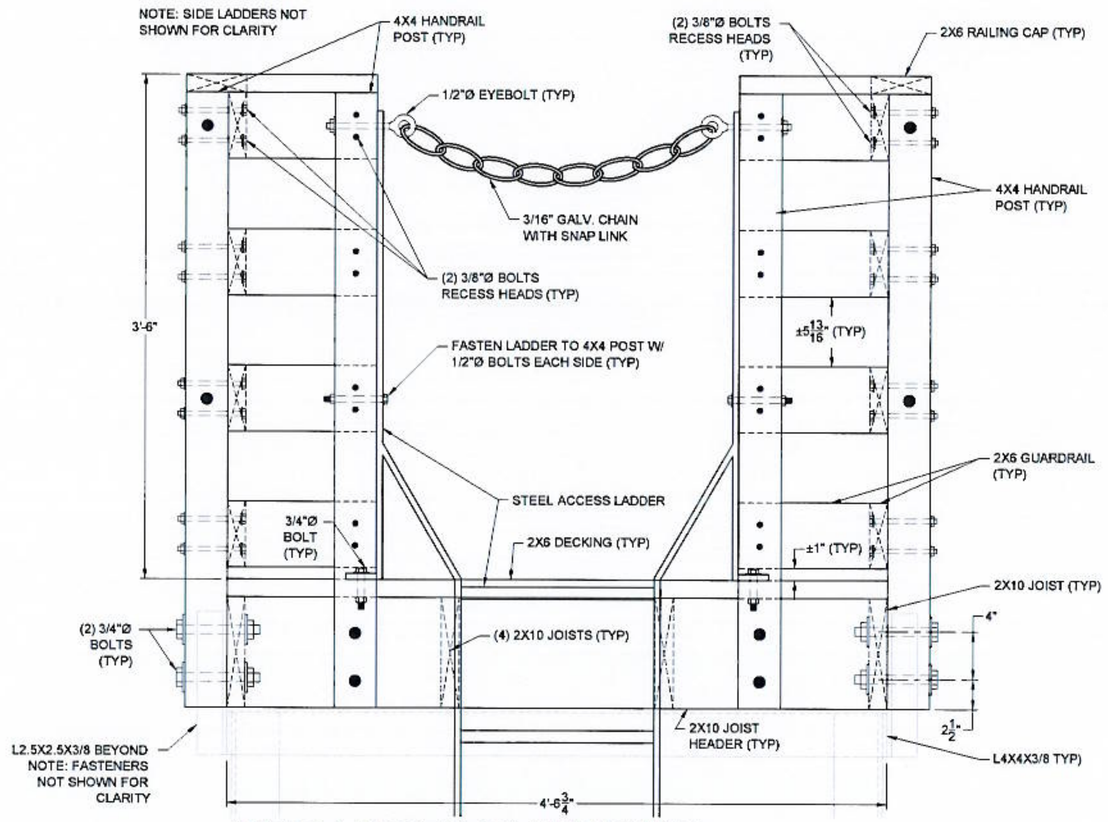
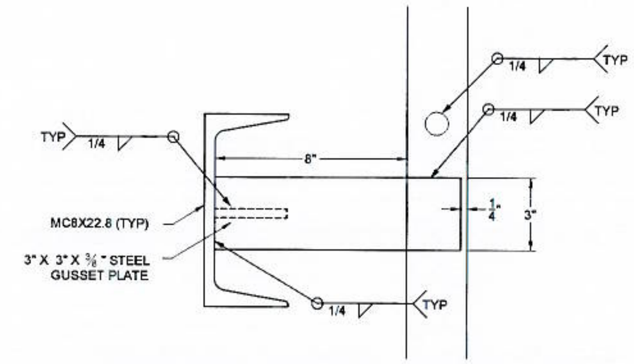


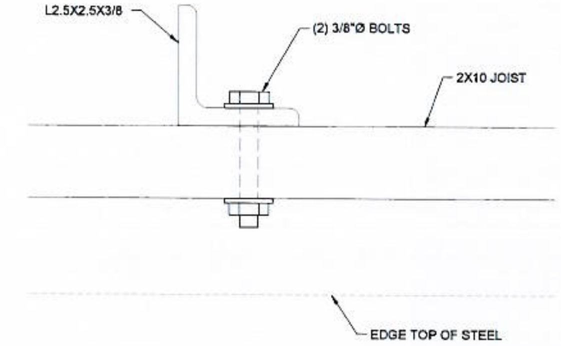
WEIR LADDER TO WALKWAY CONNECTION - SIDE ELEVATION (TYP)

S12 / S-2
22X34: 1-1/2" = 1'
11X17: 3/4" = 1'
0 1/2' 1'



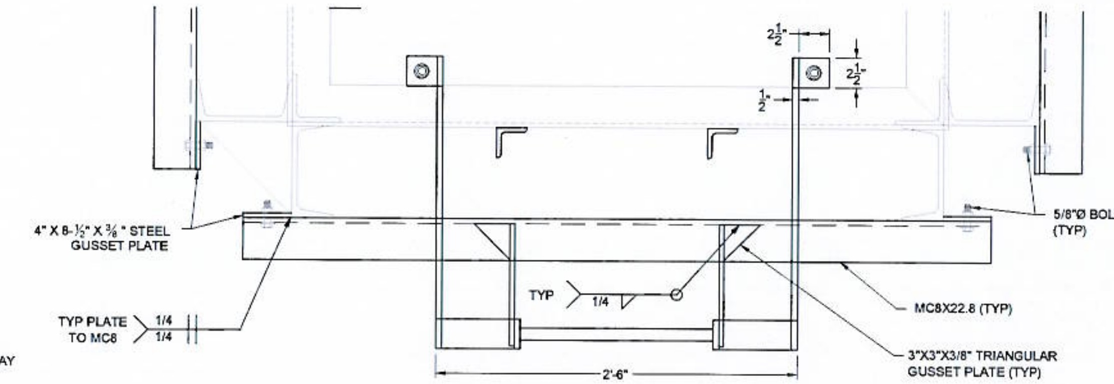
LADDER SUPPORT (TYP) - ELEV

D17 / S-7
22X34: 3" = 1'
11X17: 1-1/2" = 1'
0 3" 6"



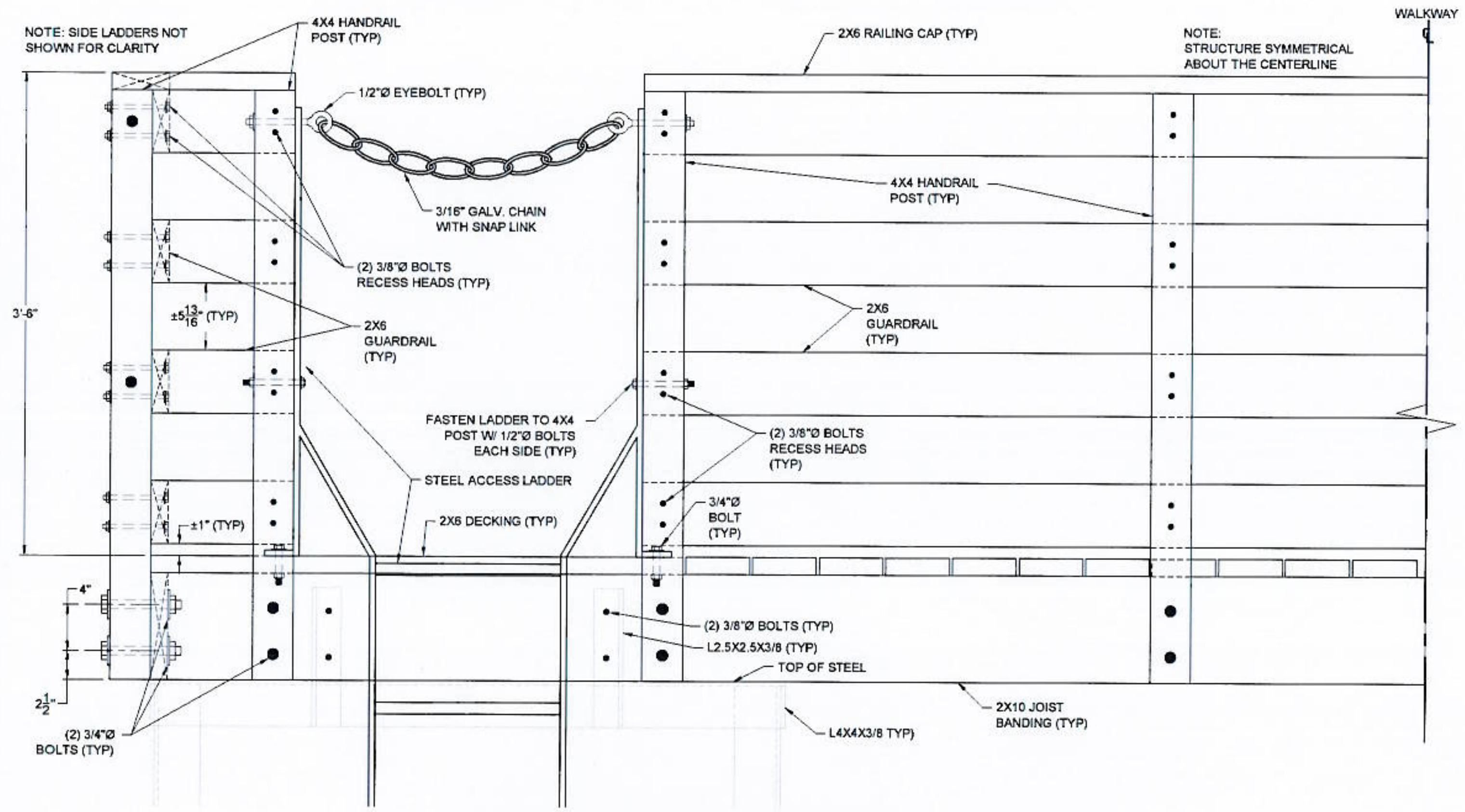
STEEL TO JOIST CONNECTION (TYP) - PLAN

D19 / S-2
22X34: 6" = 1'
11X17: 3" = 1'
0 1" 2" 3"



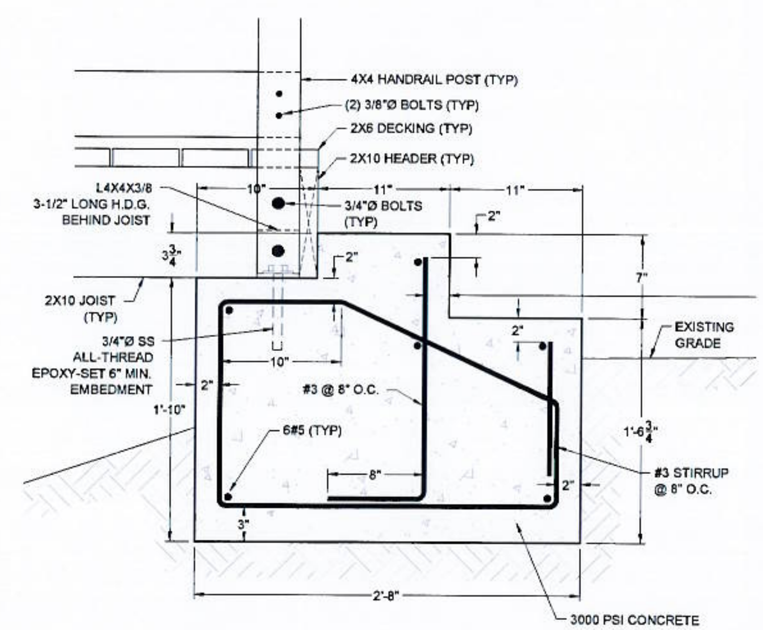
WEIR LADDER (TYP) - PLAN

S20 / S-7
22X34: 1-1/2" = 1'
11X17: 3/4" = 1'
0 1/2' 1'



WEIR LADDER TO WALKWAY CONNECTION - FRONT ELEVATION (TYP)

S13 / S-2
22X34: 1-1/2" = 1'
11X17: 3/4" = 1'
0 1/2' 1'



WALKWAY CONCRETE FOOTER - SECTION

S9 / S-2
22X34: 1-1/2" = 1'
11X17: 3/4" = 1'
0 1/2' 1'

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DRAWING TITLE
WEIR WALKWAY AND LADDER DETAILS

S-9

SHEET 27 OF 29

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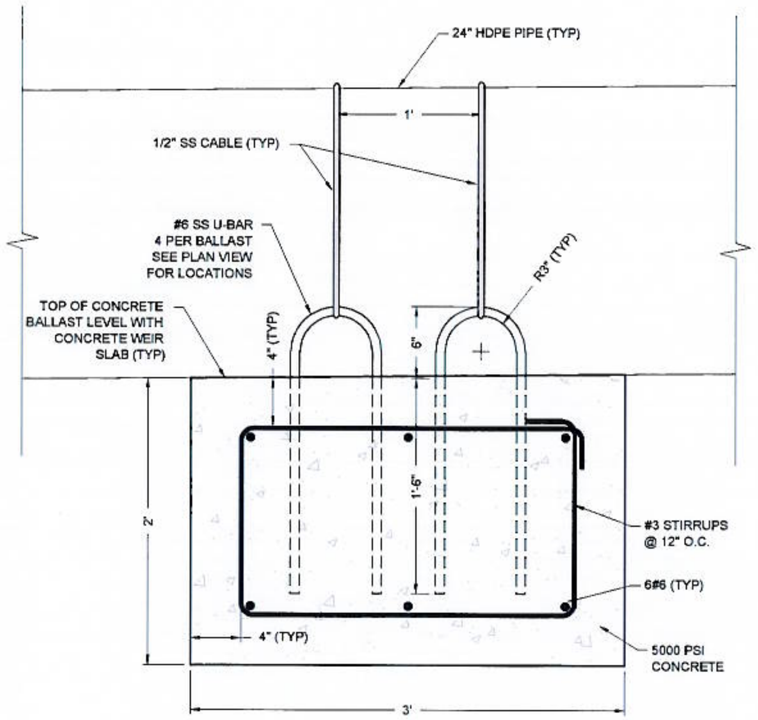
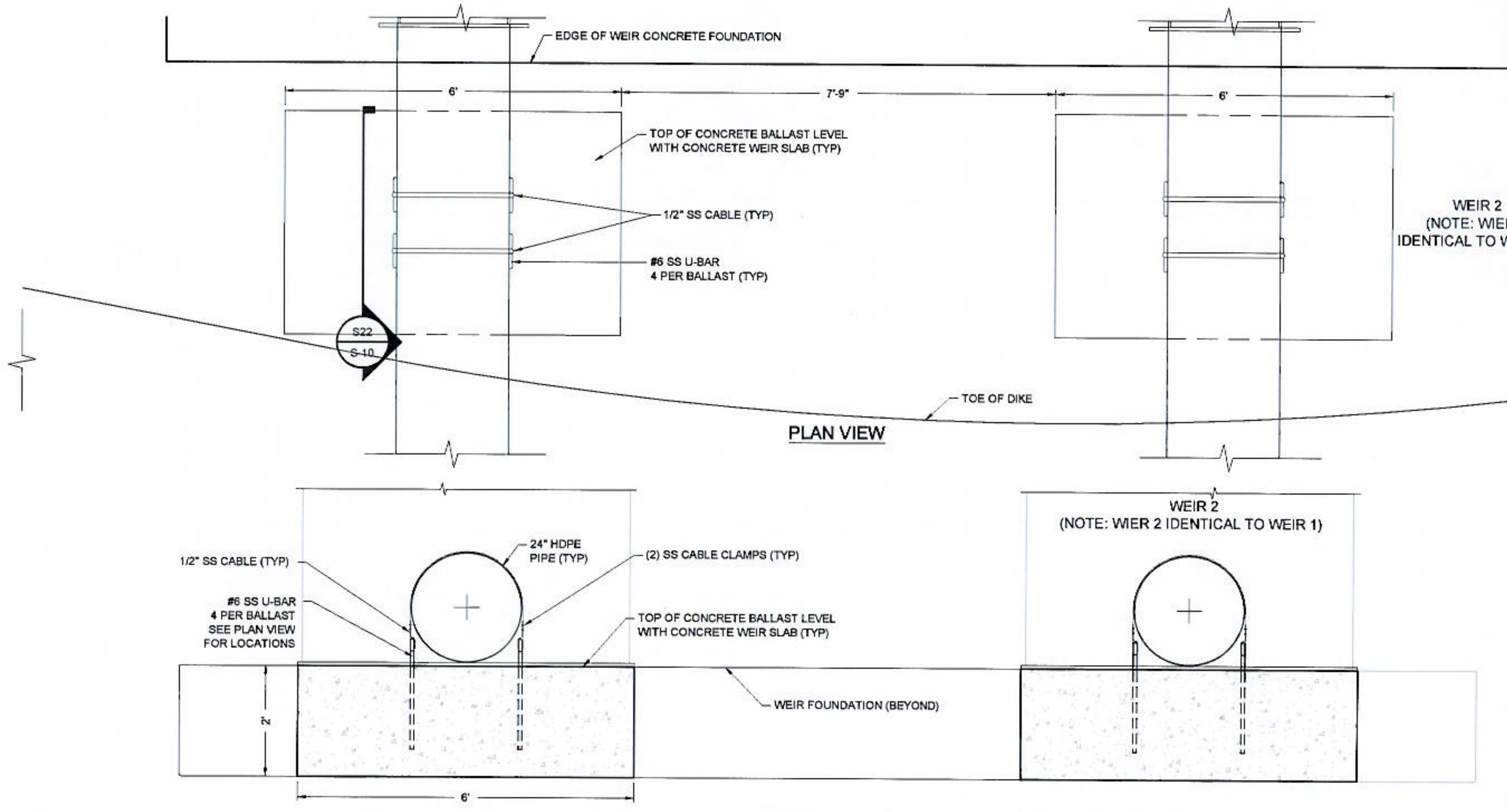


S22 / S-10 CONCRETE BALLAST - SECTION

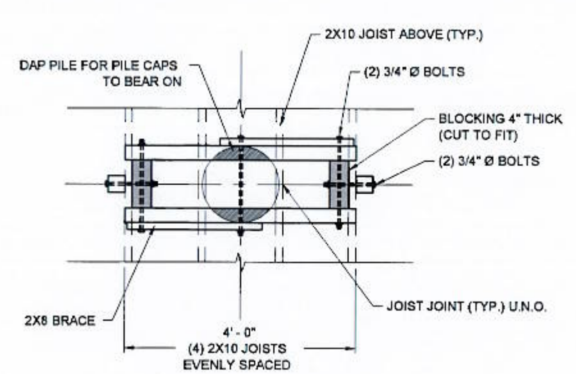
22X34: 1-1/2" = 1'
11X17: 3/4" = 1'

0 1/2' 1'



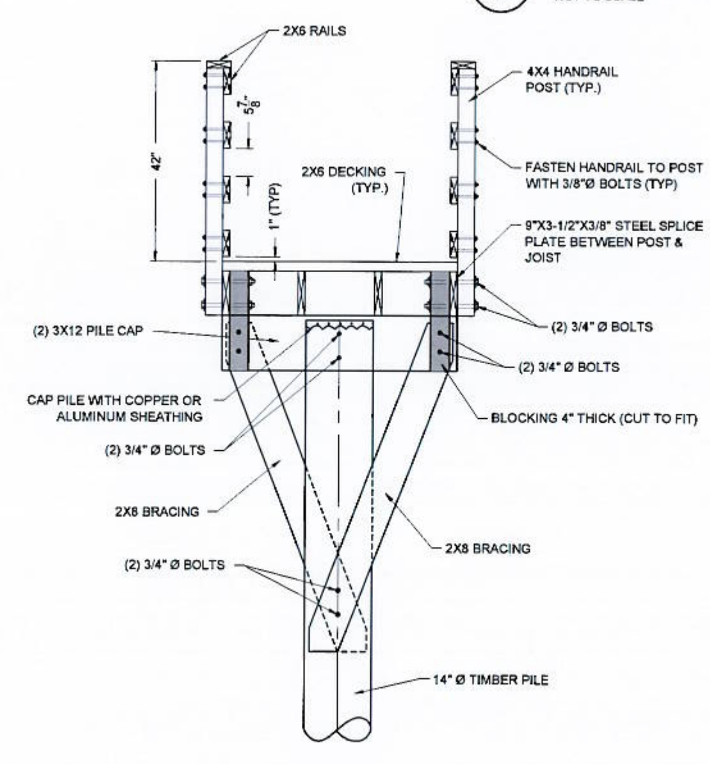
D5 / S-1 CONCRETE BALLAST - PLAN AND ELEVATION

NOT TO SCALE



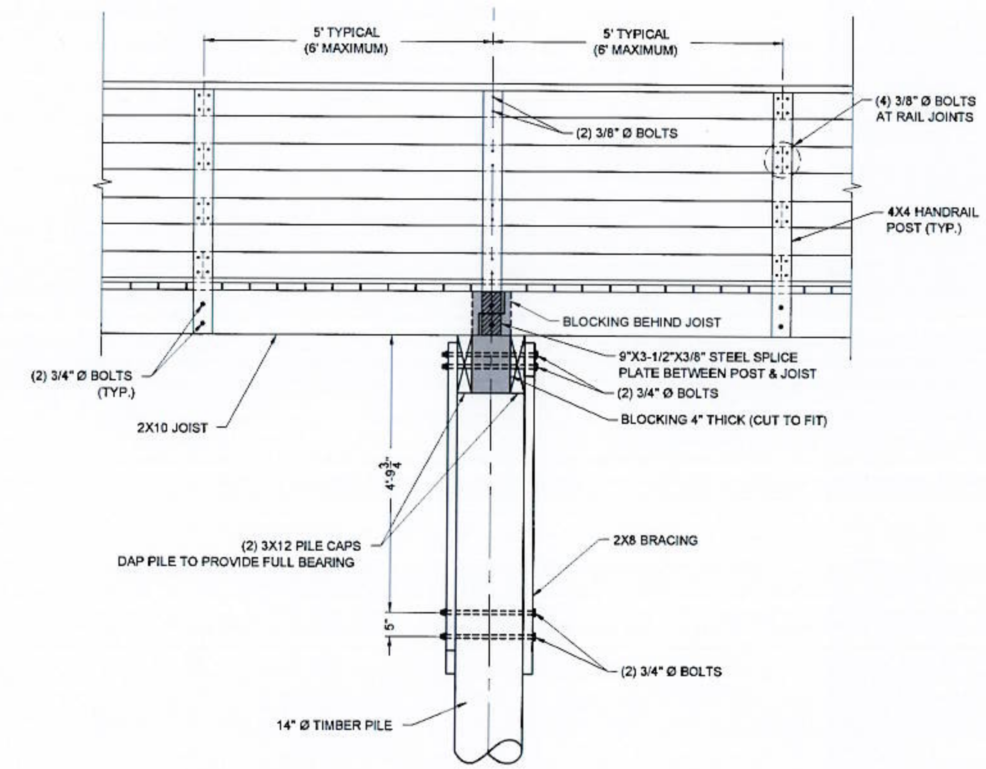
PILE CAP & JOINT DETAIL - PLAN

NOT TO SCALE



S11 / S-2 PILE CAP & WALKWAY DETAIL - SECTION

NOT TO SCALE



S10 / S-2 PILE CAP & WALKWAY DETAIL - ELEVATION

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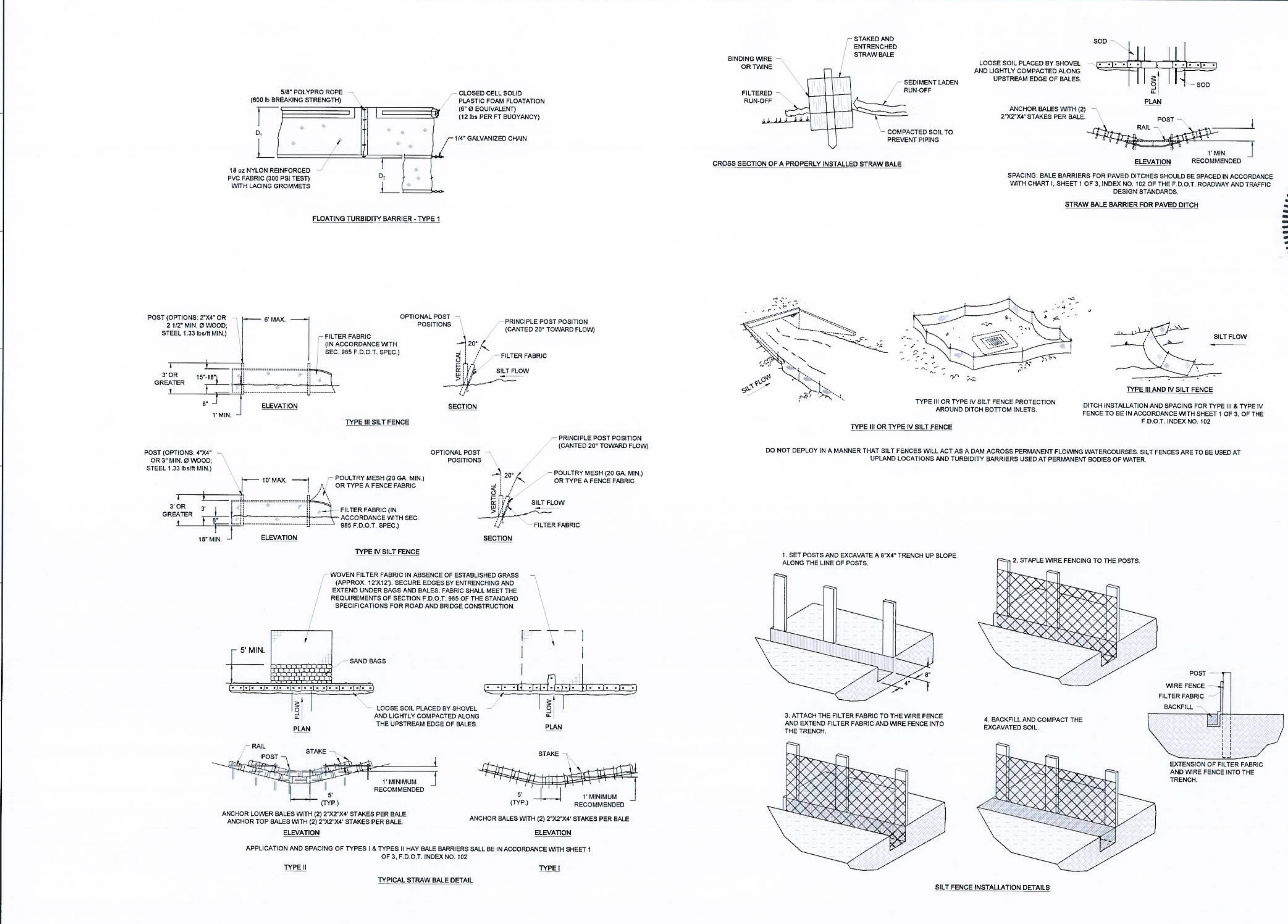
DRAWING TITLE

WEIR WALKWAY AND
BALLAST DETAILS

S-10

SHEET 28 OF 29



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DRAWING TITLE
EROSION CONTROL DETAILS

ER-1
SHEET 29 OF 29

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Engineering Narrative
Crane Island Disposal Area

This narrative is a summary of the documents which comprise the permit application package submitted to obtain a long-term dredge/fill permit for the development of the Crane Island dredged material disposal area as a permanent facility to service the maintenance requirements of the Atlantic Intracoastal Waterway (AIWW) from Fernandina Harbor to Nassau Sound. The submission of this application package represents an intermediate step towards the completion of the second phase of a two phase project sponsored by the Florida Inland Navigation District. Phase I of the project, which is documented in a report included as Attachment 6 to this permit application, developed basic plan concepts for the continuing management of maintenance material dredged from the Intracoastal Waterway in Nassau and Duval Counties, defined short and long term program needs based on a comprehensive examination of historical dredging records for the project area, and identified suitable centralized sites which satisfy these needs based on preliminary environmental, engineering and operational criteria. Phase II of the project consists of the gathering of detailed, site-specific information required for the preparation and submission of permit applications for the eight disposal sites identified in Phase I. In addition, Phase II also addresses the design of the site disposal facilities; the acquisition of these sites, through negotiation or condemnation, by the Florida Inland Navigation District; and the construction and continuing operation and maintenance of these sites as permanent dredged material management facilities.

No attempt is made in this narrative to recount, in detail, the information contained in the documents which accompany the permit application. Rather, this narrative is designed to assist the reviewer in organizing this information, while emphasizing the engineering considerations and design specifications presented in the attached permit drawings. In addition to the permit drawings and the Phase I report already mentioned, the documents which comprise the permit application package for the Crane Island Disposal Area include: (1) the boundary survey, providing completeness, as well as the legal description necessary for site acquisition; (2) the topographic survey, documenting pre-construction topography and drainage patterns, and providing information necessary for site design, volumetric calculations, and grade analysis; (3) the sub-surface and soils report, identifying site foundation conditions and in-situ construction material suitability, as well as locating the water-table on-site; (4) the environmental report, documenting existing environmental conditions, including vegetation communities and wildlife habitats, and serving to guide the configuration of the containment area within the site so as to avoid, to the greatest extent possible, the most sensitive environmental areas; and (5) a site-specific management plan, insuring that the disposal area will continue to be operated in an efficient manner without undue conflicts with adjacent off-site land use, and allowing the site to be maintained as a permanent facility. It is hoped that the information contained in this permit application package will provide for the granting of a long-term permit in keeping with the long-range goals of the project.

Reference to the Phase I report, which reveals that the Crane Island site was originally identified as a secondary alternative, reinforces the necessity and timeliness of the present effort. Since completion of Phase I, rapid residential development on the primary, or first choice, site required that the Crane Island disposal area be elevated to primary status.

Crane Island is a natural maritime hammock island located east of the AIWW and west of the Fernandina Beach Airport on Amelia Island (permit application drawing, Sheet 1 of 7). In the past, the upland area of the island was augmented by the unconfined hydraulic placement of dredged material between Crane

Island and Amelia Island in a series of lobes connecting with the 'original' portion of Crane Island. The environmental, engineering, and operational considerations for confining the disposal area to the northern 20% of the main island and northernmost disposal lobe are discussed in the Phase I report. The relatively small required disposal plan area of 24.6+ ac allows the avoidance of much of the island's most environmentally sensitive areas, specifically the mature maritime hammock to the south. The original plan concept called for the inclusion of a 300 ft buffer of natural undisturbed vegetation to the south of the actual disposal area, resulting in a total site area of approximately 35.5 acres. However, reorientation of the southern site boundary to cross a wider portion of the island (Boundary Survey, Attachment 1) required a reduction of the buffer width to 100 ft. The total buffer area remains unchanged from the original site concept.

Detailed environmental information for the Crane Island site is provided in the attached environmental report (Attachment 4). Salient on-site features include the freshwater slough between the main island and major disposal lobes, and the tongue of saltmarsh extending westward between the two major lobes. The total area of probable DER wetland jurisdiction on-site is 1.31 acres, with the total area impacted by construction of the disposal area being 0.81 acres. The major portion of the tongue of saltmarsh is preserved within the buffer area (permit application drawings, Sheets 2 and 6 of 7).

The remaining 96.3% of the site may be characterized as uplands of low relief, with elevations ranging from approximate mean high water (+4.0 ft NGVD±) to +5.2 ft above MHW (+9.2 ft NGVD). It should be noted that a formal determination of MHW was not done, but rather a reasonable estimate of its position was made by a Registered Land Surveyor familiar with the requirements of such determinations, using accepted survey practice. The containment area was configured to lie upland of this estimate of MHW as well as the surveyed treeline, with additional allowance for the inlet pipeline to be positioned above MHW on-site. Calculations based on the results of a topographic survey have determined the mean site elevation to be +6.51 ft NGVD.

The disposal area is defined by earthen dikes to be constructed of material excavated from the site interior. Specific soil and foundation information (soils/sub-surface report, Attachment 3) confirmed the utility of the preliminary conservative design originally adopted as being well within the range of standard U.S. Army Corps of Engineers (COE) practice for similar sites and materials (permit application drawing Sheet 3 of 7). Design dike specifications include a dike crest height of +15.0 ft above grade (+21.5 ft NGVD), a side slope of 1V : 3H, and a crest width of 12.0 ft, yielding a dike width at grade of 102.0 ft. As indicated on the site plan (permit application drawing, Sheet 2 of 7) the total plan area within the outside toe of the dike is 24.89 acres, leaving approximately 10.61 acres of the total site area essentially undisturbed. As measured at the crest centerline, the dike perimeter is 3930 ft, requiring 124,450 c.y. of material to construct.

An additional feature of the containment structure is a ramp to allow ingress and egress of heavy equipment to and from the interior of the containment area. Ramp details are shown in permit application drawings, Sheets 2 and 4 of 7. The outside slope of the ramp and the slope of the supporting toe maintain the same 1V : 3H slope as the main dike. The ascending/descending grade is 4%. These ramps, which allow removal of the dewatered dredged material, reinforce an important program concept, as detailed in the Phase I report. That is, although the containment area is designed to provide capacity adequate to serve the projected 50-year requirement of a designated reach of the waterway, it is also designed to be a permanent operating facility. Prior to reaching design capacity, the ramps, in association with operational procedures detailed in the site-specific management plan (Attachment 5), will provide for the efficient removal of material for other uses dictated by prevailing restrictions and market conditions.

The total volume of material required for ramp construction is 12,824 c.y., which when added to the dike requirement of 124,450 c.y. yields a total construction material requirement of 137,274 c.y. This is to be provided by uniform excavation of the interior containment area to a depth of +0.8 ft NGVD, while maintaining the above grade interior dike side slope (permit application drawing, Sheet 3 of 7). Allowing for 2.0 ft of freeboard and an additional 2.0 ft of ponding depth at the completion of final disposal operations (i.e, filling the containment area to 4.0 ft below the dike crest, or +11.0 above grade) yields a total site disposal capacity of 434,295 c.y. This is adequate for the projected 50-year disposal requirement of 429,003 c.y. for the Fernandina Harbor to Nassau Sound channel reach as described in the project Phase I report (Attachment 6). It should be noted that this disposal requirement represents the 50-year projected in-situ volume multiplied by a bulking plus over-dredging factor of 2.15. Also to be noted is the existence of the on-site water table at +2.0 ft NGVD $\pm$, or 1.2 ft $\pm$ above the excavation grade, which may require a sump and/or pumping of groundwater seepage during construction.

Supply and return pipeline access to the site will be provided by a single pipeline easement, 60 ft in width and approximately 550 ft in length, obtained from the Trustees of the Internal Improvement Trust Fund. As shown in permit application drawings, Sheets 1 and 2 of 7, this easement is located so as to minimize the impact of pipeline placement on the saltmarsh vegetation, utilizing the unvegetated sand flats surrounding an old spoil feature to the greatest extent possible. Within the site boundaries, the inlet pipeline will follow the outside toe of the dike along the west and north sides of the containment area, at all points upland of approximate MHW, to enter the containment area at its northeast corner.

Removal of the de-canted effluent will be accomplished by a parallel arrangement of four (4) corrugated metal half-pipes, located diagonally opposite the slurry inlet. Each half-pipe will provide for the release of effluent over a sharp-crested weir section of minimum length of 9 ft, for a total minimum crest length of 36 ft. The weir crest height will be adjustable by means of removable flash boards from +13 ft above grade to below grade. The four weirs are to be connected by a manifold, with the single outlet pipe passing under the dike, returning the supernatant to state waters by the most direct route, utilizing the same pipeline easement described above.

The specification of a minimum weir crest length of 36 ft is based on U.S. Army Corps of Engineers guidelines related to the dredge equipment most likely to be used for AIWW channel maintenance (i.e, 24 inch O.D. dredge, with a discharge velocity of 16 ft/sec, a volumetric discharge of 6430 c.y./hr, and a 20/80 solids/liquid slurry mix). Analysis of weir performance based on nomograms developed at the COE Waterways Experiment Station (WES) under the Dredged Material Research Program (DMRP) (Walski and Schroeder, 1978) indicates that these design parameters may be expected to produce an effluent suspended solids concentration of 0.63 g/ , assuming an average ponding depth of 2 ft. Translation of suspended solids concentration to a measure of turbidity on which Florida water-quality standards are based is highly dependent on the suspended material characteristics. However, WES guidelines (Palermo, 1978) indicate that this effluent quality should be adequate. Should effluent quality deteriorate below the ambient conditions of the receiving waters, steps shall be taken to decrease effluent turbidity. These include intermittent dredge operation, increased ponding depth, or the use of turbidity curtains surrounding the site outlet weirs.

Finally, as part of this application an analysis of containment area efficiency was performed. Available data characterizing the sediments to be placed in the proposed Crane Island Disposal Area are limited to the results of core borings taken within the channel prior to its maintenance in 1982. Based on the boring logs and suspended sediment-time curves, sediment obtained from boring CB-IWW-46 was determined to represent the most difficult material to decant of the limited samples analyzed (permit application drawing, Sheet 7 of 7). Analysis of these data indicates that the containment area provides adequate retention time to allow the sediment to settle out of the average ponding depth of 2 ft (9.96 hrs maximum retention time vs. 3.0 hrs settling time multiplied by a safety factor of 3, or 9.0 hrs). Moreover, the WES-DMRP guidelines indicate that for the minimum design weir loading (i.e, liquid discharge/weir crest length) of 1.07 cfs/ft, the withdrawal depth (i.e, the depth at which the gravity forces on a suspended sediment particle exceed the inertia forces) ranges from 0.67 ft based on empirical results, to 2.11 ft based on the WES Selective Withdrawal Model. It should be noted that even the larger of these values should not result in the resuspension of sediment because of the negative slope of the deposition layer from inlet to weir, resulting in greater ponding depths at the weir than the 2 ft average ponding depth over the entire containment area.

REFERENCES

Palermo, M.R., R.L. Montgomery, and M.E. Poindexter, "Guidelines for Designing, Operating, and Managing Dredged Material Containment Areas", Technical Report DS-78-10, Dec. 1978, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, MS.

Walski, T.M. and P.R. Schroeder, "Weir Design to Maintain Effluent Quality from Dredged Material Containment Areas", Technical Report D-78-18, May 1978, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, MS.

REQUEST FOR ADDITIONAL INFORMATION (RAI NO. 2)

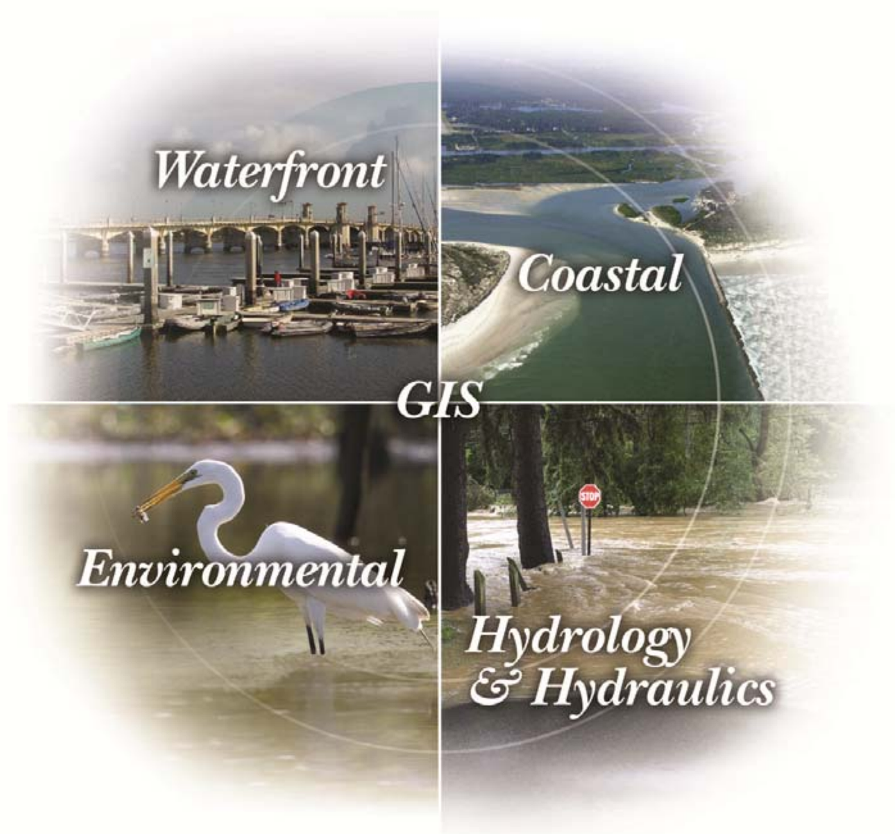
FDEP File Number: 45-291060-001-EI
USACE File Number: SAJ-2008-03402
Applicant Name: Florida Inland Navigation District
Project Name: NA-1 Dredged Material Management Area

ATTACHMENT 1

UPDATED NA-1 MANAGEMENT PLAN
DECEMBER 2010

Management Plan
NA-1 (Crane Island)
Dredged Material Management Area

Nassau County, Florida
November 1987
Revised December 2010



10151 Deerwood Park Blvd., Bldg. 300, Suite 300, Jacksonville, FL 32256
(904) 731-7040 ~ www.taylorengineering.com

Management Plan
NA-1 (Crane Island) Dredged Material Management Area
Nassau County, Florida

Prepared For:

FLORIDA INLAND NAVIGATION DISTRICT

by:

Taylor Engineering, Inc.
10151 Deerwood Park Blvd.
Bldg. 300, Suite 300
Jacksonville, FL 32256
(904) 731-7040

November 1987
Revised December 2010

C2008-044

TABLE OF CONTENTS

LIST OF FIGURES

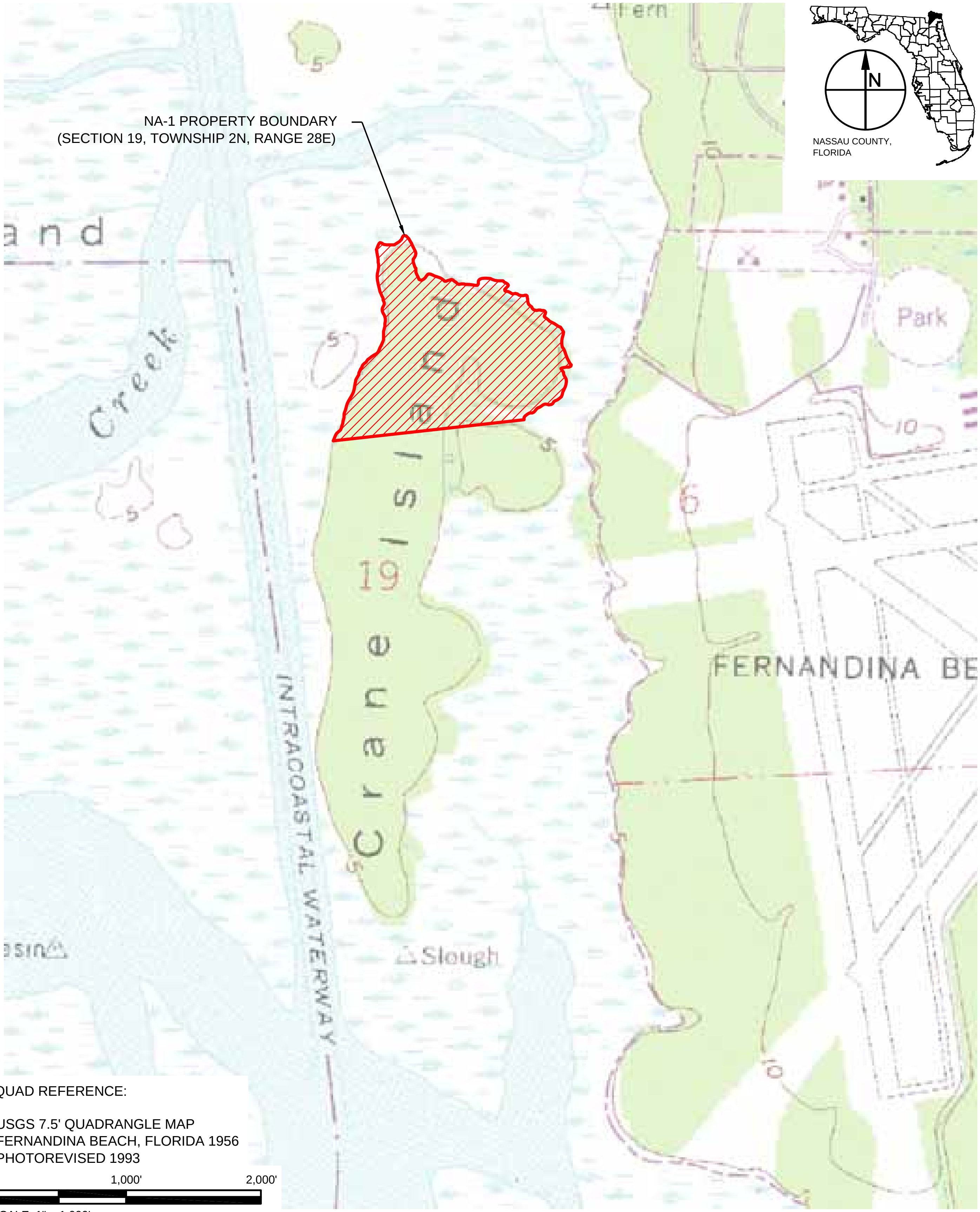
1.0 INTRODUCTION

Site NA-1 (Figure 1.1) is one of eight proposed dredged material management areas (DMMA) designed to serve the long-term maintenance requirements of the Atlantic Intracoastal Waterway (AIWW) and Intracoastal Waterway within Nassau and Duval Counties. The site-specific management plan for the NA-1 DMMA, outlined in this report, provides guidance for the development and operation of the material management area so that it efficiently processes, temporarily stores, and ultimately transfers material dredged during scheduled channel maintenance operations.

To that end, this document addresses those facets of site design and operation that directly influence site efficiency or reduce off-site conflicts. These include elements of site preparation and facility construction, techniques of decanting and dewatering the dredged material during and immediately following maintenance operations, and guidelines for post-dredging site operation and maintenance. Throughout, the goal of each phase of site management is to ensure that the site not only achieves its minimum 10-year (-yr) design service life but also fulfills its potential as a permanent operating facility for the intermediate storage, processing, and transfer of maintenance material dredged from the AIWW.

Located in the town of Fernandina Beach, the 35.5-acre NA-1 DMMA lies on the northernmost section of Crane Island, east of the AIWW and west of the Fernandina Beach Municipal Airport. Open water and salt marsh generally surrounds Crane Island and the NA-1 site. The western half of the site consists of a natural maritime hammock while the eastern half of the vegetated island includes an underlying composition of dredged material placed between 1943 and 1960. A saltmarsh community borders the north, west, and east boundaries of the site; the proposed Crane Island Development (currently associated with the Amelia Island Plantation) borders the south and immediate east boundary of NA-1.

The NA-1 DMMA serves Reach I (Figure 1.2) of the AIWW. Reach I extends 10.53 miles between Fernandina Harbor and Nassau Sound. The containment areas of each of the eight sites have been sized to provide capacity based on a detailed and comprehensive evaluation of dredging records (Taylor and McFetridge, 1989). In most cases, the required capacity represents the projected 50-yr in-situ volume multiplied by a bulking plus over-dredging factor of 2.15. Based on 2004 survey data (Taylor et al., 2006), the projected storage requirement for Reach I equals 664,286 cubic yards (cy) over the 50-yr life of the project. However, due to several restrictions, the NA-1 site does not provide enough capacity to contain the projected 50-yr dredging volume. The required 100-foot (ft) buffers between NA-1 and the proposed Crane Island Development reduce the acreage available for the DMMA. In addition, because the NA-1 site lies



QUAD REFERENCE:

USGS 7.5' QUADRANGLE MAP
FERNANDINA BEACH, FLORIDA 1956
PHOTOREVISED 1993

0 1,000' 2,000'

SCALE: 1" = 1,000'

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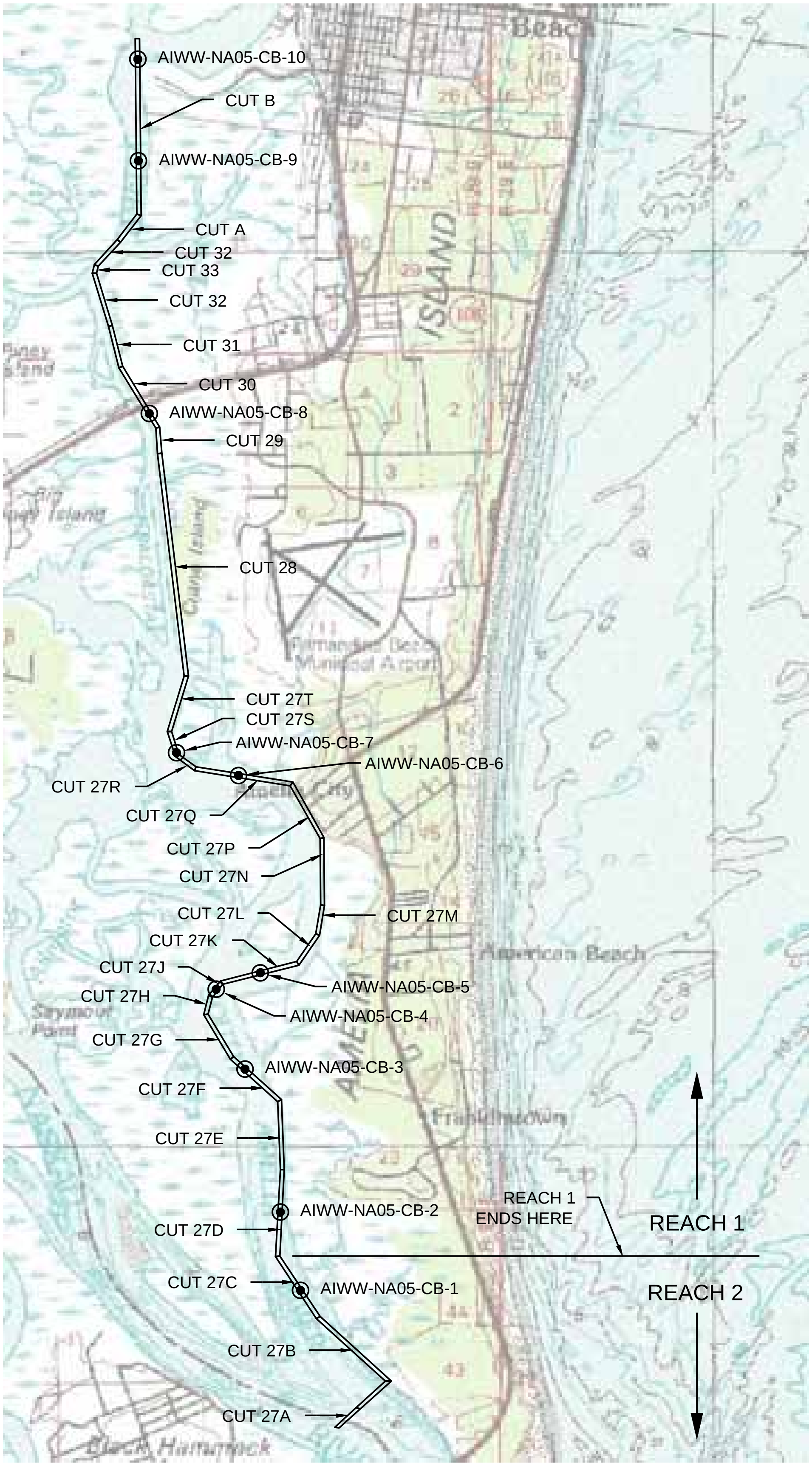
FIGURE 1.1
LOCATION MAP
NA-1 DREDGED MATERIAL MANAGEMENT AREA
NASSAU COUNTY, FLORIDA

PROJECT	C2008-044
DRAWN BY	
SHEET	1 of 7
DATE	AUG 2010



LEGEND:

- VIBRACORE LOCATIONS ATHENA TECHNOLOGIES, FEB 22-23, 2006

QUAD REFERENCE:
FERNANDINA BEACH, FLORIDA-GEORGIA
N3030-W8100/30X60 1981

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SCALE: 1" = 6,000'

ANTON FLEWELLING X:\SYS\VAULT_PROJECTS\C2008-044 NA-1 DMMA\PERMIT\MANAGEMENT PLAN FIGURES\C2008-044-P-REACH1.DWG 8/11/2010 2:51:09 PM

TAYLOR ENGINEERING INC. 10151 DEERWOOD PARK BLVD. BLDG. 300, SUITE 300 JACKSONVILLE, FL 32256 CERTIFICATE OF AUTHORIZATION # 4815	FIGURE 1.2 REACH 1 DESIGNATION NA-1 DREDGED MATERIAL MANAGEMENT AREA NASSAU COUNTY, FLORIDA	PROJECT C2008-044 DRAWN BY SHEET 2 of 7 DATE AUG 2010

PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.

near the Fernandina Airport, the Federal Aviation Administration restricts the dike height to a maximum of 16 ft above existing grade. Given these restrictions, the NA-1 DMMA capacity will meet only the projected 10-yr material storage requirement for Reach I (132,857 cy, or 1/5 of the 50-yr requirement).

Beyond providing adequate capacity, the management objective for the NA-1 DMMA is to process (i.e., decant and dewater) the dredged material efficiently and to operate the facility so as to extend its usefulness beyond the design service life. The design and construction of the containment facility establish the site's potential long-term efficiency, while its operating procedures intend to ensure the realization of this potential. Specific elements of site design and operation during and following dredging activities will be discussed in turn as they relate to site efficiency and local impacts. Accordingly, Chapter 2.0 begins the management plan with a discussion of site preparation and design. Chapter 3.0 presents operational considerations during dredging. Chapter 4.0 addresses post-dredging site management.

2.0 PRE-DREDGING SITE PREPARATION AND DESIGN FEATURES

2.1 Site Design

2.1.1 Containment Basin Configuration and Capacity Requirements

The NA-1 containment basin had to meet three primary design criteria to justify the site's designation to serve Reach II of the OWW in Martin County. First, the basin's material storage capacity had to meet or exceed the reach's projected 10-year material storage requirement. Second, the basin's placement within the site had to provide adequate separation from adjacent properties. Third, the basin's configuration had to minimize the environmental liabilities and the resulting permitting constraints associated with site development.

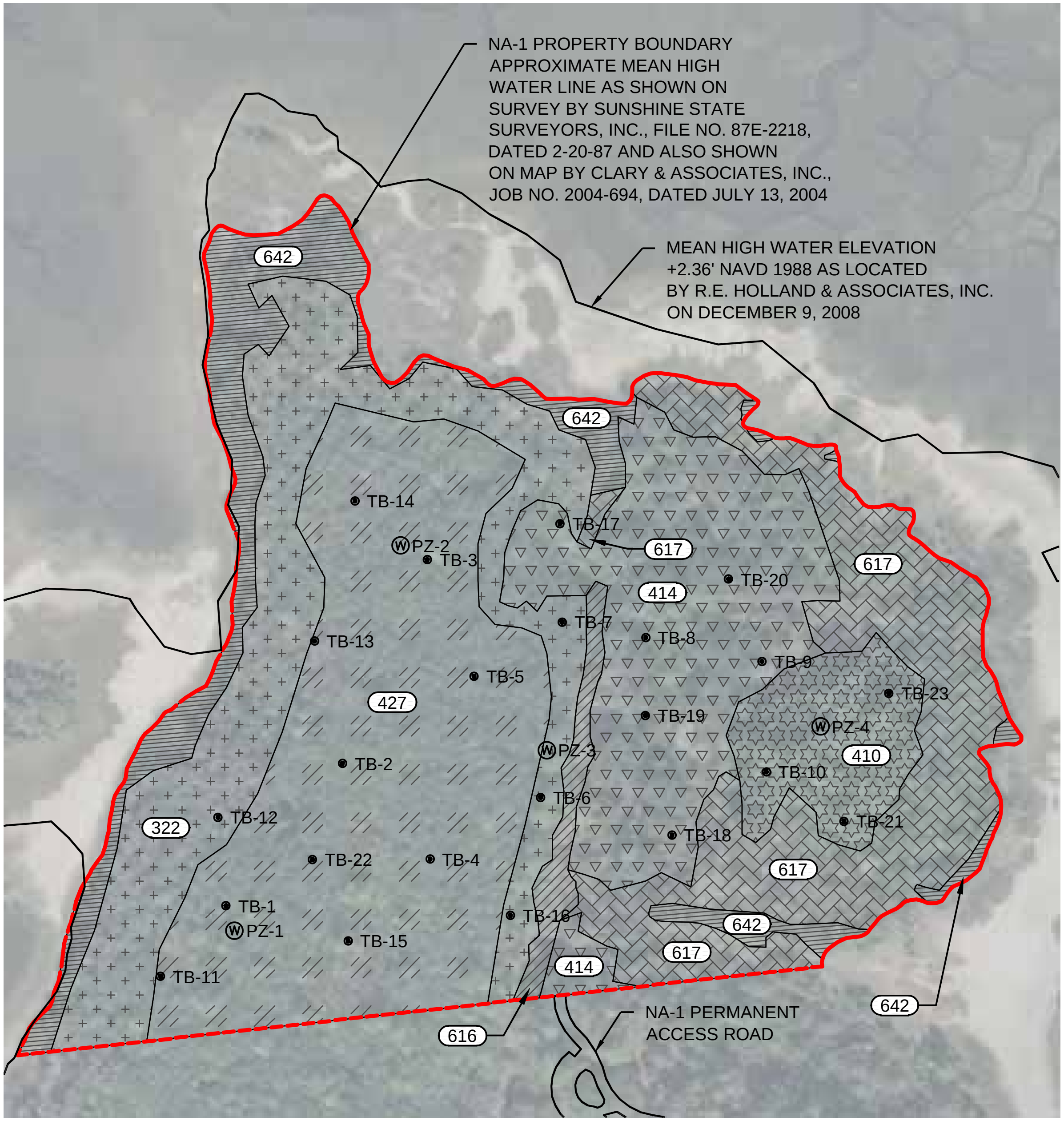
First, the basin's material storage capacity had to meet or exceed the reach's projected 10-year material storage requirement. Evaluation of Jacksonville District Corps of Engineers' archival dredging records and recent (2004) surveys documented a maximum total in situ shoal volume of 308,970 cy in this segment of the Waterway for the corresponding 62-year period of record (1943–2004). Reach I's projected 50-year storage requirement — 664,286 cy — represents extrapolation of the documented dredging volume plus the in situ shoaling volume multiplied by a bulking plus over-dredging factor of 2.15. The *Reevaluation of Dredged Material Management Alternatives Phase I Reach I, Atlantic Intracoastal Waterway, Nassau County, FL*. (Taylor et al., 2006) details the complete storage evaluation calculations. However, due to several restrictions, the NA-1 DMMA site does not provide enough capacity to contain the projected 50-yr dredging volume. With these considerations, the NA-1 DMMA capacity will meet 10-yr maintenance dredging events (132,857 cy or 1/5 of the 50-yr requirement).

Second, the containment basin's placement within the site had to provide adequate separation from adjacent properties. As documented in the updated Phase I report (Taylor et al., 2006), NA-1 was originally identified, evaluated with respect to other candidate sites, and ultimately selected as the primary site to serve Reach I based on its ability to provide the required storage capacity and also maintain reasonable separation between the containment basin and adjacent properties. The required 100-foot (ft) buffers between NA-1, the proposed Crane Island Development, and the AIWW reduced the total site construction area from its original 35.5 ac to 19.5 ac. In addition because the NA-1 site is located near the Fernandina Airport, the Federal Aviation Administration (FAA) restricts the dike height to a maximum of 16 ft above existing grade. These restrictions reduced the available capacity from 434,000 cy to 187,000 cy (roughly 54,100 cy greater than the 10-yr maintenance requirement).

Third, given the minimum basin footprint needed to provide the required storage capacity, the basin's configuration had to minimize the environmental liabilities and associated permitting constraints associated with site construction. Per the Florida Land Use, Land Cover Classification System (FLUCCS**),** the site contains a combination of upland (i.e., coastal scrub, upland coniferous forest, pine-mesic oak, live oak) and wetland (inland pond and slough, mixed wetland hardwood, and saltwater marsh) communities (Figure 2.1). Developing a basin to provide the required storage capacity within a restricted area must inevitably impact some of the constructed wetlands. The most appropriate basin configuration is that which introduces the fewest permitting constraints.

2.1.2 Containment Basin Design

With the minimum basin footprint thus determined, the following parameters specify the remaining containment basin design elements. Within the resulting 16.1-ac containment area, dike specifications include a minimum crest elevation of +18.5 ft NAVD, or 12.5 ft above the existing mean site elevation of +6 ft NAVD (Figure 2.2). The dike cross-sectional design, including side slopes of 1V:3H and a dike crest width of 15 ft, and ramp will require 96,000 cy of material for construction. Excavating the basin interior to a mean elevation of 0.0 ft NAVD — 6.0 ft below the existing mean grade elevation of the basin footprint — will provide the majority of the material for dike and ramp construction. To ensure dike stability, excavation of the basin interior will maintain the 1V:3H side slope of the interior dike slope. Due to the presence of underlying clays, interior berms (Figure 2.3) will be constructed to provide additional stability. With the containment basin filled to capacity, the surface of the deposition layer will lie a minimum 6 ft below the dike crest, comprising a minimum 4 ft of freeboard and 2 ft of ponding above the maximum deposition surface.



FLUCCS CODE LEGEND

CODE & DESCRIPTION		ACREAGE
322	COASTAL SCRUB	6.59
410	UPLAND CONIFEROUS FOREST	2.03
414	PINE-MESIC OAK	6.26
427	LIVE OAK	10.81
616	INLAND POND AND SLOUGH	0.63
617	MIXED WETLAND HARDWOOD	5.92
642	SALTWATER MARSH	3.21

● GEOTECHNICAL BORING LOCATIONS

Ⓦ PIEZOMETER LOCATIONS

N

AERIAL REFERENCE: FDOT 2008

0 300' 600'

SCALE: 1" = 300'

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FIGURE 2.1
EXISTING FLUCCS MAP
NA-1 DREDGED MATERIAL MANAGEMENT AREA
NASSAU COUNTY, FLORIDA

PROJECT C2008-044
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SHEET 3 of 7
DATE AUG 2010

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PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.

SITE FEATURES	
DIKE SLOPE	3H:1V
CREST WIDTH	15 FT
REQUIRED FREEBOARD AND PONDING DEPTH	6 FT
DIKE HEIGHT ABOVE NATURAL GRADE	12.5 FT
DEPTH OF EXCAVATION	6 FT
TOTAL AREA OF SITE	35.5 ACRES
CONSTRUCTION AREA	19.5 ACRES
BASIN AREA	16.1 ACRES
BASIN CAPACITY	187,672 CY

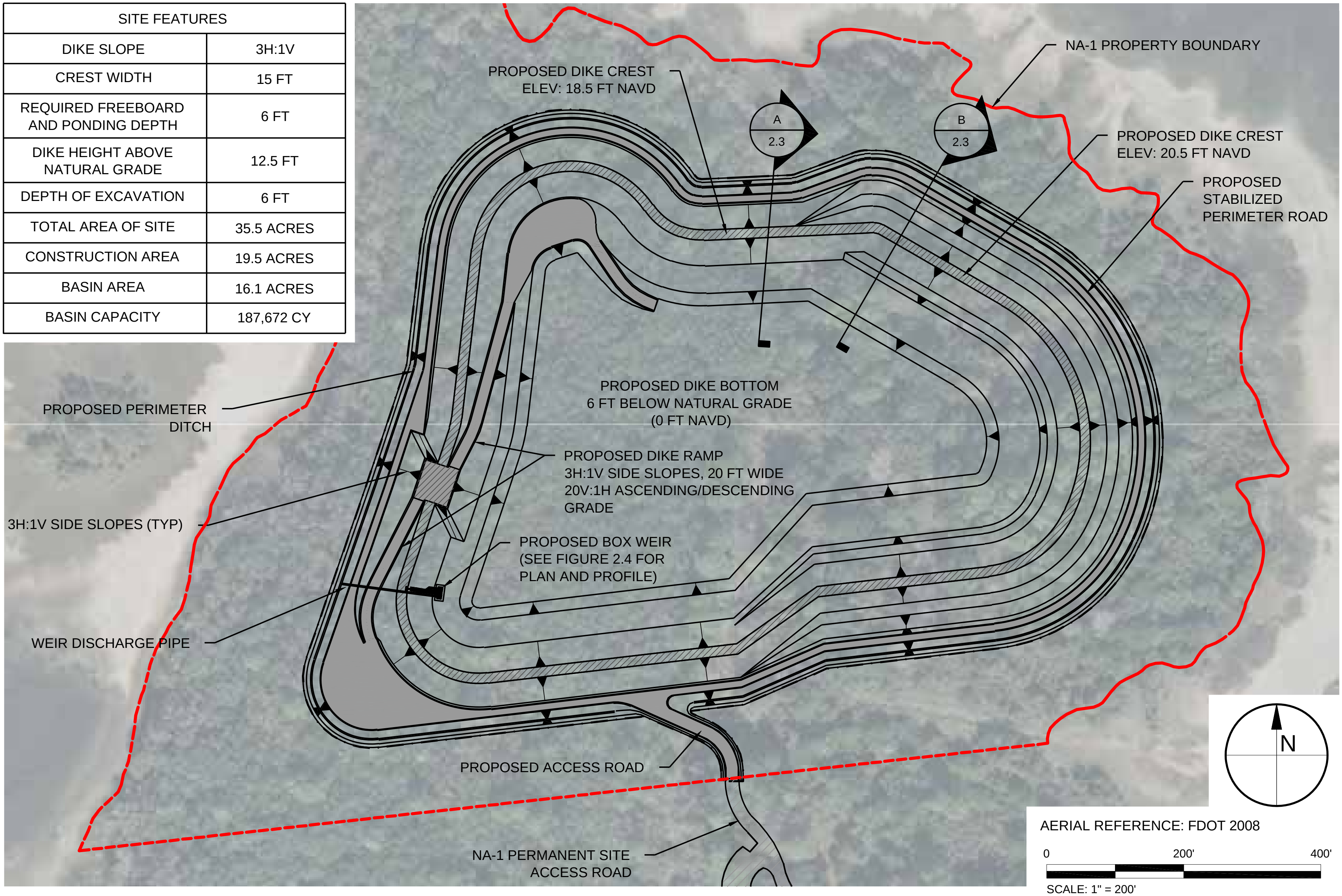

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FIGURE 2.2
PROPOSED SITE PLAN WITH AERIAL
NA-1 DREDGED MATERIAL MANAGEMENT AREA
NASSAU COUNTY, FLORIDA

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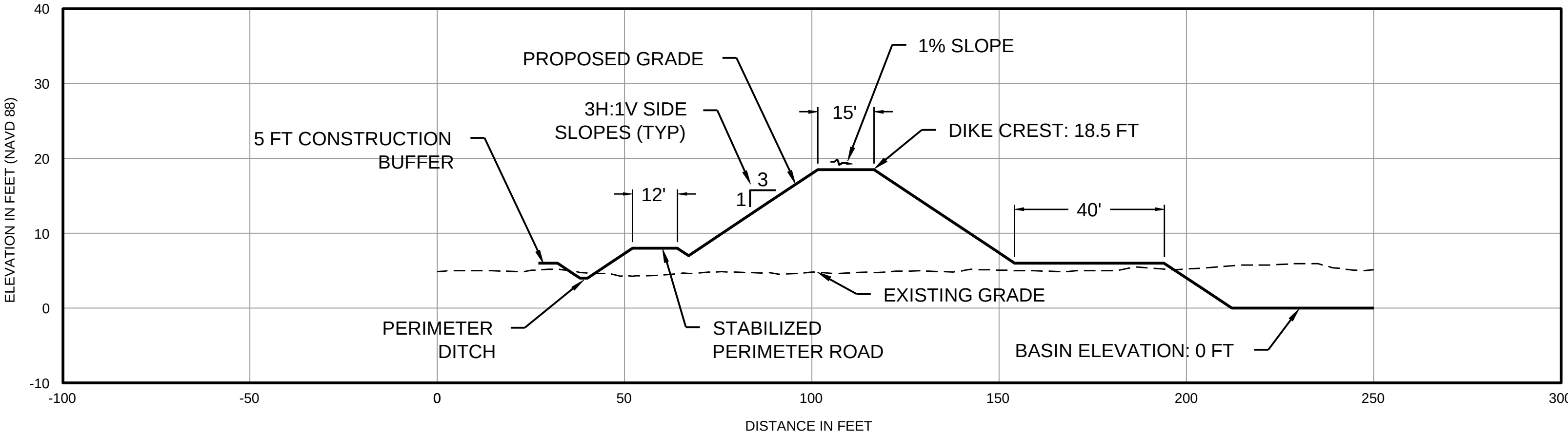
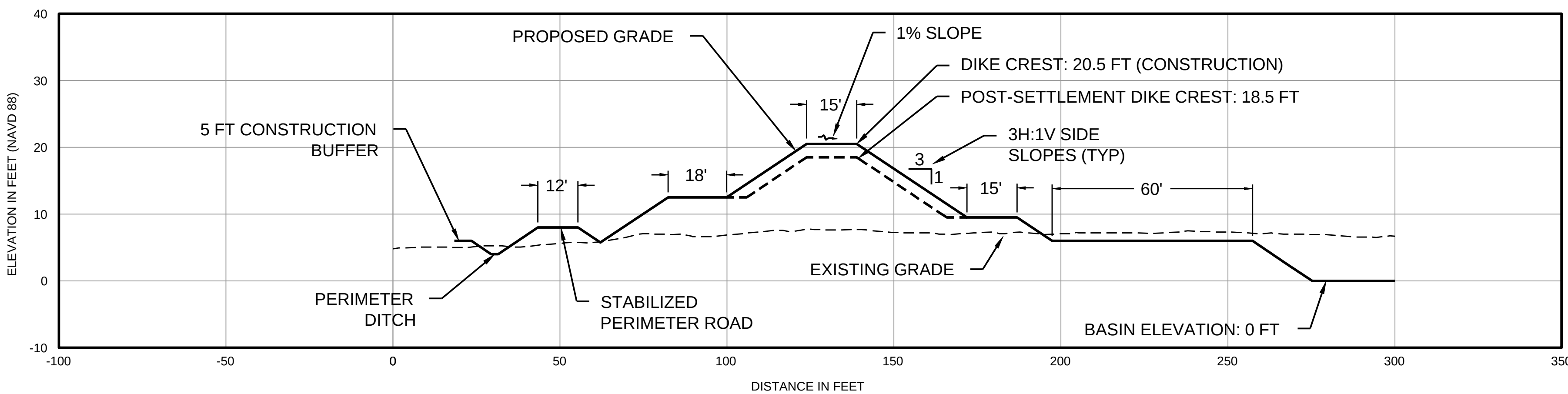
PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.



A
2.2

TYPICAL WEST DIKE TEMPLATE

SCALE: 1" = 50'
2X VERTICAL EXAGGERATION
0 50'



B
2.2

TYPICAL EAST DIKE TEMPLATE

SCALE: 1" = 50'
2X VERTICAL EXAGGERATION
0 50'

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FIGURE 2.3
SECTION VIEWS
NA-1 DREDGED MATERIAL MANAGEMENT AREA
NASSAU COUNTY, FLORIDA

PROJECT	C2008-044
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SHEET	5 of 7
DATE	AUG 2010

PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.

2.2 Facility Construction

Construction of the NA-1 facility will include containment basin construction and related earthmoving operations and the installation of outlet structures and other design features. Dike construction will also include installation of settlement platforms and pore pressure piezometer transducers for dike settlement monitoring during and after construction. This phase is subject to the scheduling and budget priorities of the Jacksonville District U.S. Army Corps of Engineers (USACE). Perimeter fencing and in-place security procedures will secure the site before excavation, grading, and dike construction begin. The remainder of this section discusses each site preparation element in more detail.

Site preparation includes all earthmoving operations required to construct the containment dike and basin to the design geometry. Preliminary site design assumes excavation of the containment basin interior to obtain the material required for initial dike and ramp construction. Excavating to an average grade elevation of +0.0 ft NAVD will provide the majority of the volume of material required to construct the dikes (±96,000 cy). Excavation of the perimeter ditch will produce additional material. Offsite material will make up the volume deficit. Alternatively, the material excavated from the ditch can contribute to the dike requirement to reduce the excavation depth in the basin interior or amount of needed off-site material. The final excavation depth and distribution of material, determined in the final design phase, will reflect the results of detailed subsurface investigation.

As a caveat to the preceding discussion, the required excavation depth combined with a seasonally high water table will likely require pumping groundwater seepage during excavation and interior grading. Geotechnical data (Dunkelberger, 2010) showed the on-site water table at an average elevation of ± 2.9 ft NAVD. If basin construction takes place within the wet season (typically May – October), pumping groundwater seepage will be required during excavation and grading. Once construction has been completed and pumping has been stopped, the basin will likely remain flooded until dredging operations raise the basin interior above the natural water table.

2.3 Additional Design Features

2.3.1 Inlet

The number and locations of the dredge slurry outfalls, or pipeline inlets, govern the pattern of deposition within the containment basin. A single, moveable inlet offers several advantages over single or multiple fixed designs. A single, fixed inlet would produce a mound of coarse material at the fixed inlet point.

If not mechanically redistributed, the mound would effectively reduce the basin ponding area. A multiple inlet manifold could overcome this disadvantage. However, the small containment area, the relatively infrequent nature of the required maintenance, and the small volume of dredged material produced by each dredging event cannot justify the expenditure and maintenance required by a fixed, multiple inlet manifold system for the NA-1 site. More cost effective, a single inlet, periodically repositioned as dictated by the deposition pattern, can effectively distribute the coarse sediment over the basin floor. A flow-splitter or a spoon to break the jet's momentum will also help the single inlet distribute the slurry.

Preliminary analysis of the settling characteristics of the dredged material to be placed in the NA-1 containment facility indicates that, given adequate ponding depth, the maximum available distance between inlet and weir will afford adequate solids retention. Moving the inlet for more even material distribution must not significantly reduce this separation distance without additional precautions. To ensure continued compliance with water quality standards, these additional precautions may include increasing the ponding depth or installing turbidity screens surrounding the weirs.

2.3.2 Weirs

The NA-1 facility will use two sharp-crested box weirs to control the release of the clarified surface layer of the water ponded within the containment basin. Adjustment of weir height controls ponding depth within the containment basin, which, in turn, controls basin retention time. The next section discusses weir height and ponding depth in more detail. However, several additional aspects of weir design affect the flow of water inside the basin and thereby strongly influence the efficiency of solids retention and the quality of effluent released from the site. These include weir crest width, weir crest length, weir type, and the location of the weirs within the containment basin. Each of these design aspects and its effect on basin efficiency is discussed in the following paragraphs.

The first two weir design parameters, weir crest width and weir crest length, affect weir performance by determining its *withdrawal depth*. At the withdrawal depth, gravity forces on suspended sediment particles exceed the inertial forces associated with flow over the weir. Withdrawal depth, therefore, represents the depth of the surface layer of ponded water drawn over the weir crests and released from the containment basin. Maintaining the withdrawal depth less than the ponding depth reduces the possibility of resuspending sediment that has settled out of the upper water column. Moreover, because the concentration of suspended sediment increases with depth, minimizing the depth of the withdrawal layer maximizes the retention of suspended solids. Specific expected performance characteristics of the weir system are discussed later in this section.

As mentioned above, weir crest width affects withdrawal depth. Weirs typically employed in dredged material containment facilities are described as *sharp-crested* or *narrow-crested* based on their crest width relative to the static head over the weir. A weir is described as sharp-crested if the thickness (T) of the weir crest is significantly less than the static head (H) over the weir, typically H/T > 1.5.

The weir parameter that most directly influences withdrawal depth and effluent quality is weir crest length. The Selective Withdrawal Model (Walski and Schroeder, 1978) developed by the U.S. Army Engineer Waterways Experiment Station (WES) under the Dredged Material Research Program (DMRP) relates weir crest length to withdrawal depth through the parameter of weir *loading*. Weir loading is defined as the ratio of the dredge's liquid discharge (Q) to the effective weir crest length (B). Jacksonville District USACE project planning guidelines indicate that a 16-in. O.D. dredge will likely be used for future channel maintenance in Reach I. Given typical design output specifications for a 16-in. dredge (discharge velocity, 16 ft/sec; volumetric discharge, 2,800 cy/hr; 20/80 solids/liquid slurry mix), the Selective Withdrawal Model indicates that a weir crest length of 32 ft should produce a 1.5-ft withdrawal depth, based on a design weir loading (Q/B) of 0.53 cfs/ft. As discussed in the next section, this depth falls below the recommended minimum ponding depth at the weirs (2 ft) and thus should not result in the release of effluent with a high suspended sediment concentration. Moreover, DMRP research indicates that under field conditions, the actual depth of withdrawal may fall significantly below that predicted by the WES Selective Withdrawal Model. Therefore, the use of the WES Selective Withdrawal Model provides a conservative containment basin design.

Two 4 ft x 4 ft metal box weirs, each with four sharp-crested 4-ft weir sections will provide the required 32-ft total crest length. A common manifold will connect the two pipes such that the effluent will exit the containment area via a single pipe under the dike. During dredging and dewatering operations, the return water pipeline will connect to this manifold and transport the effluent to the AIWW. Section 3.1 discusses pipeline placement and retrieval.

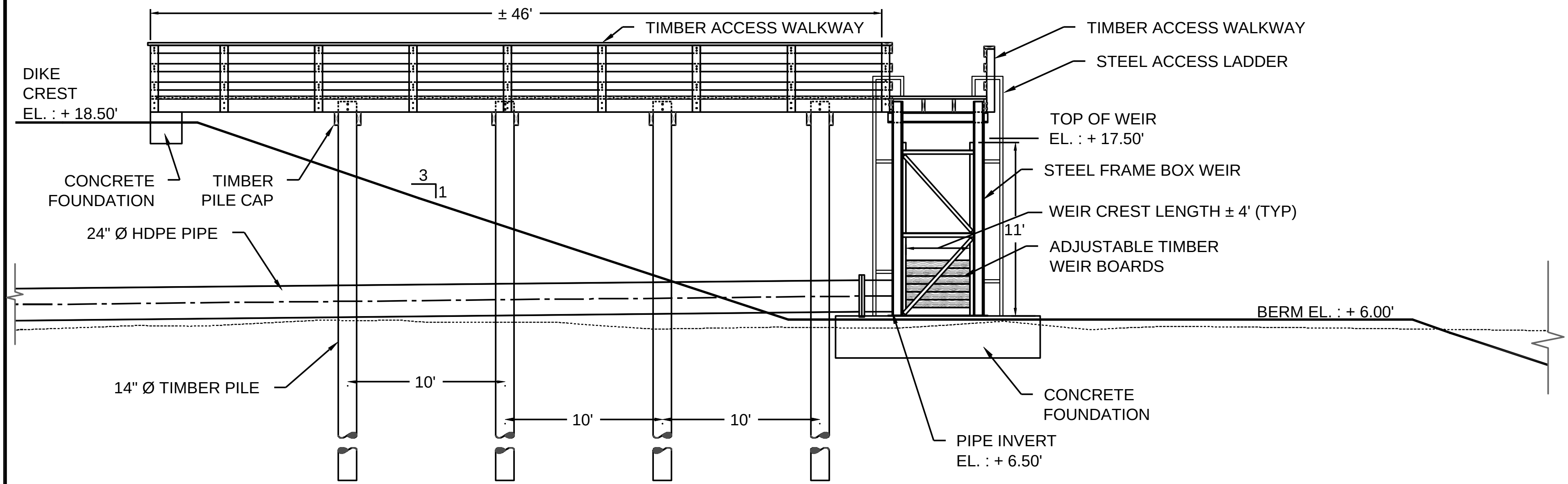
Removable flashboards will allow adjustment of weir height. The range of possible adjustment will be from a maximum elevation of +14.5 ft above grade, allowing 4 ft of freeboard below the dike crest elevation at the basin's design capacity, to a minimum elevation set below the original containment area interior grade, thereby providing a means of releasing ponded run-off before the site's initial use. Setting the weirs at the minimum elevation permits the release of ponded stormwater or groundwater seepage before the basin's first use. The flashboards will provide rigidity against hydrostatic pressure and minimize between-board seepage of water with a higher suspended sediment concentration than the clarified water selectively withdrawn over the weir crest

The final weir design parameter considered is the location of the weirs within the containment basin. Second, the weirs must be placed to maximize their distance from the dredge pipe inlet and to minimize the return distance to the receiving waters. Providing the maximum inlet-weir separation also maximizes the basin's effective area and ensures that the effluent released from the basin meets weir performance criteria. In addition, locating the weirs to minimize the return distance from the weirs to the AIWW provides the most efficient effluent transport from the containment basin. As shown in Figure 2.4, the weir base will be set at 6.0 ft NAVD on an earthen shelf and the weir pipe inverts will be set at 6.5 ft NAVD. Positioning the weirs as shown in Figure 2.2 provides approximately 800 ft from inlet to weir.

Analysis of weir performance based on nomograms developed at the WES under the DMRP (Walski and Schroeder, 1978) indicates that the weir design described above will produce an effluent suspended sediment concentration of 0.4 g/l, assuming an average ponding depth of 2 ft. Relating suspended solids concentration to Florida effluent quality standards — based on the turbidity of the effluent relative to the ambient turbidity of the receiving waters — is problematic because turbidity depends highly on the physical characteristics and concentration of the suspended material. However, WES guidelines (Palermo et al., 1978; Walski and Schroeder, 1978) indicate that this 0.4 g/l falls well below typical standards for effluent discharged into estuarine waters.

2.3.3 Ponding Depth and Basin Performance

Ponding depth refers to the height of the water column (with its suspended sediment load) maintained above the depositional surface during dredging operations. The dredging contractor/site operator regulates ponding depth by adjusting the height of the weir crests and, less directly, by modulating the dredge plant output. The ponded water, shallowest nearest the inlet, will increase to its maximum depth nearest the weirs. Conceptually, ponding depth is typically discussed in terms of its mean value over the entire basin interior. However, as a practical operational criterion, ponding depth is more usefully specified at the weirs where it can be measured directly.



SECTION THRU DIKE AT TIMBER DECK

SCALE: 1" = 10'

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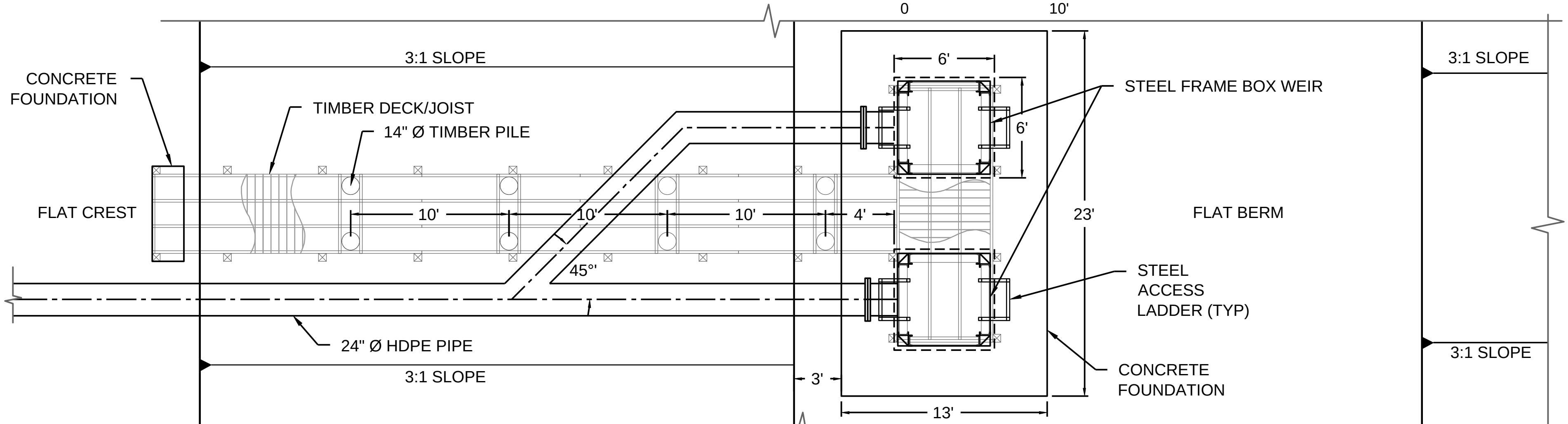

TIMBER DECK PLAN VIEW

SCALE: 1" = 10'

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TAYLOR ENGINEERING INC.
10151 DEERWOOD PARK BLVD.
BLDG. 300, SUITE 300
JACKSONVILLE, FL 32256
CERTIFICATE OF AUTHORIZATION # 4815

FIGURE 2.4
WEIR STRUCTURE DETAILS
NA-1 DREDGED MATERIAL MANAGEMENT AREA
NASSAU COUNTY, FLORIDA

PROJECT	C2008-044
DRAWN BY	
SHEET	6 of 7
DATE	AUG 2010

ANTON FLEWELLING X:\SYS\VAULT_PROJECTS\C2008-044 NA-1 DMMA\PERMIT\MANAGEMENT PLAN FIGURES\C2008-044-P-DIKE AND ROAD SECTION.DWG 8/11/2010 2:51:45 PM

PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.

Achieving maximum effluent quality dictates that ponding be maintained at the greatest possible depth during dredging operations. Increased ponding depths produce increased retention times and decreased flow velocities through the containment basin and therefore improved solids retention and effluent quality. The limiting consideration for increased ponding depth is the amount of hydrostatic pressure the dike can withstand without producing excessive seepage or loss of structural integrity.

Analysis of sediment settling characteristics established whether the 2-ft minimum mean ponding depth produces a basin retention time adequate for acceptable solids retention and effluent quality. The fine-grained sediment component, because it requires the longest time to settle out of suspension, determines the required basin retention time and therefore the required ponding depth.

A program of sampling and analysis conducted during the plan development phase provided data that characterizes channel sediments in Reach I of the AIWW (Taylor et al., 2006 and Ardaman, 2010). To document worst-case conditions, each sample came from a sampling station near a potential source of fine sediment or in an area of likely fine sediment deposition. Based on mean grain diameter, the Unified Soil Classification System (USCS) classifies sediments from the seven sampling locations (AIWW-NA05-CB4 through AIWW-NA05-CB10) within Reach I as mainly fine sand with occasional mud lenses. Analysis determined that the silt and clay-sized component of each sample ranged from 1.1 to 86.7%. In addition, each core boring contained at least one stratum with fine-grained components that exceeds 10%. The fine-grained material, because it requires the longest time to settle out of suspension, determines the required basin retention time and thereby the required ponding depth. The above material represents a small percentage of the total dredging volume. The majority of the material is predominantly fine to medium quartz sand with fine to coarse shell fragments.

Retention time relates directly to the ponded water depth maintained within the basin. Preliminary containment basin design provides a minimum 2-ft mean ponding depth above the deposition surface. Analysis of the hydraulic characteristics of various containment basin geometries (Gallagher and Company, 1978) suggests that a basin efficiency of no more than 57% should be used to estimate the proposed NA-1 containment basin's effective retention time. Based on the proposed 57% basin efficiency (length to width ratio — Gallagher and Company, 1978) and an expected discharge rate for a 16-in. dredge of 16.8 cfs (Gallagher and Company, 1978), a 2-ft mean ponding depth would provide a basin retention time of 8.2 hours to reduce turbidity to acceptable levels within the ponding depth. Given a settling time of 3.43 in/hr and a 2-ft ponding depth, fine sediments in the proposed DMMA would settle to acceptable levels within seven hours.

If future Reach I shoal sediments yield a greater quantity of fine-material than those used in this analysis or if the contractor operates the dredge greater than 19.0 cfs, increasing the ponding depths will provide greater effective retention times and effluent water quality.

However, increasing the ponding depth above 2 ft too quickly will likely increase seepage through the dike and potentially compromise its stability. Operational experience has demonstrated that dike permeability typically reduces with time as seepage through the dike filters and traps fine sediments. Thus, a sufficiently slow increase in ponding depth should minimize dike saturation and seepage through the dike's outside slope. Restricting the initial ponding depth to 5 ft should eliminate the possibility of dike failure while providing a sufficient safety factor to ensure efficient solids removal. Close, continual monitoring of the dike perimeter for signs of potential instability must occur. If such conditions are found, the ponding depth must be reduced as quickly as possible without violating effluent turbidity standards.

2.3.4 Interior Earthworks

The NA-1 containment basin design specifically excludes secondary interior dikes — e.g., multiple cells or spur dikes. Multiple cells are typically employed for continual or successive placement projects that cannot provide adequate time for dewatering the previous deposition. In addition, analysis of historical dredging records indicates that neither the quantity nor the frequency of projected dredging warrants the use of multiple cells. Spur dikes are typically used in applications where the basin's size or configuration cannot provide adequate retention time. However, hydraulic analysis (Section 2.3.3) indicates the NA-1 containment basin design provides sufficient retention time to allow the finest sediments anticipated in Reach I to settle without recourse to spur dikes.

2.3.5 Ramps

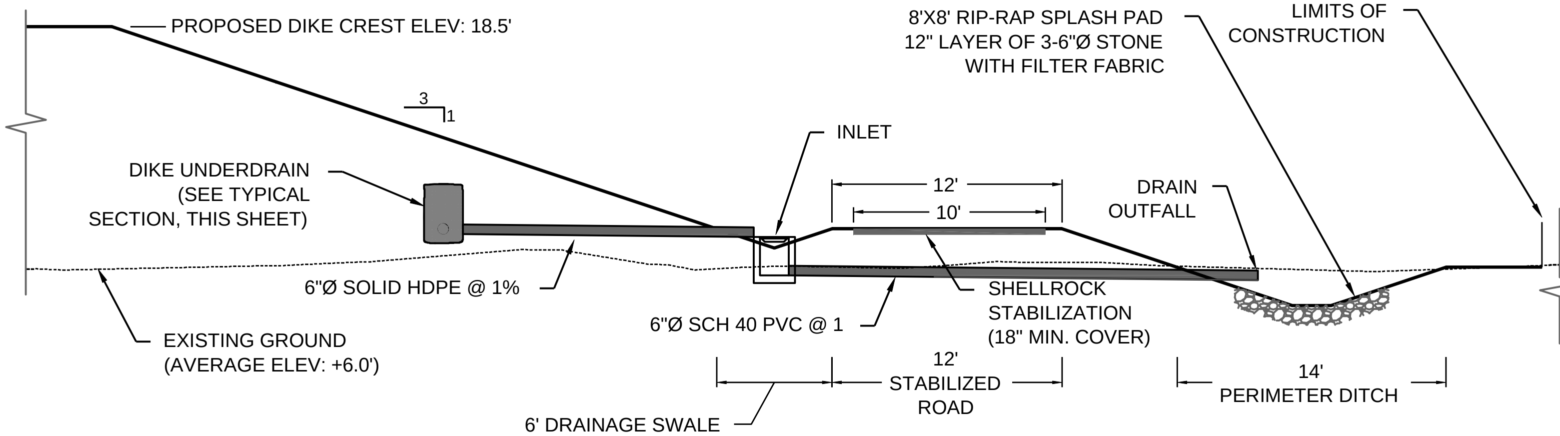
An important goal of the Long-Range Dredged Material Management Program for Florida's Intracoastal and Atlantic Intracoastal Waterways is to manage each dredged material management site as a permanent operating facility. This goal carries two operational criteria. First, the material is to be actively worked to accelerate the drying process and thus render the material suitable for removal and reuse as quickly as possible. Second, to restore the basin's capacity and thereby extend its service life, material must be removed from the basin at or before the basin reaches its design capacity. As a result, ramps to provide heavy equipment access to the containment basin interior have been integrated into the design of the containment dike. Thus, the site will function more as a material processing and rehandling station than as a permanent storage facility. In this manner, the useful service life of the site may extend indefinitely. In addition to providing for material removal, the ramps also allow easy entry for equipment used in the dewatering process. Section 4.1 discusses this latter process.

The ramps will be positioned on the west side of the containment basin. Obliquely traversing the containment dikes, the ramps' outside slopes will maintain the same 1V:3H side slope as the dikes. The recommended ascending/descending grade is 5%, with a road surface width of 12 ft.

2.3.6 Perimeter Ditch

A perimeter ditch, constructed at a 12-ft setback from the dikes outside toe, will extend around the basin's perimeter as shown on Figures 2.2 and 2.5. In addition to intercepting seepage from the basin, the perimeter ditch must also control stormwater runoff from the dike's outside slope and the perimeter service road. Preliminary perimeter ditch design specifies a mean invert elevation of 4.0 ft NAVD, a bottom width of 2 ft and side slopes of 1V:3H, to yield a mean top width of about 14 ft. Preliminary analysis indicates that the perimeter ditch will provide adequate conveyance for the first inch of storm runoff. Section 4.2.1 discusses stormwater control and stormwater runoff conveyance from within the containment basin. During dredging operations, if seepage from the DMMA causes the perimeter ditch to overflow, the dredging contractor will pump the water from the ditch back into the DMMA to provide adequate stormwater and seepage storage capacity and ensure compliance with water quality discharge criteria.

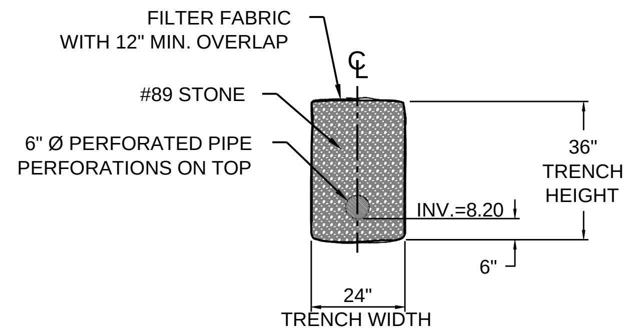
Excavation of the perimeter ditch will produce approximately 1,945 cy of material, which may be used for construction of the dike. Alternatively, the material excavated from the ditch will contribute to the dike requirement and thus reduce the required excavation depth in the basin interior. The final excavation depth and distribution of material, determined in the facility's final design phase, will reflect the results of a detailed grading plan.



TYPICAL DIKE AND ROAD SECTION WITH INFILTRATION DETAIL

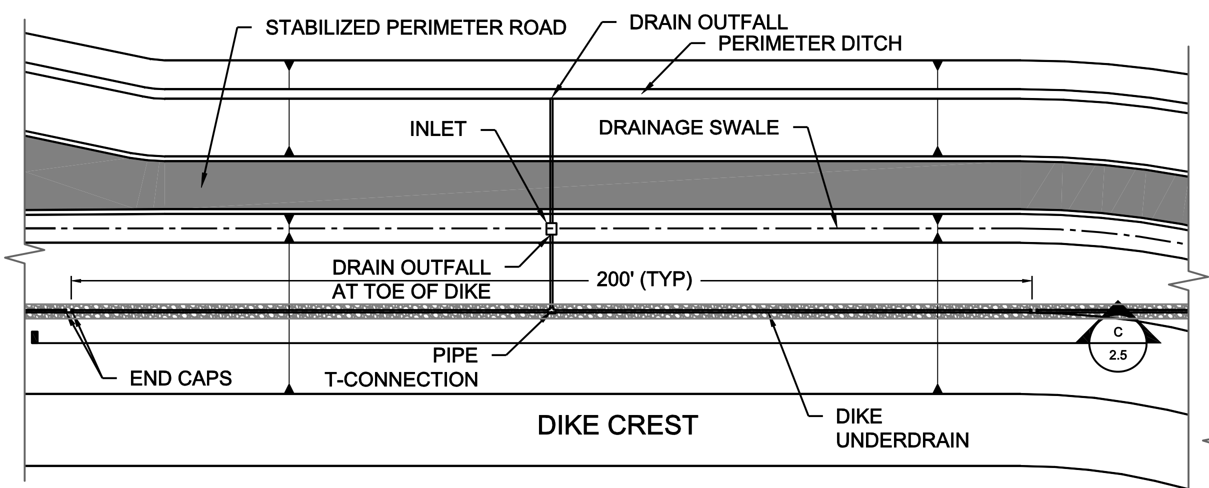
SCALE: 1" = 10'

0 10'



DIKE UNDERDRAIN TYPICAL SECTION

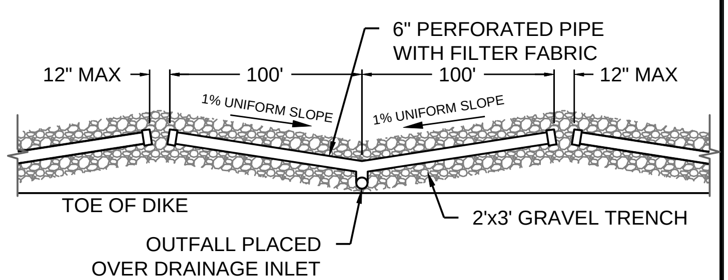
NOT TO SCALE



TYPICAL DIKE UNDERDRAIN PLAN

SCALE: 1" = 40'

0 40'



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2.5

DIKE UNDERDRAIN TYPICAL ELEVATION

NOT TO SCALE

TAYLOR ENGINEERING INC. 10151 DEERWOOD PARK BLVD. BLDG. 300, SUITE 300 JACKSONVILLE, FL 32256 CERTIFICATE OF AUTHORIZATION # 4815	FIGURE 2.5 DIKE UNDERDRAIN DETAILS NA-1 DREDGED MATERIAL MANAGEMENT AREA NASSAU COUNTY, FLORIDA	PROJECT C2008-044 DRAWN BY SHEET 7 of 7 DATE AUG 2010

PRELIMINARY DRAWINGS: THESE DRAWINGS ARE NOT IN FINAL FORM, BUT ARE BEING TRANSMITTED FOR AGENCY REVIEW.

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2.3.7 Dike Erosion and Vegetation

The stability of the containment dike must also be ensured against erosion from rainfall runoff and wind. Immediately following dike construction, native salt-tolerant grasses will be planted on the exterior dike slopes and crest. These grasses quickly form soil binding mats but do not root so deeply as to weaken the dike. An acceptable turf cover may be planted by approved techniques of sprigging, sodding, or seeding (broadcast or hydroseeding), or a combination of these methods, as determined by the contractor. Contractor responsibilities shall include the maintenance of the vegetation until adequately established, as certified by the USACE or FIND's designated representative. Vegetating the dike in this manner will also improve the site's appearance.

2.3.8 Site Security

Site security provided for the project area will restrict access, prevent vandalism and damage to site facilities, and ensure public safety. Permanent security fencing will be erected around the site's perimeter. Locked gates will control access to this area. The FIND and the Jacksonville District USACE will hold the gate keys and distribute them on an as-needed basis to agents of the USACE, dredging contractors, and other authorized parties.

Site security is most critical during active dredging and dewatering operations. Therefore, a qualified facility operator must remain at the site at all times during active dredging operations and decanting procedures following a dredging event, as well as at any time when significant ponded water remains within the containment basin. Among his other responsibilities, discussed further in Chapters 3.0 and 4.0, the site operator will ensure proper operation, adjustment, and maintenance of the weirs and will prevent premature release of effluent through unauthorized weir operation.

2.4 Additional Design Considerations

2.4.1 Migratory Bird Protection

The Jacksonville District USACE district-wide migratory bird protection policy (USACE, 1993) will be followed to ensure that operation and construction of the dredged material management area will not adversely impact migratory birds. The purpose of the migratory bird protection policy is to "*provide protection to nesting migratory bird species that commonly use the dredged material disposal sites within the Jacksonville District while facilitating disposal of dredged material to meet the Federal standard for* *navigation channel and harbor maintenance as authorized by Congress*" (pg. 1). Issues related to migratory bird protection will be addressed during all phases of site operation. Specific actions taken to protect migratory birds during pre-dredging site preparation are identified below.

Should construction activities at Site NA-1 take place during the migratory bird nesting season (April 1 through September 1), the site protection plan presented in Appendix I of the Migratory Bird Policy (USACE, 1993) will be implemented. This plan provides for education of contractor personnel, daily monitoring for nesting activity, steps to deter nesting in the construction area, avoidance of nests and, if necessary to protect nesting birds, cessation of construction activities. Alternatives that may be considered to prevent impacts to nesting birds include creation of undesirable habitat (e.g., flagging construction area, placement of ground cover, seeding or sodding exposed areas), dissuasion through noise or activity, or creation of alternative nesting sites. A final, undesirable alternative — incidental take — should only be considered during a documented emergency.

2.4.2 Cultural Resources

Inquiry to the Florida Department of State, Division of Historical Resources confirmed that the Florida Master File records do not show any archeological sites within the project area on the northern end of Crane Island (letter from George W. Percy, Historical Resources Director and State Historic Preservation Officer, dated March 9, 1995, Appendix A). The Division of Historical Resources further states that an archeological survey should precede clearing or excavating activities. In September and October 1995, the USACE performed an archeological survey of the proposed NA-1 site and found no archeological or historic sites within the project area.

3.0 OPERATIONAL CONSIDERATIONS DURING DREDGING

The primary objectives of site management during dredging operations are to maintain acceptable effluent quality during the decanting process, to maximize the dewatering rate of the deposited material by controlling the pattern of deposition, and to minimize the impact of the site on adjacent properties. To this end, six elements of site management are discussed: (1) placement and handling of the dredge discharge and return water pipelines, (2) operation and monitoring of the dredged slurry inlet, (3) operation and adjustment of the weirs, (4) monitoring of the released effluent, (5) continued monitoring of local groundwater conditions, and (6) compliance with the Jacksonville District's Migratory Bird Policy.

3.1 Pipeline Placement

The dredge (with additional boosters as necessary) will pump the dredged material as a slurry from the dredging site to the containment basin via pipeline. Thus, each dredging operation over the design life of Site NA-1 will involve placing and retrieving both the dredge discharge and the return water pipelines. Dredge discharge and return pipeline access to the NA-1 facility will occur on the west side of the containment basin. The pipeline will be placed to the greatest extent possible on unvegetated sand flats surrounding an old spoil feature to the west of the containment basin to minimize the impact on existing salt marsh vegetation. From mean high water, the dredge discharge pipeline will be placed at the outside toe of the dike along the west and north sides of the containment area, entering the containment area in its northeast corner by passing over the dike crest. The clarified effluent will be collected from the two weir boxes by a manifold system within the containment area. A single return pipeline will then exit the containment basin under the dike in the southwest corner as close as possible to the receiving waters (AIWW).

The dredge discharge pipeline will be placed immediately before dredging begins as part of the dredging contractor's mobilization procedures and will remain in place only during active dredging operations. The time required to complete this phase of operations will depend on the quantity and distribution of the dredged material. Immediately upon completion of dredging, the dredge discharge pipeline will be removed.

The return pipeline will remain in place to transport water decanted from the containment basin or released by initial trenching procedures (Section 4.1), approximately three to four weeks beyond the completion of dredging. The return water pipeline will attach to the weir-manifold system near the basin's southwestern corner to release the effluent to the AIWW.

3.2 Inlet Operation

The quality of the dredged sediment, specifically, the settling characteristics of the different grain-size fractions, will govern the operation of the inlet pipe. The coarsest fraction of material will settle out of suspension very rapidly and form a mound near the inlet. Successively finer fractions, characterized by lower settling velocities, will be deposited closer to the outlet weir. Thus, absent an inlet operation strategy, the dominant grain-size fraction will determine the distribution of sediment within the basin. For example, if fine-grained sediments dominate, a relatively large volume of material may be concentrated nearest the weirs. As discussed below, an extensive concentration of fine-grained sediment may require specialized dewatering procedures to speed drying.

As discussed in Section 2.3.3, samples taken at seven locations within Reach I indicate sediments as mainly fine sand with occasional mud lenses. The silt and clay-sized component of each sample ranged from 1.1 – 86.7%. In addition, each core boring contained at least one stratum with fine-grained components that exceeds 10%. Although these samples may be generally indicative of the quality of sediment within Reach I of the AIWW**,** additional data characterizing specific channel shoal sediments will be obtained before future dredging operations. These data will include, at a minimum, core boring logs containing a qualitative categorization of each sediment strata; laboratory data, including sediment size distribution curves and/or Atterberg limits; and suspended sediment-settling time curves representing the finest-grained sample from each boring location.

The recommended inlet operation strategy, based on the sediment data presented above and subject to event-specific sediment data, is appropriate for sediments characterized primarily as fine to medium sand, with silts and clays constituting only a minor component. This strategy makes no attempt to segregate material grain-size fractions by inlet manipulation, although some segregation will occur naturally as a result of differential settling as described above. To minimize the mounding of the coarsest sediment fraction and to distribute the deposited material more uniformly, the inlet pipeline should be repositioned during dredging operations. This will require extending the pipeline and resting each extension on the sediment mound formed at the previous position. A minimum distance of 100 ft must be maintained between the inlet and the inside toe of the dike to preclude erosion or undercutting the interior dike slope. The resulting deposition pattern should maintain a consistent slope from inlet to weir and should minimize dead zones and channelization.

An additional, although secondary, advantage gained through extending the inlet pipeline results from shutting down the dredge plant to allow the addition of each extension. These operational intermissions, together with temporary shutdowns to move the dredge, effectively increase the retention time of the containment area, thereby increasing the solids retention efficiency of the basin. However, preliminary analysis of containment area performance indicates that attaining adequate effluent quality will not require intermittent dredge operation.

The documented presence of discrete shoals or significant depositional strata characterized as predominantly fine-grained materials, such as organic silts or clays, would require an alternate strategy of inlet operation. For this case, NA-1 containment basin design specifically excludes compartmentalization of the containment area by use of interior dikes. However, segregation of the fine-grained fraction to optimize the engineering properties of the remaining sediment can occur by moving the inlet pipe to deposit silts and clays nearer the weirs, thereby keeping the fine material spatially concentrated. The coarser fraction dredged during the same operation can then be deposited along the eastern portion of the containment area. This alternate strategy would necessitate additional operating precautions. Given the reduced distance between the area of fine material deposition and the weirs, retention times adequate to allow precipitation of the fine sediment and maintain acceptable effluent quality must occur via additional ponding depth, intermittent dredge operation, or the use of turbidity control devices. Preliminary analysis of the channel sediment core borings indicated that approximately 7 hours of retention time would provide adequate solids retention. Combined with the expected shutdowns in pumping operations to relocate the dredge plant and inlet pipe, this strategy would allow for the maintenance of acceptable effluent quality. However, to achieve the desired segregation of fine-grained material, this strategy must also include the removal of a substantial portion, if not all, of the segregated material following dewatering and prior to succeeding placement operations.

3.2.1 Monitoring Related to Inlet Operation

Active dredging operations will require several monitoring procedures related to inlet operations. Ponding depth, as previously mentioned, remains a critical parameter for maintaining acceptable containment basin performance. Increased ponding depth improves the basin's solids retention performance by increasing retention time. However, under saturated foundation conditions, unbalanced hydrostatic forces resulting from too great a ponding depth can create the potential for dike failure. Indications of impending dike instability include foundation saturation at the outer dike toe and excessive seepage through the dike's outer slope, followed by piping and small-scale slumping. Obviously, such conditions must be avoided. Therefore, ponded water surface should be allowed to rise above the 2-ft minimum depth only under close monitoring by visual inspection of dike integrity. If no effluent is released at the weir, the output of a 16-in. dredge (i.e., 2,800 cy/hr slurry at a 20/80 solids/liquid mix, or 2,240 cy/hr liquid) will produce an increase in ponding depth of approximately 0.67 ft/hr and a rise in the water surface (i.e., deposition layer plus ponding) of approximately 0.83 ft/hr. These rates are slow enough to allow close continual monitoring of the entire dike perimeter.

However, ponding depth should not be permitted to increase beyond a maximum of 5 ft. Dike stability should be monitored continuously during periods when ponding depth is maintained above the 2-ft minimum.

Optimal operating efficiency requires that flow through the containment basin approaches plug flow to the greatest degree possible. Uneven flow distribution — evidenced by irregular sediment deposition, channelization, and short-circuiting — increases flow velocities, reduces retention time, and promotes sediment resuspension. If inspection reveals an irregular deposition pattern, the inlet pipe should be repositioned to produce a more uniform depositional surface. Additionally, the FIND will require the contractor to adhere to the following four-step operation protocol: (1) perform visual monitoring at 1-hour intervals; (2) collect and analyze samples (during daylight hours) at 4-hour intervals; (3) monitor NTU levels; and (4) add weir boards in advance (at roughly 24 NTU) of triggering the water quality criteria.

Last, the incoming slurry should be periodically monitored at the containment basin inlet to confirm or refine dredge output specifications, including volumetric output and slurry solids content. These parameters, in combination with the actual duration of dredging, can serve as an independent measure of deposition volume to determine remaining site capacity. Additionally, the computed deposition volume can be used with pre- and post-dredging bathymetric surveys of the channel and, following placement and dewatering of the deposition layer, topographic surveys within the containment basin to refine the bulking factor employed to translate in situ dredging volumes to required storage volumes. Also, within the same monitoring program, the quality of dredged sediment should be established by laboratory analysis of grain size distributions, settling velocities, specific gravity, and Atterberg limits.

3.3 Weir Operation

Weir operation — that is, controlling the ponding depth and flow rate over the weirs by adjusting the weir crest elevation — is the procedure most critical to maintaining effluent quality during dredging and decanting operations. Operational requirements extend to the period during and immediately after containment basin construction. Initially, the weir crest elevation should be set as high as necessary to prevent unwanted release of stormwater and groundwater seepage. Before the site's initial use, the site operator will periodically release ponded stormwater and groundwater seepage during regularly scheduled inspections.

To prevent the premature release of effluent, at the start of the first placement operation at NA-1, the minimum initial weir elevation above the mean interior site grade should be equal to the maximum anticipated mean ponding depth of 5 ft. For the NA-1 site, this will result in an initial weir crest elevation of +5.0 ft NAVD, given a distance from inlet to weir of 800 ft. During this initial operational phase, the design dredge discharge (2,800 cy/hr) will increase the ponding depth at a rate of approximately 0.67 ft/hr and increase the ponded water surface elevation (ponding depth plus deposition layer) at a rate of approximately 0.83 ft/hr. This relatively slow rise should allow for close continual monitoring of the entire dike perimeter for indications of slope instability during periods when the ponded water surface rises above the surrounding site grade elevation. Inspection becomes most critical when the ponded water surface rises above its previous maximum elevation. Experience has shown that as the ponded water percolates into the interior dike slope, the coarser dike material filters the fine suspended sediment. This filtering reduces the dike permeability and thus decreases the dike's susceptibility to excessive saturation and seepage.

As stated above, no effluent should be released until the surface of the ponded water approaches the weir crests' initial setting. Notably, a flow control structure such as a weir cannot improve effluent quality beyond that of the surface water immediately upstream. Thus, the decision to release effluent over the weirs should be based on the analysis of water samples taken immediately upstream of the weirs at the maximum depth of withdrawal. For Site NA-1, recommended WES procedures determined this depth to be 1.5 ft, based on the design dredge discharge of 2,800 cy/hr and a design weir loading of 0.53 cfs/ft. If testing shows that the turbidity of the interior surface waters remains unacceptably high, the release of effluent must be delayed by one of two methods: (1) raising the weir crests by adding flashboards or (2) shutting down the dredge plant. Additional alternative measures may include installing turbidity screens surrounding the weirs.

Once the weirs have begun to release effluent that meets established performance criteria (Section 2.3), the outflow over the weirs must not exceed the design dredge discharge, or 0.53 cfs/ft. As discussed below, static head over the weirs then becomes the most practical criterion to ensure that the flow over the weirs, and thereby the effluent quality, remains within design limits.

Static head represents the maximum elevation of the water surface above the elevation of the weir crests. To avoid the area of drawdown as the surface waters accelerate toward the weirs, the maximum elevation should be measured at least 10 – 20 ft upstream of the weirs at a point where velocities are low (1 – 2% of the velocity at the weir crests). Here, a stage gauge can measure the maximum water surface elevation directly, with the difference between the gauge elevation and the weir crest elevation indicating the static head. An empirical relationship applicable to narrow-crested weirs (Walski and Schroeder, 1978) indicates that a design weir loading 0.53 cfs/ft corresponds to a static head 0.29 ft (3.5 in.). Alternatively, measuring the depth of flow over the weir provides an indirect measurement of the static head. The ratio of depth of flow over the weirs to static head, estimated as 0.85 for sharp-crested weirs, yields a design flow depth for the NA-1 facility of 0.25 ft or 3.0 in. If the head over the weir, as measured by either method, falls below these design values because of unsteady dredge output or intermittent operation, effluent quality should increase. However, if the head exceeds these values, the ponding depth should be increased by adding flashboards or temporarily halting dredging to prevent a decrease in effluent quality.

At all times, each of two weir boxes must be maintained at the same elevation to prevent flow concentration and a decrease in effluent quality related to an increase in weir loading. Preventing floating debris from collecting in front of the weir sections is also important. An accumulation of debris at the weirs will reduce the effective weir crest length and thereby increase the withdrawal depth. This, in turn, may increase the effluent suspended solids concentration.

With dredging completed, *decanting* — the slow release of all remaining ponded water within the basin by gradually removing flashboards — begins. Flow over the weirs should drop essentially to zero before the next flashboard is removed. Effluent monitoring must continue during the decanting process. If at any time during this process effluent turbidity violates water quality standards, the effluent must be retained until analysis of the interior surface waters shows the suspended solids concentration to fall within acceptable limits. Decanting then continues in this manner until all ponded water is released over the weir. Chapter 4.0 discusses subsequent dewatering techniques.

3.4 Effluent Monitoring

As discussed in the preceding section, effluent monitoring will be an integral part of facility operation. The NA-1 containment basin has been designed to produce effluent meeting water quality standards for Class III waters as set forth in Chapter 62-302 of the Florida Administrative Code. These rules require a comprehensive monitoring program to document permit compliance. The monitoring program should therefore continue throughout active dredging and decanting operations. Effluent samples should be taken and analyzed as often as practical. The minimum recommended sampling frequency is two times per 8-hour daylight shift. Notably, due to safety reasons, no nighttime monitoring of turbidity will occur at the weir discharge pipe; however, the FIND will require the dredging contractor to install a temporary light at the discharge location to visually monitor (on an hourly basis) the effluent water quality.

Because effluent turbidity is a primary water quality parameter for site operation, compliance with turbidity standards will largely control both the dredge plant output and the release of effluent. However, the prediction and interpretation of basin performance and effluent quality in terms of these standards can prove problematic. This situation arises from the incompatibility of established design and compliance criteria. State standards for effluent turbidity are expressed in terms of optical clarity relative to ambient conditions of the receiving waters. By comparison, containment area design guidelines published by the USACE WES under the DMRP relate containment area performance to the suspended solids concentration of the effluent. The level of turbidity produced by a specific suspended solids concentration depends highly on the physical characteristics of the suspended material. Previous investigations (e.g., Walski and Schroeder, 1978) could not establish an effective method to translate suspended solids concentration to optical clarity even for sediments with well-defined physical characteristics. The design and operation of this and other similar sites would greatly benefit from such a predictive relationship. A primary objective of the effluent monitoring program should be to relate suspended solids concentration to the state performance criterion based on turbidity for sediments typically encountered in the AIWW.

3.5 Dike Inspection Requirements

Throughout all phases of dredging and dewatering the contractor shall be responsible for additional inspections of the containment facility related to ensuring the integrity and stability of the containment dikes. The remainder of this chapter details specific inspection requirements.

3.5.1 Critical Inspections

The contractor shall perform periodic inspections of the containment dikes to check for certain critical conditions that may require the implementation of remedial measures. All inspections shall be conducted by a qualified geotechnical engineer or engineering tec18.hnician with specific training and experience in performing inspections of earthen dams, earthen reservoirs, or earthen dredged material containment facilities. As part of his required preconstruction submittals, the contractor must submit the qualifications of the designated dike inspector for review and approval of the FIND or its authorized representative.

The contractor shall conduct inspections for the items listed below every week. Any of these conditions shall be considered as indicating a critical condition that requires immediate investigation and may require emergency remedial action. Immediately upon confirming the existence of a critical condition, the contractor must inform the Project Engineer and increase the inspection frequency to a minimum of once daily. The Project Engineer will then immediately notify the Florida Department of Environmental Protection (FDEP). Within 24 hours of confirming a critical condition, the contractor must submit to the Project Engineer documentation of the inspections and implemented remedial actions. The Project Engineer will then submit to the FDEP a written report detailing the condition and the implemented remedial actions within seven (7) days of the confirmation of the critical condition. The following items shall be considered as indicating a critical condition:

1) Seepage with boils, sand cones, or deltas on outer face of the dike or downstream from the dike's outer toe;

2) Silt accumulations, boils, deltas, or cones in the drainage ditches at the dike's base;

3) Cracking of soil surface on the dike's crest or on either face of the dike;

4) Bulging of the downstream face of the dike;

5) Seepage, damp area, or boils in vicinity of or erosion around a conduit through the dike; and

6) Any subsidence of the crest or faces.

3.5.2 Supplemental Inspections

During the critical inspections described above, the items listed below shall be considered indicators of potential areas of concern that the contractor must then continue to monitor closely during subsequent inspections and to perform repairs as necessary. Within 24 hours of confirming the presence of an indicator of a potential area of concern, the contractor must also inform the Project Engineer of the item and any required repairs undertaken. Indicators of potential areas of concern include the following:

1) Overgrowth patches of vegetation on the downstream face or close area downstream from the toe;

2) Surface erosion, gullying, or wave erosion of the upstream face of the dike;

3) Surface erosion, gullying, or damp areas on the downstream face of the dike, including the berm and the area downstream from the outside toe;

4) Erosion below any conduit exiting the dike; and

5) Wet areas or soggy soil in the downstream face of the dike or in the natural soil below dike.

3.6 Groundwater Monitoring and Soil Sample Collection

Crane Island is an area of upland, surrounded mostly by salt marsh experiencing periodic tidal inundation. As expected under such conditions, preliminary subsurface surveys have documented a high water table, typically less than 2.5 ft beneath the undisturbed soil surface at the specific locations sampled. Although the NA-1 containment basin will impound brackish water pumped from the AIWW in connection with dredging operations only for relatively short periods (2 – 3 weeks) once every 4 – 5 years, the possibility exists for chloride intrusion into the shallow aquifer. The planned residential development on the southern portion to the island will most likely connect to the Fernandina Beach municipal water supply, and therefore will require no potable or sanitary water from wells. However, water for lawn irrigation may be drawn from the shallow aquifer if it proves suitable. Prior to any construction or disposal activity, a shallow test well should be sunk within the planned on-site buffer region that separates the containment area from the remainder of the island. A baseline chloride concentration should be determined under pre-construction conditions, and a regular monitoring program should be established to document any deviations from these conditions. If residential irrigation water is drawn from the shallow aquifer, saltwater intrusion could result. Therefore, an ongoing well monitoring program should be kept in place to distinguish any changes in groundwater chloride concentrations attributable to the operation of the containment site.

For reasons similar to those outlined above, the FIND will collect pre-construction soil samples (in vicinity of the planned monitoring well installation) for analysis of the Sodium Adsorption Ratio (SAR). This information will provide background data and future SAR monitoring will only occur on an as-needed basis.

3.7 Migratory Bird Protection

Should dredging be necessary during the migratory bird nesting season (April 1 – September 1), procedures presented in Appendix I of the Migratory Bird Policy (USACE, 1993) will be implemented. These procedures include a variety of measures, summarized in Section 2.5, to ensure avoidance of impacts to migratory birds during periods of active dredging operations.

4.0 POST-DREDGING SITE MANAGEMENT

The post-dredging phase of site operation begins following the completion of decanting and continues until the start of the next planned dredging event. Post-dredging site management will be accomplished by the FIND and will include, at a minimum, quarterly site inspections. The following section discusses additional post-dredging site management tasks.

During the post-dredging phase, dredged material deposited within the containment basin is actively managed to reduce its moisture content. Through this process, the material is made suitable for handling and, should market conditions prove favorable, removal and beneficial reuse. However, Site NA-1's intended use as a permanent facility requires other management procedures between successive dredging operations. These include a comprehensive monitoring and data collection effort, mosquito control, and site security. Each element of post-dredging site management is discussed below.

4.1 Dewatering Operations

Dewatering techniques at Site NA-1 will depend on the physical characteristics of the dredged material as well as the thickness of the deposition layer. As discussed in Section 2.3.3, preliminary data indicate that the material to be placed in the NA-1 containment basin will consist of mainly fine sand with occasional mud lenses. Composed primarily of fine-grained material resistant to natural drying, such a deposition layer — unlikely to dry through natural evaporation and percolation alone — may require supplementary dewatering techniques. The most appropriate dewatering techniques for this purpose include surface water removal, progressive trenching to promote continued drainage, and progressive reworking or removal of the dried surface layer. Each procedure and its specific application to the present situation are discussed below.

Decanting all ponded surface water is necessary before significant evaporative drying of the fine-grained material can occur. Simply continuing to lower the weir crests will remove most of the ponded water following the completion of dredging operations. However, the anticipated topography of the deposition layer makes draining all ponded water in this manner unlikely. As discussed, differential settling of the various size fractions of the sediment results in partial segregation of the dredged material within the containment basin. Coarser sand- and gravel-sized particles settle nearer the inlet, while finer particles concentrate nearer the weir. The sand-sized fraction, concentrated nearer the inlet, should experience relatively little consolidation because of its low initial water content. However, the fine material's greater consolidation will likely form one or more depressions nearer the weirs. To remove the ponded water that remains in these areas, a drainage trench may be needed to connect each depression to a sump excavated adjacent to one or more weirs. During this phase of operations, the weir crests may be raised to prevent the premature release of the ponded water which, as a result of the excavation, will likely contain a high concentration of suspended solids. Clarified water can then be released over the weirs as soon as effluent turbidity standards are met.

Following the removal of all remaining ponded water, evaporative drying will eventually form a crust over the deposition layer. This crust will trap water beneath its surface and retard continued evaporation. In addition, the desiccation cracks that quickly form in the crust will hold rainwater and limit further drying. Therefore, complete drying may require additional trenching. Initially, a dragline or clamshell operating from the crest of the containment dike can excavate a perimeter trench. More intensive trenching must wait until a crust of significant thickness (greater than 1 – 2 in.) has developed on the deposition surface. The crusted surface will eventually allow the use of conventional low ground pressure equipment. A network of radial or parallel trenches should then be constructed throughout the area of fine sediment deposition. The slumping resistance of the semiliquid layer beneath the crust will determine the appropriate depth of each trenching operation. The thickness of the fine-grained deposition layer, in turn, will dictate the number of trenching operations required. After initial construction of the trenches, the NA-1 site will require grading no more than once to provide sufficient drainage for the relatively thin fine sediment deposition layer. Given a sufficient volume of coarser sediments, the dried surface crust can also be transferred to a more well-drained area of sandier material nearer the inlet. This would expose the wetter under layers and restore a relatively high rate of evaporative drying.

The dewatering process will continue until the crust extends over the entire depth of the deposition layer. The time required to complete this phase of site operation will depend on the physical characteristics of the sediment, as well as climatic conditions (e.g., rainfall, relative humidity, season, etc.). During the entire dewatering phase of the site operation, the weirs must be operated to control the release of residual water and impounded stormwater. The clarified effluent will be routed to the perimeter ditch and drained off site.

4.2 Control of Stormwater Runoff and Topographic Surveys

4.2.1 Control of Stormwater Runoff

As stated, grading the dewatered deposition layer provides the additional benefit of allowing the control and release of stormwater that drains from the interior slopes of the containment dike as well as the dewatered sediment. In compliance with regulatory policy, a sump or retention area of adequate capacity should be constructed adjacent to the weirs (with the weir flashboards in place) to retain the runoff from the first 1 in. of rainfall. A site operator would then be responsible for the gradual release of the ponded runoff at intervals determined by local weather conditions. As discussed in Section 3.1, the clarified runoff will be routed from the terminus of the outlet manifold to MHW via culvert, following the same route as the return pipeline. However, construction details (required slope, culvert size, etc.) will be deferred to the final design phase.

Before the contractor demobilizes from the site, the Project Engineer will determine the weir crest height required to ensure that no uncontrolled release of stormwater occurs following project close-out. This determination will reflect information specific to each placement operation at the NA-1 facility including the bulked volume of the dredged material, the geometry of the deposition, and specific permit requirements imposed to govern the control and release of stormwater from the NA-1 facility. The contractor must then reinstall the weir boards in all weirs at or above this elevation.

After the contractor completes his demobilization from the NA-1 facility, responsibility for continued management of stormwater within the basin, as well as all other continuing site maintenance activities between successive dredging operations, resides with the FIND. To this end, the FIND's designated site operator will periodically return to the site to release stormwater as well as the accumulated drainage from the dredged material as it continues to consolidate under its own weight.

To release this water, the site operator will remove one or more weir boards from a single stack as necessary to release the surface layer of the ponded water adjacent to the weirs. To minimize the work required, the operator need only open one side of a single weir stack (that is, one column of boards) and only to the level to start water flowing over the lowered weir crest. Only when the flow over the lowered weir crest approaches zero should the operator remove another board. This process should continue one board at a time, until all ponded water drains from the site. The operator should then replace the weir boards to the required elevation to prevent uncontrolled stormwater releases.

4.2.2 Topographic Surveys

Monitoring the containment area between successive dredging events will include two topographic surveys of the dike crest and deposition surface. Results from a post-dredging survey, performed as soon as possible after grading of the dewatered material, will provide an independent check of the dredging pay volume derived from pre- and post-dredging bathymetric comparison. The second type of topographic survey would follow the completion of material offloading and related grading operations. Results from this would be used to compute the quantity of material removed and the remaining site capacity. Used in combination with the earlier post-grading survey, this second survey will determine the remaining site capacity.

As mentioned in Section 2.2, initial dike construction will include installation of settlement platforms and pore pressure piezometer transducers for dike settlement monitoring during and after construction. Before each dredging event, the FIND will apply the topographic survey results and settlement monitoring data to restore the minimum design crest elevation of 18.5 ft NAVD.

4.3 Material Rehandling/Reuse

As discussed in Chapter 1.0, Site NA-1 is one of eight proposed dredged material management areas designed to serve the long-term maintenance requirements of the Atlantic Intracoastal and Intracoastal Waterways within Nassau and Duval Counties. This report, as well as the accompanying permit documentation, has emphasized that although each site has been designed for a specific service life, each is also to operate as a permanent facility for the intermediate storage and rehandling of dredged material. To fulfill this intended use, at some point the dewatered material must be removed off site. The following paragraphs discuss the ultimate use of this material.

Based on a comprehensive analysis of dredging records, the bulked material volume projected for placement and temporary storage over the 50-yr design service life of the eight facilities exceeds 5,000,000 cy of predominately fine to medium quartz sand. Although relatively minor by the standards of some dredging operations, this volume still represents a significant quantity of potentially valuable material. Even if the possible return on the sale of this material were disregarded, the cost savings of permanent storage alone would justify an effort to determine, through a formal market analysis, the potential demand for dewatered dredged material.

If such a determination shows that material resale and/or reuse is practical, the properties of the dredged material must then satisfy the requirements of commercial interests. The coarsest fraction of material (sand and gravel), partially segregated through differential settling, can likely be used *as is*. However, the feasibility of compartmentalized segregation of material during dredging or mechanical separation following dewatering should be explored if market conditions dictate. Portions of the material determined to be unsuitable for fill or other construction purposes because of organic silt or clay content might be used for landfill capping or agricultural purposes.

4.4 Additional Environmental Considerations

4.4.1 Biological Monitoring

A primary consideration in the design and operational guidelines for Site NA-1 is the intent to limit adverse impacts directly related to construction of the dredged material management facility. Notwithstanding the above, additional biological monitoring will be required within the buffer zone which lies outside the containment area. A biological monitoring program, perhaps extended to the proposed pipeline route as well as the immediate vicinity of the site, may include the following elements. If required to update existing information, an environmental survey of these areas will be performed before site construction to establish current baseline habitat conditions and population densities. Periodic resurveys should then continue throughout the service life of the site. Impacts to local habitat resulting from site construction or operation should be noted, corrective actions taken, and guidelines developed to avoid similar consequences. Similarly, beneficial aspects of site management should be recognized and encouraged, and the lessons learned should be applied to the future operation of this and other comparable dredged material management areas.

4.4.2 Migratory Bird Protection

As discussed in Section 2.3.3, available sediment data suggest that the deposition layer will present very little sandy substrate, and thus should prove poorly suited for migratory bird nesting. However, given sufficient sandy material, migratory birds may nest in portions of the containment basin following dewatering and grading as well as on the containment dike. Should post-dredging site management activities be required during the April 1 – September 1 nesting season, they will be carried out in accordance with the site protection plan (USACE, 1993) summarized in Section 2.4.

4.4.3 Mosquito Control

The basic approach of the mosquito control program for Site NA-1 will emphasize physical rather than chemical control. The time during which standing water remains inside the containment area will be kept to a minimum to reduce the potential for mosquito breeding. The operational phase most favorable for mosquito breeding follows the completion of decanting when desiccation cracks form in the crust. Trenching procedures (Section 4.1) will accelerate the dewatering process by allowing much of the moisture within the cracks to drain to the weirs. However, given the anticipated thickness of the deposition layer and the nature of the dredged material, the dewatering phase will likely extend long enough to result in successful breeding within the desiccation cracks and residual ponds. This would require a short-term spray program coordinated through the Nassau County Mosquito Control Board.

4.5 Site Security

Providing adequate site security will remain a key element in the proper management of NA-1. Unsecured dredged material containment areas typically host a variety of unauthorized activities including illegal dumping, vandalism, hunting, and dike destruction by off-road vehicles. As discussed in Section 2.3.8, security fencing installed around the site’s upland perimeter should limit such activities within the NA-1 containment facility. Authorized access to the area within the fence will be restricted to agents and representatives of the FIND and the Jacksonville District USACE, and contractor personnel. Access gates will remain locked at all times except during dredging and maintenance operations. The presence of an on-site operator during such operations should further discourage unauthorized entry to the site and the occurrence of unsanctioned activities.

Between dredging operations the site operator will be responsible for carrying out regularly scheduled inspections. The primary purpose of these inspections will be to perform routine operational functions and to ensure that facility security is maintained. Breaches in site security will be identified and appropriate actions will be taken as quickly as possible to restore the site to a fully operational standby condition. Other responsibilities of the operator during these visits will include weir operation and stormwater release, groundwater monitoring, and routine inspection of dike integrity and buffer area conditions.

REFERENCES

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Taylor, R. B., McFetridge, W. F., Maguire, A.J., Ellis, C.B. 2006. *Reevaluation of Dredged Material Management Alternatives Phase I Reach I, Atlantic Intracoastal Waterway, Nassau County, FL.* Taylor Engineering., Inc., Jacksonville, FL.

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APPENDIX A

March 1995 State Historic Preservation Office Letter

FLORIDA DEPARTMENT OF STATE
Sandra B. Mortham
Secretary of State
DIVISION OF HISTORICAL RESOURCES
R.A. Gray Building
500 South Bronough Street
Tallahassee, Florida 32399-0250

Director's Office
(904 488-1480

Telecopier Number (FAX)
(904) 488-3353

March 9, 1995

Mr. A. J. Salem, Chief
Planning Division, Environmental
Resources Branch
Jacksonville District Corps of
Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

In Reply Refer To:
Robin D. Jackson
Historic Sites
Specialist
(904) 487-2333
Project File No. 950254

RE: Cultural Resource Assessment Request
NA-1, Crane Island
Disposal Area Construction
Nassau County, Florida

Dear Mr. Salem:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the referenced project(s) for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authority for this procedure is the National Historic Preservation Act of 1966 (Public Law 89-665), as amended.

A review of the Florida Site File indicated that there are no archaeological or historic sites recorded within the project area on the northern end of Crane Island. However, the lack of recorded historic properties is not considered significant because this part of the Island has never been subjected to a systematic, professional survey to locate such properties. The remainder of Crane Island area was surveyed in 1988 (copy of report enclosed). Two new archaeological sites, 8NA708 and 8NA709, were located during that survey and one previously recorded archaeological site, 8NA59 (Florida Site File form enclosed) was revisited. It is, therefore, the opinion of this office that there is a reasonable probability of project activities impacting historic properties potentially eligible for listing in the National Register of Historic Places, or otherwise of historical or architectural value.

Since potentially significant archaeological and historic sites may be present, it is our recommendation that, prior to initiating any project related land clearing or ground disturbing activities within the project area, it should be subjected to a systematic, professional archaeological and historical survey. The purpose of this survey will be to locate and assess the significance of historic properties present. The resultant survey report must conform to the specifications set forth in Chapter 1A-46 and will need to be forwarded to this agency in order to complete the process of reviewing the impact of this proposed project on historic properties.

The results of the investigations will determine if significant historic properties would be disturbed by this project. In addition, if significant remains are located, the data described in the report and the archaeologist's conclusions will assist this office in determining measures that must be taken to avoid, minimize, or mitigate adverse impacts to historic properties listed, or eligible for listing in the National Register of Historic Places.

Because this letter and its contents are a matter of public record, the applicant may be contacted by consultants who have knowledge of our recommendations. This should in no way be interpreted as an endorsement by this agency. A listing of archaeological consultants who work in Florida may be obtained from this office or from the Florida Archaeological Council.

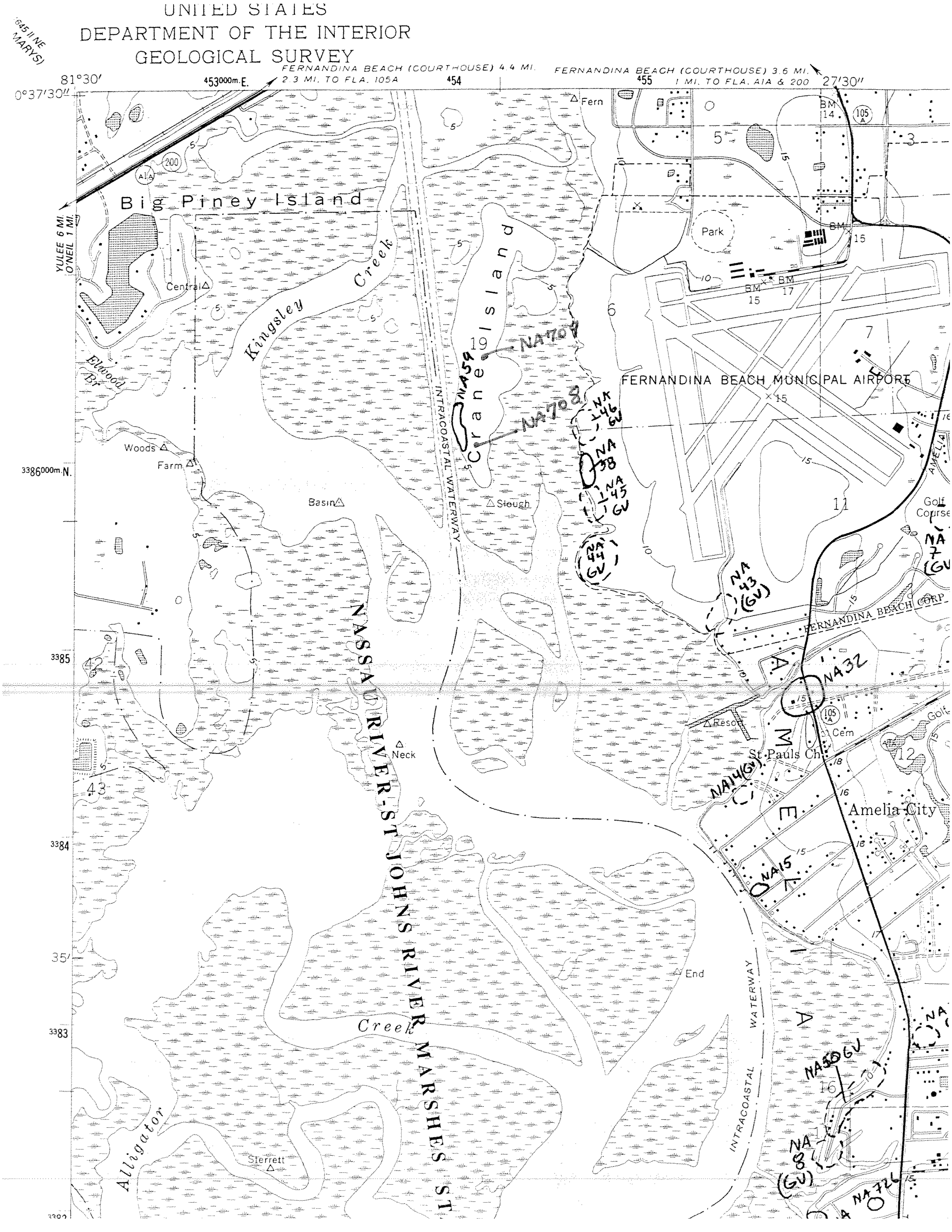
If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's historic properties is appreciated.

Sincerely,

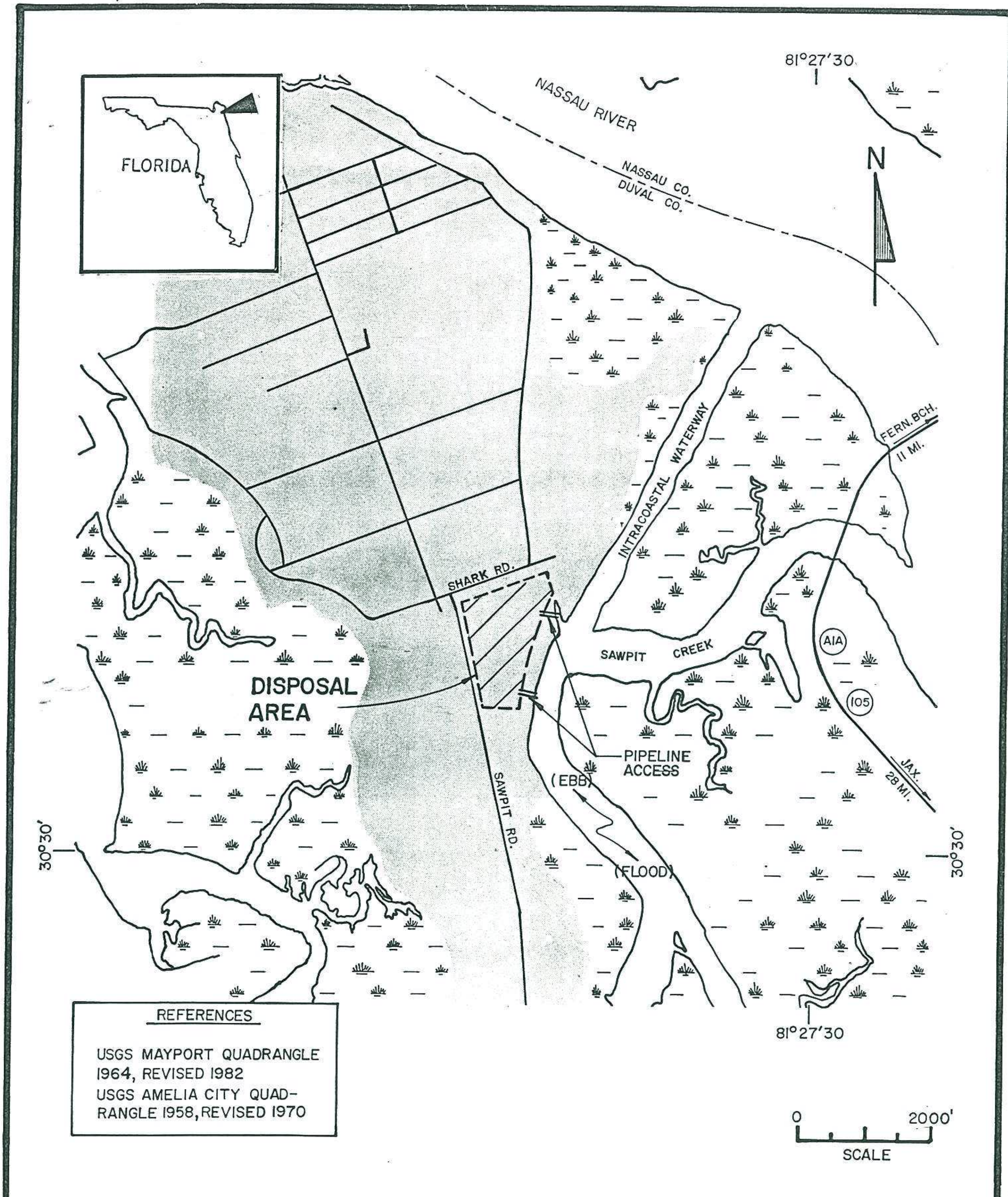
Laura A. Kammerer

for George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

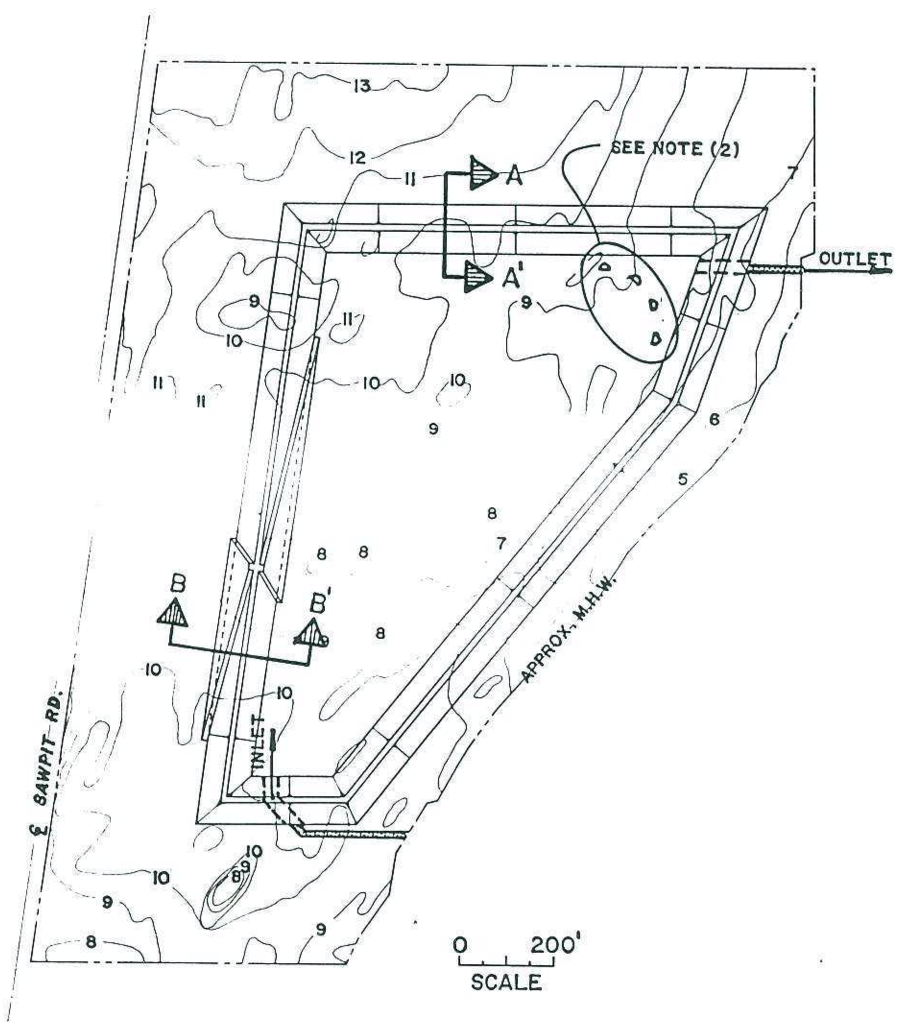
GWP/Jrj
Enclosures (3)



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
FERNANDINA BEACH (COURTHOUSE) 4.4 MI.
2.3 MI. TO FLA. 105A
FERNANDINA BEACH (COURTHOUSE) 3.6 MI.
1 MI. TO FLA. A1A & 200
81°30′
30°37′30″
27′30″
YULEE 6 MI.
O'NEIL 1 MI.
Big Piney Island
Kingsley Creek
Crane Island
Elwood Br
Central
Woods
Farm
Basin
Slough
Fern
Park
FERNANDINA BEACH MUNICIPAL AIRPORT
INTRACOASTAL WATERWAY
NASSAU RIVER-ST JOHNS RIVER MARSHES ST
FERNANDINA BEACH CORP
Golf Course
Resort
Cem
St Pauls Ch
Amelia City
Neck
End
Creek
Alligator
Sterrett
NA 59
NA 70 A
NA 70 B
NA 46 GV
NA 38
NA 45 GV
NA 44 GV
NA 43 (GV)
NA 7 (GV)
NA 32
NA 14 (GV)
NA 15
NA 50 GV
NA 8 (GV)
NA 72 C



TAYLOR & DIVOKY INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE FLORIDA 32216	N.E. BLACK HAMMOCK ISLAND DISPOSAL SITE LOCATION	PROJECT C-8610 REVISION SHEET 1 OF 7 DATE 1-7-88



NOTES :

1. SUPPLY AND RETURN PIPELINES TO ENTER SITE DIRECTLY FROM SAWPIT CREEK (STATE WATERS) WITH NO ADDITIONAL EASEMENT REQUIRED; PIPELINE PLACEMENT WILL REQUIRE THE CROSSING OF MINIMAL (< 10 FT.) SALTMARSH.
2. WEIRS: FOUR 9'-15' DIA. CM HALF PIPES W/REMOVABLE FLASH BOARDS ADJ. FROM + 13 FT. ABOVE GRADE TO BELOW GRADE (WITH CONNECTING MANIFOLD.)
3. CONTAINMENT AREA : WITHIN OUTSIDE TOE OF DIKE: 22.76 AC.
   WITHIN INSIDE TOE OF DIKE : 13.69 AC.
   CAPACITY : 394,972 C.Y.
4. SECTION A-A', SEE SHEET 3 of 7
5. SECTION B-B', SEE SHEET 4 of 7
6. ELEVATION DATUM : NGVD OF 1929
7. AREA OUTSIDE DIKE WITHIN SITE BOUNDARY TO BE A BUFFER OF NATURAL VEGETATION.

LEGEND

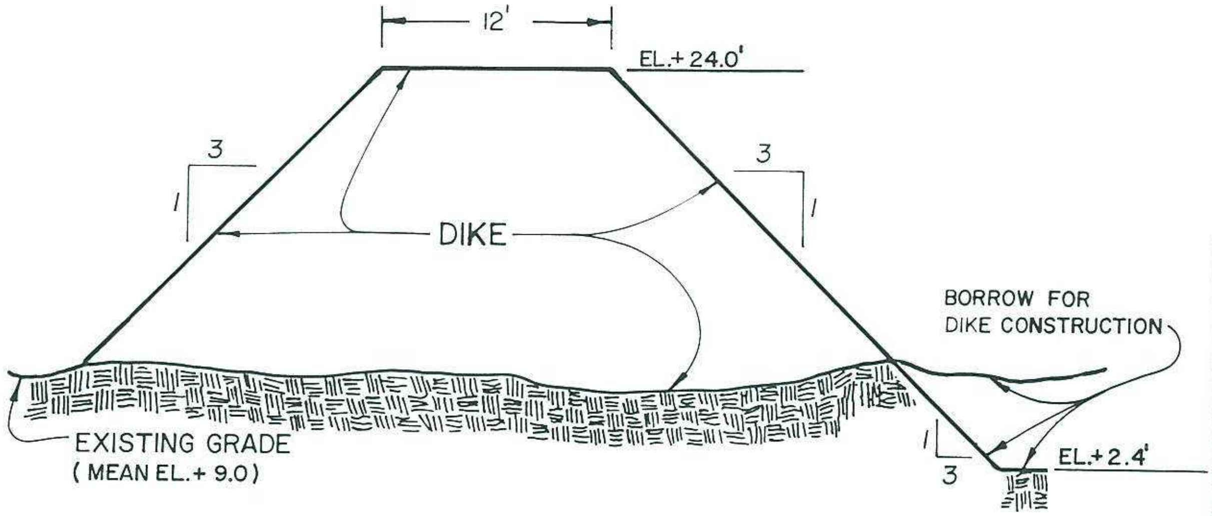
PIPELINE ROUTE
SITE BOUNDARY

TAYLOR & DIVOKY INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE FLORIDA 32216

NORTHEAST BLACK HAMMOCK ISLAND
DISPOSAL AREA-SITE PLAN

PROJECT	C-8610
REVISION	
SHEET	2 of 7
DATE	1-7-88

301233

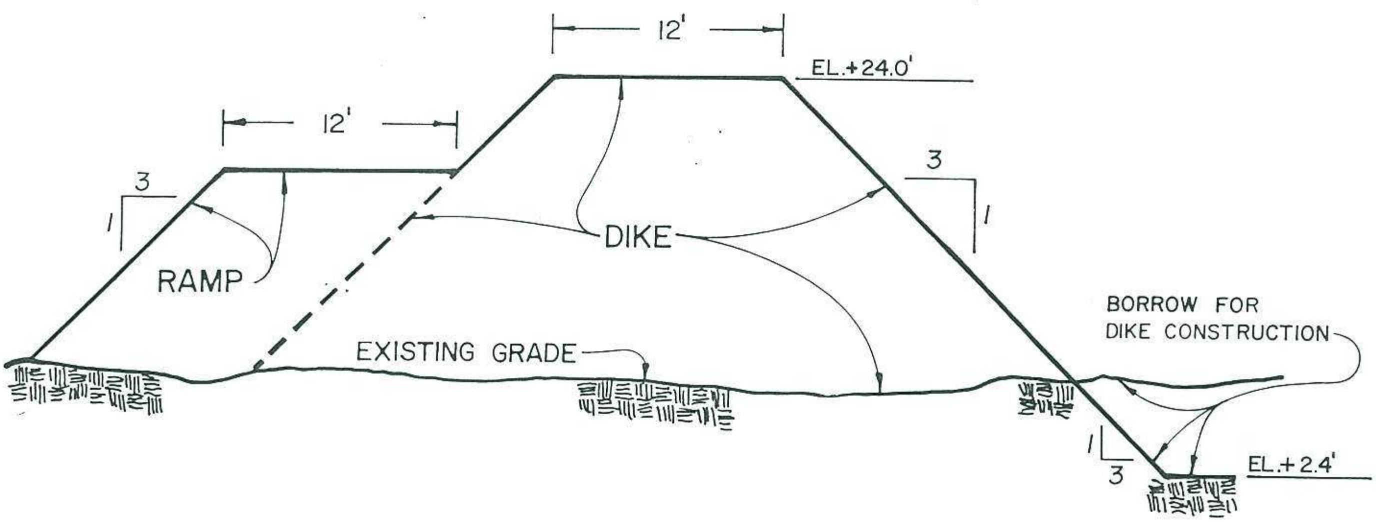


SECTION A–A'

N.T.S

NOTE:
ELEVATIONS REFERENCED
TO NGVD 1929

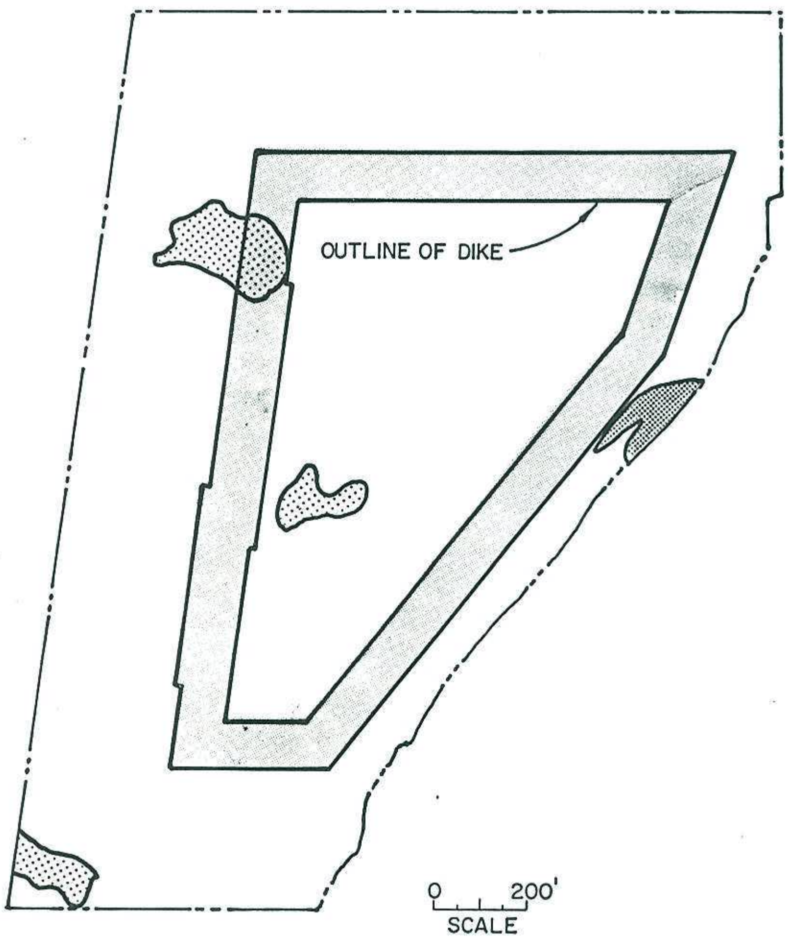
TAYLOR & DIVOKY INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE FLORIDA 32216	N.E. BLACK HAMMOCK ISLAND TYPICAL DIKE SECTION	PROJECT C-8610 REVISION SHEET 3 OF 7 DATE 1-7-88



SECTION B–B'
N.T.S.

NOTE:
ELEVATIONS REFERENCED
TO NGVD 1929

TAYLOR & DIVOKY INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE FLORIDA 32216	N.E. BLACK HAMMOCK ISLAND DIKE-RAMP SECTION	PROJECT C-8610 REVISION SHEET 4 of 7 DATE 1-7-88



NOTES:

1. AREA OF DER JURISDICTIONAL WETLANDS ON SITE = .4 AC.
   AREA OF DER JURISDICTIONAL WETLANDS IMPACTED = Ø AC.
2. AREA OF ISOLATED WETLANDS ON SITE = 1.8 AC.
   AREA OF ISOLATED WETLANDS IMPACTED = .65 AC.

LEGEND

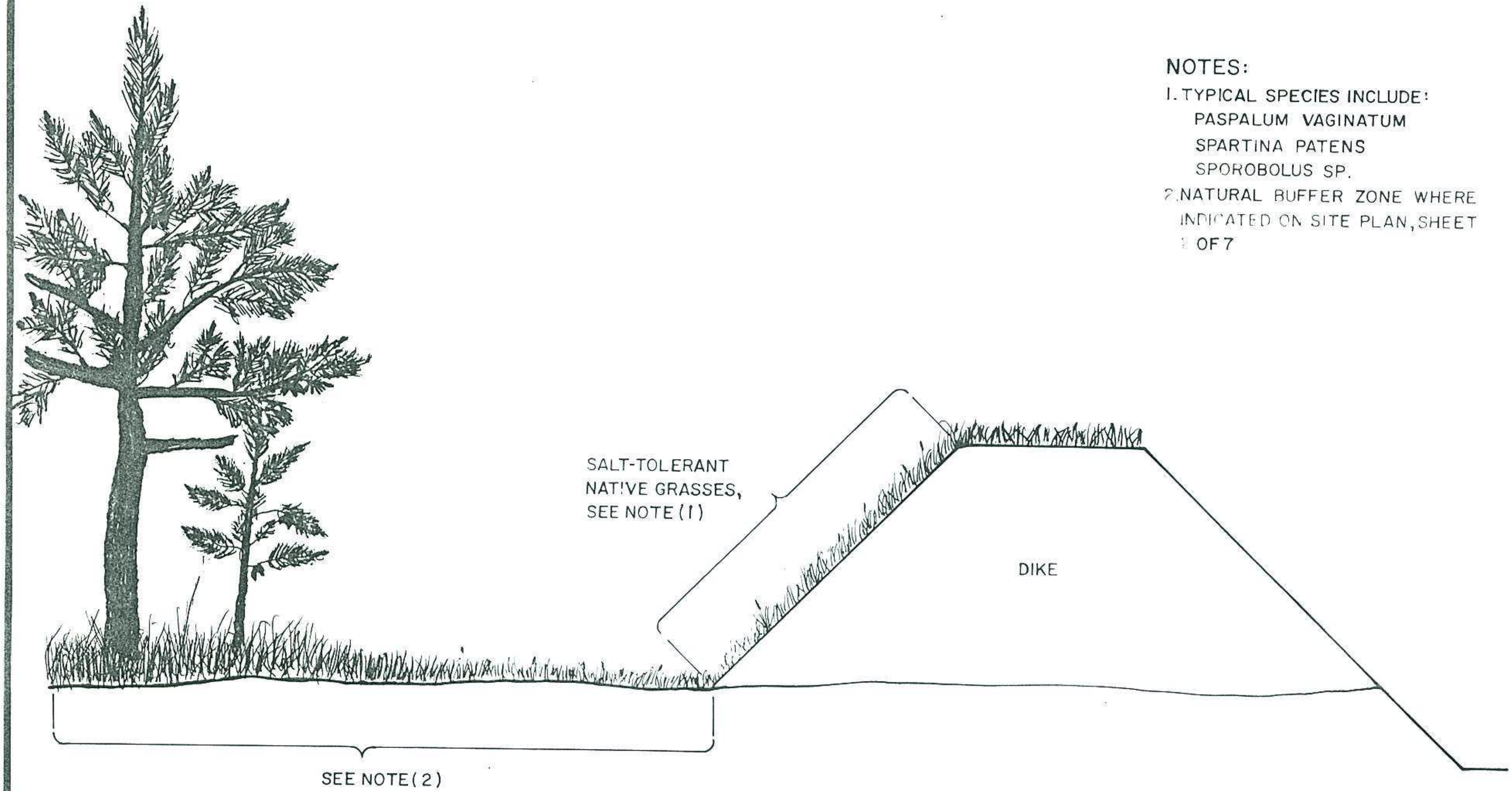
- JURISDICTIONAL WETLAND
- ISOLATED WETLAND
- SITE BOUNDARY

TAYLOR & DIVOKY INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE FLORIDA 32216

NORTH EAST BLACK HAMMOCK ISLAND
DISPOSAL AREA-WETLANDS MAP

PROJECT	C-8610
REVISION	
SHEET	5 of 7
DATE	1-7-88

301233



NOTES:

1. TYPICAL SPECIES INCLUDE:
   PASPALUM VAGINATUM
   SPARTINA PATENS
   SPOROBOLUS SP.
2. NATURAL BUFFER ZONE WHERE INDICATED ON SITE PLAN, SHEET 1 OF 7

TAYLOR & DIVOKY INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE FLORIDA 32216

NORTHEAST BLACK HAMMOCK ISLAND DISPOSAL AREA - VEGETATION PLAN

PROJECT	C-8610
REVISION	
SHEET	6 OF 7
DATE	1-7-88

Time In Minutes

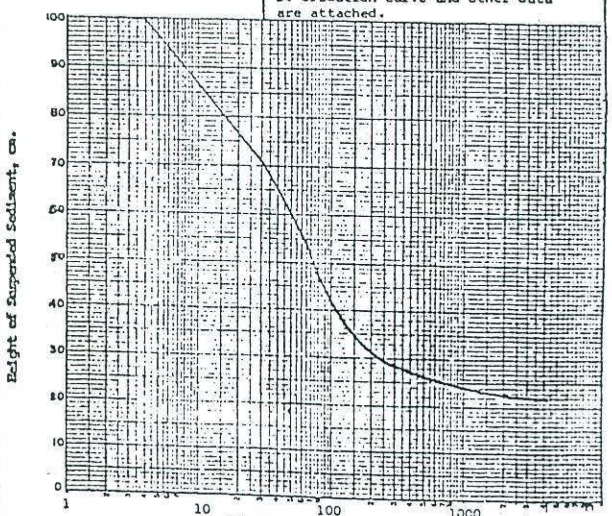
* Moist Wt. of Sample (gms/L)

** Final Concentration (gms/L)

* 100 gms/liter

** 457

NOTES:
1. Test specimen
100 gms/liter suspended in sea water (salinity about 10 ppT) in 100 cm long bottom withdrawal tubes.
2. Suspended sediment-time curves represent the contact surface between the sediment still in suspension and the "clear" water on top at the elapsed time indicated.
3. Gradation curve and other data are attached.



% TOTAL SOLIDS: 55.9

PROJECT: AIWW - Fernandina to St. Johns Maintenance

AREA:

BORING NO.	SAMPLE NO. 1 of 3	EL. -11.5/-16.5	DATE: 4-29-80
CB-IWW-54	Suspended Sediment-Time Curves		

Hole No. CB-IWW-54

DRILLING LOG	DIVISION South Atlantic	INSTALLATION Jacksonville District	SHEET 1 OF 1 SHEETS
1. PROJECT AIWW, Fernandina to St. John, Maintenance		10. SIZE AND TYPE OF BIT See remarks	
2. LOCATION (Coordinates or Station) X=352,700 Y=2,246,560		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLW	
3. DRILLING AGENCY Corps of Engineers		12. MANUFACTURER'S DESIGNATION OF DRILL ACKER	
4. HOLE NO. (As shown on drawing title and file number) CB-IWW-54		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER R. Gordon		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER Tidal	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE STARTED 2 Apr 80	COMPLETED 2 Apr 80
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE -11.5	
9. TOTAL DEPTH OF HOLE 9.0'		18. TOTAL CORE RECOVERY FOR BORING 60 %	
		19. ~~XXXXXXXXXXXXXXXX~~ GEOLOGIST: J. GENTILE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						BIT OR BARREL
-11.5	0.0					-11.5
			SILT, soft, slightly sandy, dark gray, organic stain (ML)	40	1	2" SAMPLER
						-16.5
					2	" "
-18.5	7.0		SAND, fine to medium quartz, clayey, gray (SC)	80		
-19.5	8.0				3	
-20.5	9.0		CLAY, plastic, gray, slightly silty (CL)		4	-20.5
						300# hammer with 18" drop used on 2" I.D. spoon

TAYLOR & DIVOKY INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE FLORIDA 32216	NORTHEAST BLACK HAMMOCK ISLAND TYPICAL DREDGED MATERIAL DATA	PROJECT C-8610 REVISION SHEET 7 OF 7 DATE 1-7-88

301233

Engineering Narrative
Northeast Black Hammock Island Disposal Area

This narrative is a summary of the documents which comprise the permit application package submitted to obtain a long-term dredge/fill permit for the development of the Northeast Black Hammock Island dredged material disposal area as a permanent facility to service the maintenance requirements of the Atlantic Intracoastal Waterway (AIWW) from Nassau Sound to its confluence with the Ft. George River (cut 27 through cut 11, sta 10+00). The submission of this application package represents an intermediate step towards the completion of the second phase of a two phase project sponsored by the Florida Inland Navigation District. Phase I of the project, which is documented in a report included as Attachment 6 to this permit application, developed basic plan concepts for the continuing management of maintenance material dredged from the Intracoastal Waterway in Nassau and Duval Counties, defined short and long term program needs based on a comprehensive examination of historical dredging records for the project area, and identified suitable centralized sites which satisfy these needs based on preliminary environmental, engineering, and operational criteria. Phase II of the project consists of the gathering of detailed, site-specific information required for the preparation and submission of permit applications for the eight primary disposal sites identified in Phase I. In addition, Phase II also addresses the design of the site disposal facilities; the acquisition of these sites, through negotiation or condemnation, by the Florida Inland Navigation District; and the construction and continuing operation and maintenance of these sites as permanent dredged material management facilities.

No attempt is made in this narrative to recount, in detail, the information contained in the documents which accompany the permit application. Rather, this narrative is designed to assist the reviewer in organizing this information, while emphasizing the engineering considerations and design specifications presented in the attached permit drawings. In addition to the permit drawings and the

Phase I report already mentioned, the documents which comprise the permit application package for the Northeast Black Hammock Island Disposal Area include: (1) the boundary survey, providing completeness, as well as the legal description necessary for site acquisition; (2) the topographic survey, documenting pre-construction topography and drainage patterns, and providing information necessary for site design, volumetric calculations, and grade analysis; (3) the sub-surface and soils report, identifying site foundation conditions and in-situ construction material suitability, as well as locating the water-table on-site; (4) the environmental report, documenting existing environmental conditions, including vegetation communities and wildlife habitats, and serving to guide the configuration of the containment area within the site so as to avoid, to the greatest extent possible, the most sensitive environmental areas; and (5) a site-specific management plan, insuring that the disposal area will continue to be operated in an efficient manner without undue conflicts with adjacent off-site land use, and allowing the site to be maintained as a permanent facility. It is hoped that the information contained in this permit application package will provide for the granting of a long-term permit in keeping with the long-range goals of the project.

The proposed Northeast Black Hammock Island disposal area (permit application drawing, sheet 1 of 7) is a 49.91 acre site vegetated primarily by pine flatwoods, palmetto prairie, mixed oak/pine, maritime hammock, and wetland communities. The site lies immediately west of Sawpit Road, south of Shark Road, and west of the AIWW (Sawpit Creek). It is one of three dredged material disposal sites proposed for Black Hammock Island. The other two sites, one existing, one proposed, are located approximately two miles south of the Northeast Black Hammock Island disposal area, on the west side of Sawpit Road.

The environmental, engineering, and operational considerations which led to the selection of the Northeast Black Hammock Island site as one of the three Black Hammock Island sites are discussed in the

Phase I report. Also documented is the projected disposal requirement for the Nassau Sound to Ft. George River reach of the AIWW served by the three sites. Providing this capacity with three sites allows the diked containment basin for the Northeast Black Hammock Island disposal area to be restricted to the central 22.76 acres of the site (permit application drawing, sheet 2 of 7), leaving buffer areas of undisturbed vegetation 300 feet in width to the north, west and south. An additional irregular buffer area, varying from 80 feet to over 120 feet in width, separates the containment area from the AIWW to the east.

Detailed environmental information for the Northeast Black Hammock Island site is provided in the attached environmental report (Attachment 4). Salient on-site features include the area of salt marsh which extends into the east-central portion of the site. This area is clearly connected to the AIWW/Sawpit Creek marsh system (State waters) and is therefore under the jurisdiction of the Florida Department of Environmental Regulation (DER) permitting criteria. However, it will not be impacted by containment area construction since it lies completely within the eastern buffer zone (permit application drawing, sheet 5 of 7). A portion (0.34 acres) of a second, larger wetland area (0.77 acres), classified as wet prairie, which exists in the northwestern portion of the site will be destroyed in the course of dike construction. As an isolated wetland this area is not under DER jurisdiction. However, the total area of the contiguous wetland exceeds the 0.5 acre threshold for St. Johns River Water Management District jurisdiction, although the portion to be impacted falls below threshold. Also impacted by the construction of the containment area is a second isolated wetland in the center of the site (0.37 acres) which is also below St. Johns River Water Management District jurisdictional threshold. A third isolated wetland, in the extreme southwest corner of the site, lies wholly within the buffer area and will not be impacted by construction. The band of maritime hammock (temperate hardwoods) and mixed wetland hardwoods which lie along the eastern boundary of the site are also preserved within the buffer.

The topography of the proposed containment area is nearly level, generally ranging from +6.5 ft to +11.5 ft NGVD, with a maximum of +13.5 ft NGVD in the extreme northwest corner of the site, and a minimum of +4.2 ft NGVD (approximately +2.0 ft MHW in this area) along the AIWW (Attachment 2; permit application drawing, sheet 2 of 7). It should be noted that a formal determination of MHW was not done, but rather a reasonable estimate of its position was made by a Registered Land Surveyor familiar with the requirements of such determinations, using accepted survey practice. The gentle slope drains most of the site eastward toward the AIWW and Sawpit Creek. Calculations based on the results of a topographic survey have determined the mean elevation of the proposed containment area to be +9.0 ft NGVD.

The containment area is defined by earthen dikes to be constructed of material excavated from the site interior. Specific soil and foundation information (soils/sub-surface report, Attachment 3) confirmed the utility of the preliminary conservative design originally adopted as being well within the range of standard U.S. Army Corps of Engineers (COE) practice for similar sites and materials (permit application drawing, sheet 3 of 7). Design dike specifications include a dike crest height of +15.0 ft above grade (+24.0 ft NGVD), a side slope of 1V : 3H, and a crest width of 12.0 ft, yielding a dike width at grade of 102.0 ft. As indicated on the site plan (permit application drawing, sheet 2 of 7) the total plan area within the outside toe of the dike is 22.76 acres, leaving approximately 27.15 acres (54%) of the total site area essentially undisturbed. As measured at the crest centerline, the dike perimeter is 3890 ft, requiring 123,183 c.y. of material to construct.

An additional feature of the dike is a ramp to allow ingress and egress of heavy equipment to and from the interior of the containment area. Ramp details are shown in the permit application drawings, sheets 2 and 4 of 7. The outside slope of the ramp and the slope of the supporting toe maintain the same 1V : 3H slope as the main dike. The ascending/descending grade is 4%. These ramps, which allow removal of the dewatered dredged material, reinforce an important program concept, as detailed in the Phase I report. That is, although the containment area is designed to provide capacity adequate to serve the projected 50-year requirement of a designated reach of the waterway, it is also designed to be a permanent operating facility. Prior to reaching design capacity, the ramps, in association with operational procedures detailed in the site-specific management plan (Attachment 5), will provide for the efficient removal of material for other uses dictated by prevailing restrictions and market conditions.

The total volume of material required for ramp construction is 14,232 c.y., which when added to the dike requirement of 123,183 c.y. yields a total construction material requirement of 137,415 c.y. This is to be provided by the excavation of the interior containment area to a mean elevation of +2.4 ft NGVD, while maintaining the above grade interior dike side slope (permit application drawing, sheet 3 of 7). Allowing for 2.0 ft of freeboard and an additional 2.0 ft of ponding depth at the completion of final disposal operations (i.e, filling the containment area to 4.0 ft below the dike crest, or +11.0 ft above grade) yields a total site disposal capacity of 394,972 c.y. This projected capacity, in combination with the projected capacity of the proposed West Central Black Hammock Island site and the remaining capacity of the existing Black Hammock Island site (MSA-300E), is adequate for the projected 50-year disposal requirement of 1,553,852 c.y. for the Nassau Sound to Ft. George River reach as described in the project Phase I report (Attachment 6). It should be noted that this disposal requirement represents the 50-year projected in-situ volume multiplied by a bulking plus over-dredging factor of 2.15. Also to be noted is the existence, at the time of testing, of the on-site water table at +8.4 ft NGVD $\pm$, or 6.0 ft $\pm$ above the planned excavation grade, which may require a sump and/or pumping of groundwater seepage during construction.

Supply and return pipeline access is available directly from the AIWW/Sisters Creek (State waters) to the site (permit application drawing, sheet 1 of 7) with no additional easement required. Pipeline placement will require the crossing of little or no fringing marsh since the shoreline which forms the eastern site boundary is predominantly an eroding bluff which does not support the establishment of marsh vegetation. The supply pipeline will enter the site near the southeast corner of the containment basin (permit application drawing, sheet 2 of 7). From MHW, the pipeline is to be routed along the outside toe of the southern containment dike to enter the basin in its southwest corner by passing over the dike crest.

Removal of the de-canted effluent will be accomplished by a parallel arrangement of four (4) corrugated metal half-pipes, located diagonally opposite the slurry inlet (permit application drawing, sheet 2 of 7). Each half-pipe will provide for the release of effluent over a sharp-crested weir section of minimum length of 9 ft, for a total minimum crest length of 36 ft. The weir crest height will be adjustable by means of removable flash boards from +13 ft above grade to below grade. The four weirs are to be connected by a manifold, with a single outlet pipe passing under the dike in the northeast corner of the containment basin, returning the supernatant to state waters by the most direct route.

The specification of a minimum weir crest length of 36 ft is based on U.S. Army Corps of Engineers guidelines related to the dredge equipment. For this and all project calculations, it has been assumed that a 24 inch O.D. dredge (discharge velocity of 16 ft/sec, volumetric discharge of 6430 c.y./hr, and a 20/80 solids/liquid slurry mix) would be used for future channel maintenance. However, the physical constraints of the channel will most likely dictate the use of a 16 to 18 inch O.D. dredge. Therefore, the assumption of a 24 inch dredge insures a conservative disposal site design. Analysis of weir performance based on nomograms developed at the COE Waterways Experiment Station (WES) under the Dredged Material Research Program (DMRP) (Walski and Schroeder, 1978) indicates that these design parameters may be expected to produce an effluent suspended solids concentration of 0.63 g/l, assuming an average ponding depth of 2 ft. Translation of suspended solids concentration to a measure of turbidity on which Florida water-quality standards are based is highly dependent on the suspended material characteristics. However, WES guidelines (Palermo, 1978) indicate that this effluent quality should be adequate. Should effluent quality deteriorate below the ambient conditions of the receiving waters, steps shall be taken to decrease effluent turbidity. These include intermittent dredge operation, increased ponding depth, or the use of turbidity curtains surrounding the site outlet weirs.

Finally, as part of this application an analysis of containment area efficiency was performed. Available data characterizing the sediments to be placed in the proposed Northeast Black Hammock Island Disposal Area are limited to the results of core borings taken within the channel prior to its maintenance in 1982. Based on the boring logs and suspended sediment-time curves, sediment obtained from the artificial Sawpit Cut-off (cut 27), specifically boring CB-IWW-54, was determined to represent the most difficult material to decant of the limited samples analyzed (permit application drawing, sheet 7 of 7). Analysis of these data indicates that the containment area provides adequate retention time to allow the sediment to settle out of the average ponding depth of 2 ft (8.59 hrs maximum retention time vs. 1.72 hrs required settling time multiplied by a safety factor of 3, or 5.15 hrs). This indicates that a basin retention efficiency of 60% is required to provide adequate retention time, when the efficiency of similar containment areas is typically on the order of 44%, based on WES-DMRP research (Shields, Thackston and Schroeder, 1987). However, since retention time is directly proportional to ponding depth, providing the recommended 5 feet of ponding will decrease the required basin efficiency to a more reasonable 23.7%. Moreover, the WES-DMRP guidelines indicate that for the minimum design weir loading (i.e, liquid discharge/weir crest length) of 1.07 cfs/ft, the withdrawal depth (i.e, the depth at which the gravity forces on a suspended sediment particle exceed the inertia forces) ranges from 0.67 ft based on empirical results, to 2.11 ft based on the WES Selective Withdrawal Model. It should be noted that even the larger of these values should not result in the resuspension of sediment even at the minimum ponding depth. This is because of the negative slope of the deposition layer from inlet to weir, which results in greater ponding depths at the weir than the 2 ft minimum average ponding depth over the entire containment area.

REFERENCES

Palermo, M.R., R.L. Montgomery, and M.E. Poindexter, "Guidelines for Designing, Operating, and Managing Dredged Material Containment Areas", Technical Report DS-78-10, Dec. 1978, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, MS.

Shields, F.D., Jr. E.L. Thackston, and P.R. Schroeder, "Design and Management of Dredged Material Containment Areas to Improve Hydraulic Performance", Technical Report D-87-2, June 1987, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, MS.

Walski, T.M. and P.R. Schroeder, "Weir Design to Maintain Effluent Quality from Dredged Material Containment Areas", Technical Report D-78-18, May 1978, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, MS.

Management Plan

Northeast Black Hammock Island Disposal Area

(Phase I Designator A-12.4 W – 27-3)

February 1988

Management Plan

Northeast Black Hammock Island Disposal Area

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1.0 INTRODUCTION

A key element in the long-term utilization of the Northeast Black Hammock Island Disposal Area is the development and implementation of a site-specific management plan. The management plan for the Northeast Black Hammock Island site, outlined in this report, is intended to provide guidance for the development and operation of the disposal area so that optimum efficiency is achieved in both effluent quality and disposal area service life while minimizing the impact of the site on the environment and adjacent areas. Addressed are those facets of site design and operation which directly influence site efficiency or reduce off-site conflicts. These include elements of site preparation prior to the initial dredging and disposal of maintenance material, techniques of decanting and dewatering the maintenance material during and immediately following a disposal event, and criteria for post-dredging site operation and maintenance. Throughout, the goal of each aspect of site management is to assure that the site not only achieves its minimum design 50-year service life, but also fulfills its potential as a permanent operating facility for the intermediate storage and re-handling of maintenance material dredged from the Atlantic Intracoastal Waterway (AIWW).

The Northeast Black Hammock Island site is one of 8 maintenance material disposal sites selected as part of a project to provide long-term dredged material containment capacity for the Intracoastal Waterway within Nassau and Duval Counties. Specifically, the Northeast Black Hammock Island site is intended to serve that reach of the AIWW between Nassau Sound and the Ft. George River, a distance of 6.05 miles. The containment areas of the 8 sites have been sized to provide a minimum 50-year disposal capacity, based on a detailed and comprehensive evaluation of dredging records (Taylor and McFetridge, 1986). The design capacity of the Northeast Black Hammock Island site is 394,972 cubic yards (c.y). This projected capacity, in combination with the projected capacity of the proposed West Central Black Hammock Island site and the remaining capacity of the existing Black Hammock Island site (MSA-300E), is adequate for the projected 50-year disposal requirement of 1,553,852 c.y. for the Nassau Sound to Ft. George River reach. It should be noted that this disposal requirement represents the 50-year projected in-situ volume multiplied by a bulking plus over-dredging factor of 2.15.

However, as stated above, beyond satisfying an initial capacity requirement, the management objective for each of the sites selected within the project area is to efficiently process (i.e. decant and dewater) the dredged material, and operate the facility so as to extend its usefulness beyond its design service life. The potential long-term efficiency of the disposal area is established by the design and construction of the facility, while the degree to which this potential is realized is largely determined by operating procedures. Specific elements of site design and site operation during and following disposal activity will be discussed in turn as they relate to site efficiency and local impacts. However, design features and construction practices, beginning with site preparation, provide the foundation for the project, both physically and figuratively, and should reflect the level of effort that has gone into the selection of the Northeast Black Hammock Island site, as well as the substantial long-term commitment of state and federal funds that this project represents. Therefore, the plan begins with a discussion of these in Section **2.0**. Site operational considerations during dredging are discussed in Section **3.0**. Post-dredging site management is addressed in Section **4.0**.

2.0 PRE-DREDGING SITE PREPARATION AND DESIGN FEATURES

2.1 Site Preparation

Site preparation required for the Northeast Black Hammock Island disposal area will include the clearing of vegetation and the alteration of existing topography within the proposed containment area, either prior to, following, or in association with dike construction. Historically, containment area construction has often been accomplished without any interior site preparation. Moreover, it is recognized that clearing and grubbing vegetation and uniformly excavating and leveling the site interior adds significantly to the initial construction cost of the containment area, and should not be undertaken without the expectation of significant benefits. However, it is felt such measures are warranted in the present situation. Regarding the clearing of vegetation, it has been established (Haliburton, 1978; Gallagher, 1978) that although a limited growth of herbaceous vegetation or native grasses can improve sedimentation by filtration, the large woody vegetation (brush, trees) that characterizes the Northeast Black Hammock Island site can constrict or channelize the flow through the containment area, resulting in short-circuiting, reduced retention times, resuspension of sediment through increased flow velocities, and the deterioration of effluent quality. Additionally, failure to clear existing vegetation will result in an increase in the organic content of the fill, rendering it less suitable for removal and re-use as construction material. Therefore, the containment area should be cleared and grubbed prior to construction.

Similarly, the existing topography within the containment area, if allowed to remain, will cause the flow from inlet to weir to channelize, thereby reducing the effective sedimentation area, increasing flow velocities, and again, decreasing the efficiency of solids removal. Moreover, irregular topography will produce irregular deposition, which, in turn, will result in the ponding of surface water, thereby inhibiting the drying of the deposition layer and making initial attempts at surface trenching more difficult. For these reasons, it is important that a uniform grade be provided from inlet to weir as part of the initial construction of the facility, with an adequate slope on the order of 0.2%. It is also recognized that given an initially level surface, differential settling of varying grain size fractions (i.e., rapid precipitation of the coarser fractions nearer the inlet with increasingly finer sediments deposited nearer the outlet) will quickly establish a deposition surface sloping downward from inlet to weir once disposal operations begin.

Preliminary site design assumes that the material for dike construction is to be obtained from the excavation of the interior of the containment area. Construction efficiency may dictate that the dike material be initially taken from a perimeter trench immediately inside the containment dikes. However, it is imperative that this trench be eliminated and the site interior re-graded prior to initial disposal, rather than allowing the trench to fill with sediment, if acceptable effluent quality is to be initially achieved. Preliminary sub-surface surveys show that material obtained from either a uniform scraping of the site interior, or from digging a perimeter trench is equally suitable for dike construction. To provide the volume of material required to construct the dikes it is necessary to excavate to an average grade elevation of +2.4 feet NGVD. Limited data obtained at the time of the soil survey showed the on-site water table at a mean elevation of +8.4 ft NGVD±, or 6.0 ft± above the mean excavation grade. This may require a sump and/or the pumping of groundwater seepage during construction.

2.2 Design Features

No attempt will be made here to address, in detail, all elements of site design. These are described elsewhere in the permit documentation. Rather, the present discussion will be limited to those aspects of site design which directly influence site operation and maintenance.

2.2.1 Site Capacity

Dredging records indicate that since the establishment in 1943 of the present 12 foot project depth within the AIWW segment of the Nassau-Duval County area, maintenance dredging has occurred in the reach of the Waterway to be served by the three Black Hammock Island sites on average every 6.3 years, with an average in-situ dredging volume of 91,060 c.y. per event. Applying the recommended bulking factor of 2.15 results in an average disposal requirement of 195,780 c.y. per event.

Several strategies of apportioning the material among the three sites which are to serve this reach are suggested. From an operational standpoint, the most efficient approach would be for all the material dredged from the artificial Sawpit Cutoff (cut 27), representing 35% of the disposal requirement for the reach, to be placed in the adjacent Northeast Black Hammock Island site. The remaining 65% of the disposal requirement would then be apportioned between the two more centrally located sites. This strategy offers the operational advantage of minimizing the necessary pumping distance. However, it does carry the disadvantage of requiring that the supply pipeline be moved between two sites during each maintenance of the entire reach. Moreover, this apportionment will result in a more rapid filling of the Northeast Black Hammock Island site since the Sawpit Cutoff is projected to produce approximately 35% of the maintenance material from the Nassau Sound - Ft. George River reach, while the adjacent disposal area represents only 21% of the total capacity of the 3 sites designed to serve this reach. Nevertheless, for the development of management guidelines it will be assumed that this mode of disposal will be followed. The remaining 65% of the dredged material from any one maintenance event will then be placed in the West Central Black Hammock Island site or alternatively the existing site MSA-300E.

One implication of this apportionment strategy, already mentioned, is that the Northeast Black Hammock Island site will fill more rapidly than the other two sites designated to service the Nassau Sound to Ft. George River reach of the AIWW. As derived from dredging data presented in the Phase I report (Taylor and McFetridge, 1986), the projected 50-year disposal capacity requirement (i.e., the projected 50-year dredging requirement, multiplied by a bulking factor of 2.15) for the artificial Sawpit Cut-off (Cut 27) is 543,950 c.y., yielding an annualized disposal requirement of 10,879 c.y. When applied to the design capacity of the Northeast Black Hammock Island site of 394,972 c.y., this disposal rate would result in the site's reaching design capacity in just over 36 years. The marketing strategies necessary for dredged material removal and re-use, to be outlined in Section 4.3, must therefore be in place prior to that time if the Northeast Black Hammock Island facility is to continue operations. If a procedure for removing the dewatered dredged material is not resolved prior to reaching site capacity, the increased distance required to place the dredged material in one of the two sites more centrally located within the reach must be accepted if the combined 50-year design service life of the three sites is to be realized. It should be noted that this increased distance is still well within dredge equipment design limits, and therefore only decreases the efficiency of disposal operations when future dredging is required in the Sawpit Cut-off.

The above considerations yield an average disposal requirement per event of 68,538 c.y. for the Northeast Black Hammock Island site. With a diked interior plan area of 13.69 acres, this volume would produce an average lift of 3.10 feet.

The optimum thickness of the deposition layer produced from a single dredging event (i.e., the optimum thin lift thickness) has been defined (Haliburton, 1978) under the U.S. Army Engineers Waterways Experiment Station (WES) Dredged Material Research Program (DMRP) as 3 feet or less when the material reaches its decant point (i.e., the point at which no ponded water remains above the depositional layer). If it is assumed that the bulked volume of the typical projected lift thickness of 3.10 feet approximates the volume of the material at its decant point, then it is apparent that the thickness of the projected lift approximates the optimum thin lift thickness, as defined above. Moreover, an additional consideration emphasizes the reasonableness of applying thin lift dewatering techniques to the Northeast Black Hammock Island site. Maintenance of the Intracoastal Waterway (AIWW and ICWW) within Northeast Florida has historically been determined less by need than by the availability of adequate disposal areas, a situation which made necessary the present project. As documented in the project Phase I report (Taylor and McFetridge, 1986), the growth of environmental awareness supported by regulatory policy rendered unworkable most pre-existing disposal easements and accepted disposal practices. However, the provision of accessible, permanent disposal facilities such as the Northeast Black Hammock Island site should allow for more frequent maintenance of the channel with a smaller volume of material being produced from each event.

The primary advantage of employing thin lifts is that each lift may be completely dewatered prior to each subsequent scheduled maintenance. Moreover, less active management of the dredged material is necessary to accomplish the dewatering. Specific dewatering techniques will be discussed in detail in Section 4.0, Post-Dredging Site Management.

2.2.2 Interior Earthworks

Secondary compartmentalization of the Northeast Black Hammock Island containment area is neither required nor is it desirable. Reducing the effective containment plan area would compromise the advantages of thin lift disposal already discussed. In addition, analysis of historical dredging records indicates that neither the quantity nor the frequency of projected dredging warrants the use of parallel disposal areas.

The relatively small size of the Northeast Black Hammock Island containment area precludes the use of spur dikes to improve retention times for several reasons. One is that the increased retention times which may result from the use of spur dikes do not offset the loss of capacity within the containment area. Another is that within small containment areas spur dikes are often counter-productive because they constrict the flow, leading to increased velocities and the possibility of sediment resuspension. For this site the increased irregularity of the containment area geometry would result in more dead zones, a reduced effective retention area, and less uniform deposition. Moreover, preliminary analysis of containment area efficiency indicates that retention times which are adequate to allow precipitation of the finest category of sediment to be encountered within the reach served by the Northeast Black Hammock Island site are achievable without recourse to spur dikes.

2.2.3 Ramps

An important project concept is the management of each site as a permanent operating facility even though each of the three Black Hammock Island sites is sized to provide a combined capacity adequate for their projected 50-year design life. Therefore, ramps to provide heavy equipment access to the containment area interior have been integrated into the design of the containment dikes (permit application drawings sheets 2 and 4 of 7). This was done to provide the capability of efficiently removing the dewatered dredged material as prevailing restrictions and market conditions dictate. Thus, the disposal site is designed to function more as a material processing and rehandling station than as a permanent storage facility. In this manner the useful service life of the site may be extended indefinitely.

The ramps themselves obliquely traverse the containment dikes, maintaining the same 1V:3H side slope as the dikes. The recommended ascending/descending grade is 4%, with a road surface width of 12 feet. The ramps are positioned along the western containment dike to allow access from Sawpit Road. In addition to providing for material removal, the ramps also allow easy entry for equipment to be utilized in the dewatering process. This is discussed in Section 3.0.

2.2.4 Ponding Depth

Ponding depth refers to the height of the water column (with its suspended sediment load) which is maintained above the depositional surface during dredging and disposal operations. Ponding depth is regulated by the height of the weir crest, and to a lesser extent, by the dredge plant output. More of an operational criterion than a design feature, ponding depth is nevertheless a primary design consideration, impacting containment area and dike geometry, as well as weir design.

It is advantageous to maintain as great a ponding depth during disposal operations as possible. Increased ponding depth is directly reflected in increased retention time and decreased flow velocities through the containment basin, and is therefore directly related to improved solids retention and effluent quality. The limiting consideration for increased ponding depth is the unbalanced head, or hydrostatic pressure, which the dikes can withstand without compromising their structural integrity.

Preliminary design of the containment area and dikes has provided for a minimum 2 foot ponding depth in that the capacity of the site is reduced by the requirement of 2 feet of ponding plus 2 feet of freeboard at the end of the design service life of the containment area, if no intervening removal of dredged material occurs. Additionally, preliminary analysis of containment area efficiency indicates that a 2 foot ponding depth provides adequate retention time and acceptable effluent quality.

Care must be exercised during disposal operations such that recommended increased ponding depths above the 2 foot minimum are not attained too quickly, causing excessive piping and the possibility of dike failure. However, operational experience has demonstrated that if ponding depth is increased slowly, or over a series of dredging events, the permeability of the interior dike slopes is reduced as fine sediments are filtered and trapped by piping through the dike thereby decreasing the probability of dike failure. Restricting initial ponding depth to 5 feet should eliminate this possibility while providing a sufficient safety factor to insure efficient solids removal.

2.2.5 Dike Erosion and Vegetation

The stability of the containment dikes must also be insured against erosion from rainfall runoff and wind. This will be accomplished by vegetating the outer dike slope and crest immediately following dike construction. Native salt-tolerant grasses will be used (including, but not limited to Paspalum vaginatum) which quickly form soil binding mats while not rooting so deeply so as to structurally weaken the dikes. Planting will be on maximum 18 inch centers using nursery stock (slips) to insure rapid coverage. An additional benefit of vegetating the dikes in this manner is the reduction of the visual impact of the containment area thereby improving site aesthetics and the local acceptance of what is to be a permanent facility.

2.2.6 Site Security

Security should be provided appropriate to the commitment of public funds that this project represents. As a minimum, the site perimeter should be fenced to control public access and to eliminate unauthorized vehicular traffic (off-road vehicles) which damages the dikes. Fencing will also serve to minimize vandalism.

In addition, on-site operators should be present at all times during active disposal, decanting following a dredging event, or at any time when significant ponded water remains within the containment area. This is to insure the proper operation, adjustment, and maintenance of the weirs, as well as to prevent the premature release of effluent through unauthorized weir operation. Active on-site operation will be discussed in more detail in Section 3.0.

2.3 Inlet Features

The number and location of the dredge slurry outfalls, or pipeline inlets, within the containment basin are the primary factors regulating the pattern of deposition within the disposal area. The disadvantage of a single, fixed inlet is the characteristic mounding of the coarser fraction of dredged material in the vicinity of the inlet, which if not mechanically re-distributed, results in reduced retention area. However, the size of the containment area, the relatively infrequent nature of the required maintenance, and the small disposal volume associated with each dredging event cannot justify the expenditure and maintenance required by a fixed, multiple inlet manifold system for the Northeast Black Hammock Island site. More appropriate is the use of a moveable single inlet with the flexibility to be repositioned between dredging and disposal operations or within a single dredging event. The single inlet should also be fitted with a device which breaks the momentum of the jet, such as a flow-splitter or a spoon, to aid in the distribution of the slurry. However, the ability to evenly distribute the coarser fraction of dredged material within the containment area by repositioning the inlet pipe and breaking the discharge jet may not preclude the necessity of regrading the de-watered sediment prior to the succeeding disposal operation. Efficient use of the containment area and maximum solids retention performance will require that the initial uniform slope (on the order of 0.2%) from inlet to weir be re-established between each event.

Preliminary analysis of settling behavior for the Northeast Black Hammock Island Disposal Area indicates that the maximum available distance between inlet and weir is required for adequate solids retention. Therefore, movement of the inlet to achieve more even sediment deposition should not result in a significant reduction in the separation distance between inlet and outlet without the implementation of additional precautions to ensure that water quality standards are met. These may include increasing the ponding depth, or the use of floating baffles or turbidity screens surrounding the weirs.

2.4 Weirs

The efficiency of solids retention and the quality of effluent released from the Northeast Black Hammock Island containment area are strongly influenced by several aspects of weir design. These include weir type, weir crest length, and the location of the weirs within the containment area.

The type of weir structure employed at the Northeast Black Hammock Island site represents a compromise between considerations of performance, adjustability, maintenance, and economy. A sharp-crested, rectangular weir is specified to minimize the depth of withdrawal of the supernatant. Sharp-crested means that the thickness of the weir crest (T) is small in comparison to the depth of flow over the weir (h); typically $h/T > 1.5$. Rectangular means that the weir crest is straight, and flow over the weir is perpendicular to the weir. The withdrawal depth refers to the depth at which the gravity forces on a suspended sediment particle exceed the inertial forces. Reducing the depth of withdrawal to a small fraction of the ponding depth as measured immediately in front of the weir, minimizes the possibility of sediment resuspension. Moreover, since the concentration of suspended sediment increases with depth, minimizing the depth of withdrawal maximizes solids retention. Specific expected performance characteristics of the Northeast Black Hammock Island weir system are discussed later in this section.

The adjustability of the weir crest height is accomplished by means of removable flashboards. The range of possible adjustment will be from a maximum elevation of +13.0 feet above grade, allowing 2.0 feet of freeboard below the dike crest elevation at the end of design service life, to a minimum elevation set below the original containment area interior grade, thereby providing a means of releasing ponded run-off prior to initial disposal operations. The flashboards are to be 4 x 4 stock, interlocking by tongue-and-groove to provide rigidity against hydrostatic pressure, and to minimize between-board seepage of water with a higher suspended sediment concentration than the clarified water selectively withdrawn over the weir crest. The use of a flashboard width of 3 inches (after milling) assures that the minimum adjustment increment is less than the projected depth of flow over the weir crest (4.8 inches) during disposal operations after the maximum ponding depth has been attained. At this point the weir discharge approximately equals the liquid inflow to the containment area. In this manner the operator is provided with adequate adjustment resolution to maximize weir performance and effluent quality.

The specification of a minimum weir crest length totaling 36 feet is based on U.S. Army Corps of Engineers guidelines related to dredge equipment. For this and all project design calculations, it has been assumed that a 24 inch O.D. dredge (discharge velocity, 16 ft/sec; volumetric discharge, 6430 c.y./hr; 20/80 solid/liquid slurry mix) would be used for future channel maintenance. However, the physical constraints of the channel will most likely dictate the use of a 16 to 18 inch O.D. dredge. Therefore, the assumption of a 24 inch dredge insures a conservative disposal site design. The 36 foot minimum weir length is to be provided by 4 corrugated metal half-pipes, each with a sharp-crested weir section of minimum length 9 feet. The four pipes will be connected by a common manifold such that the effluent will exit the containment area via a single pipe under the dike. Analysis of weir performance based on nomograms developed at the Waterways Experiment Station under the Dredged Material Research Program (Walski and Schroeder, 1978) indicates that these design parameters may be expected to produce an effluent suspended sediment concentration of 0.63 g/l, assuming an average ponding depth of 2 feet. Increasing ponding depth above this level as recommended should result in a further improvement in effluent quality. Translation of suspended solids concentration to a measure of turbidity on which Florida water quality standards are based is highly dependent on the suspended material characteristics. However, WES guidelines (Palermo, 1978) indicate that this effluent quality should be adequate.

The final weir design parameter which was considered is the location of the weirs within the containment area such that the distance from the dredge pipe inlet is maximized and the return distance to the AIWW is minimized. The latter requirement is to allow the effluent to be transported from the containment area by gravity flow. However, it may prove necessary to provide auxiliary pumping of the effluent for the first disposal event until the deposition level in the containment area is sufficiently raised above mean high water (+2.0 feet ± NGVD). Positioning the weirs as shown in permit application drawing, sheet 2 of 7, provides approximately 1200 feet from inlet to weir.

Based on this weir location, an analysis of containment area efficiency was performed. Available data characterizing the sediments to be placed in the proposed Northeast Black Hammock Island Disposal Area are limited to the results of core borings taken within the channel prior to its maintenance in 1982. Based on the boring logs and suspended sediment-settling time curves, sediment obtained from boring CB-IWW-54 was determined to represent the most difficult material to decant of the limited samples analyzed (permit application drawing, Sheet 7 of 7). Analysis of these data indicates that the containment area provides adequate retention time to allow the sediment to settle out of the average minimum ponding depth of 2 ft (8.59 hrs maximum retention time vs. 1.72 hrs required settling time multiplied by a safety factor of 3, or 5.51 hrs). This indicates that a basin efficiency of 60% is required to provide adequate retention time, greater than the reported mean efficiency of similar containment basins (44%), but well within the reported range of basin efficiencies under similar conditions, based on WES-DMRP research (Shields, Thackston and Schroeder, 1987). Moreover, since retention time is directly proportional to ponding depth, providing the recommended 5 feet of ponding will decrease the required basin efficiency to a more reasonable 23.7%. The WES-DMRP guidelines also indicate that for the minimum design weir loading (i.e, liquid discharge/weir crest length) of 1.07 cfs/ft, the withdrawal depth ranges from 0.67 ft based on empirical results, to 2.11 ft based on the WES Selective Withdrawal Model. It should be noted that even the larger of these values should not result in the resuspension of sediment even at the minimum ponding depth. This is because of the negative slope of the deposition layer from inlet to weir, resulting in greater ponding depths at the weir than the minimum 2 ft average ponding depth over the entire containment area.

3.0 OPERATIONAL CONSIDERATIONS DURING DREDGING

The primary considerations in managing the containment area during disposal operations are maintaining acceptable effluent quality during the decanting process, and by controlling the pattern of deposition, maximizing the potential for dewatering the deposited material subsequent to the completion of dredging operations. To this end, four aspects of site management are discussed. The first addresses the placement and handling of pipelines to and from the containment area. Emphasis here is placed on minimizing associated adverse environmental impacts. The second consideration discussed is the operation and monitoring of the containment area inlets. Site operational guidelines and procedures included here are intended to promote the efficient utilization of the containment area, and to facilitate the achievement of effluent water quality standards. The third site management consideration addressed, and the one most critical for determining the quality of effluent released from the disposal site, is weir operation. Lastly, a monitoring program to insure that the operation of the containment area does not degrade the shallow aquifer groundwater of the region will be discussed.

3.1 Placement of Pipelines

Each maintenance and disposal operation over the design life of the Northeast Black Hammock Island disposal site will require the placement and retrieval of both supply and return pipelines. Supply and return pipeline access is available directly from the AIWW/Sisters Creek (State waters) to the site (permit application drawings, sheet 1 of 7) with no additional easement required. The supply pipeline will enter the site near the southeast corner of the containment basin (Permit application drawing, sheet 2 of 7). From MHW, the pipeline is to be routed along the outside toe of the southern containment dike to enter the basin in its southwest corner by passing over the dike crest.

The clarified effluent will be collected from the four weir sections by a manifold system within the containment area. A single return pipeline will then exit the containment area under the dike in the northeast corner, returning the supernatant to state waters by the most direct route.

Following completion of the required dredging, the supply pipeline will be removed. The return pipeline will remain in place until all ponded water is removed and the decanting process is completed, at which time it also will be removed. Detailed analysis of dredging records indicates that maintenance of the Nassau Sound to Ft. George River reach of the AIWW has historically been required an average of every 6.3 years. Although it is expected, for reasons previously discussed, that the frequency of maintenance dredging within this reach will increase somewhat in the future, it is not feasible from the standpoint of economy to allow the pipelines to remain permanently in place when they are to be required no more than once every 3 to 4 years. It should also be noted that the run-off which is expected to collect in the containment area will be removed via the weir system so that any suspended sediment, eroded from the dikes and deposited material, will be retained. The run-off will be routed to the AIWW/Sawpit Creek requiring less than 120 feet of culvert pipe. There it will be released at the mean high water line of the waterway. The removal of run-off will be discussed further in Section **4.2.1**.

3.2 <u>Inlet Operation</u>

The manner in which the inlet pipe is operated will be primarily determined by the quality of the sediment to be dredged. Previous estimates of containment area solids retention performance have been based on a limited series of channel sediment core borings obtained prior to the last channel maintenance (1982). Although these samples may be generally indicative of the quality of sediment to be encountered within the Sawpit Cut-off (Cut 27) served by the Northeast Black Hammock Island site, more specific information will be obtained prior to future maintenance operations. This information will document the results of core borings taken within the shoal areas to be dredged, and will include, at a minimum, boring logs and qualitative categorization of each strata of sediment, gradation curves and/or Atterberg limits, and suspended sediment-settling time curves for the aggregate from each boring location.

The documented presence of discrete shoals or significant depositional strata characterized as predominantly fine-grained materials would require a special strategy of inlet operation, differing from the predominant strategy employed at the majority of the sites within the project area in which the sediment consists mostly of fine to medium quartz sand, but appropriate for the organic silts to be placed in the

Northeast Black Hammock Island site. For this case, compartmentalization of the containment area by use of interior dikes is not warranted for reasons discussed in Section 2.0. However, segregation of the fine-grained major fraction to optimize the engineering properties of the remaining sediment is desirable, and can be achieved by moving the inlet pipe to deposit the silts nearer the weirs, thereby keeping the fine material spatially concentrated. The relatively minor coarser fraction dredged during the same operation can then be deposited within the southwestern corner of the containment area adjacent to where the inlet pipe crosses over the dike crest. However, if this were to be done, additional operating precautions would become necessary. Because of the reduced distance between the area of fine material deposition and the weirs, retention times adequate to allow precipitation of the fine sediment and maintain acceptable effluent quality must be provided by additional ponding depth, intermittent dredge operation, or the use of turbidity control devices. Preliminary analysis of the channel sediment core borings, taken prior to the last maintenance of this reach (1982), indicated that approximately 5.15 hours of retention time were required to provide adequate solids retention. Based on the operating parameters of the dredge equipment as discussed previously (Section 2.4), this retention time would be provided by allowing the ponding depth to increase an additional 1.2 feet following deposition of the fine material. This increase over the 2 foot minimum ponding depth is clearly reasonable given the previous recommendation of a maximum operational 5 foot ponding depth. Combined with the expected shut-downs in pumping operations to relocate the dredge plant and inlet pipe, this strategy would allow for the maintenance of acceptable effluent quality. However, to achieve the desired segregation of fine-grained material, this strategy must also include the removal of a substantial portion of the segregated material following dewatering and prior to succeeding disposal operations.

3.2.1 Monitoring related to Inlet Operation

During active disposal operations, several monitoring procedures related to inlet operations will be required. Ponding depth, as previously mentioned, is a critical parameter for the optimization of containment area performance. It is desirable to maintain as great a ponding depth as possible, thereby increasing retention time, solids retention, and effluent quality. However, unbalanced hydrostatic forces resulting from too great a ponding depth under saturated foundation conditions can lead to slope instability, slumping, and the potential for dike failure. Obviously, the latter situation must be avoided at all costs. Therefore, ponding depth can be increased above the 2 foot minimum only under close monitoring, by visual inspection, of dike integrity. Indications of impending instability include evidence of seepage related to piping and foundation saturation at the outer dike toe, and small-scale slumping. If no effluent is released at the weirs, the design dredge output (i.e., 6430 c.y./hr slurry at a 20/80 solids/liquid mix, or 5144 c.y./hr liquid) will produce an increase in ponding depth of approximately 0.23 ft/hr at the Northeast Black Hammock Island site. This rate is slow enough to allow close continual monitoring of the entire dike perimeter. Ponding depth should not be permitted to increase beyond a maximum of 5 feet. Continuous monitoring of dike stability should be performed during periods when ponding depth is maintained above the 2 foot minimum.

Optimal containment area operating efficiency requires that flow through the basin approximate plug flow to the greatest degree possible, thereby minimizing the uneven distribution of flow velocities and sediment re-suspension, and maximizing retention time. Therefore, the pattern of sediment deposition should be monitored for indications of irregular distribution, channelization, and short-circuiting. If evidence of such anomalies is found, the inlet pipe should be repositioned until a more uniform depositional surface is formed.

Lastly, the dredge plant output should be periodically monitored at the slurry outfall within the containment area throughout dredging and disposal operations to confirm or refine dredge output specifications including volumetric output and slurry solids content. These parameters, in combination with the duration of actual dredge operation can be used as an independent measure of disposal volume for purposes of determining remaining site capacity. Additionally, disposal volume can be used with pre- and post-dredging bathymetric surveys of the channel and topographic surveys within the containment area following disposal and dewatering of the deposition layer to refine the bulking factor employed to translate in-site dredging volume to required disposal volume. Also, within the same monitoring program the quality of sediment dredged should be examined by typical laboratory techniques of soils analysis including the establishment of grain size distributions, settling velocities, specific gravity, and Atterberg limits, if appropriate. The results of this monitoring and analysis, together with measures of effluent quality, to be discussed in the following section, will provide a basis for the operational management of containment area performance and efficiency.

3.3 Weir Operation

Once the containment area is constructed and dredging and disposal operations have begun, the most effective way to control effluent quality is by changing the ponding depth and rate of flow over the weir through adjustments in the weir crest elevation. Prior to the commencement of dredging, the weir crest elevation should be set as high as possible to preclude the early release of effluent. The minimum initial elevation above the mean interior site grade should be equal to the maximum anticipated mean ponding depth of 5 feet. For the Northeast Black Hammock Island site, this will result in an initial weir crest elevation of +14.0 ft NGVD, or 6.2 feet above grade at the weirs, given an initial containment area interior slope of 0.2%, and a distance from inlet to weir of 1200 ft. As the deposited material reaches the base of the weirs, the weir crest elevation should be increased at approximately the same rate as the growth of the depositional layer. With the average depth of deposition per event projected to be 3.10 ft (Section 2.2.1), maintaining a mean ponding depth of 5.0 ft (6.2 ft at the weirs) will result in a weir crest elevation at the completion of dredging of approximately +17.1 ft NGVD.

Once dredging begins, the weir crest elevation should be maintained at its initial elevation until the ponded water surface approaches the weir crest. During this initial phase of operation in which no effluent is released, the discharge of the dredge plant should result in an increase in ponding depth of approximately 0.23 ft/hr, and an increase in the ponded water surface elevation (ponding depth plus depositional layer) of approximately 0.29 ft/hr. This relatively slow rise should allow for close continual monitoring of the entire dike perimeter for indications of slope instability, as discussed in the previous section. Inspection is most critical during the initial phase of operations, and during subsequent disposal periods when the ponded water surface is raised above its previous maximum elevation. Experience has shown that as the ponded water percolates into the interior dike slope, the fine suspended sediment is filtered by the coarser dike material. This reduces the permeability of the dikes and decreases the susceptibility of the dikes to piping and saturation.

As ponding depth increases above the 2 foot minimum design depth (or approximately 3.2 feet at the weirs), the decision must be made to initiate release of the supernatant. It is important to note that the weirs are only flow control structures and therefore cannot improve effluent quality beyond that of the surface water immediately interior to the weir crests. Thus, the decision to release must be based on the results of turbidity testing or suspended sediment concentration analysis conducted on the surface waters inside the weirs. These tests must reflect conditions at the maximum depth of withdrawal. For the Northeast Black Hammock Island site this was determined from recommended WES procedures to be 2.11 feet, based on a design weir loading of 1.07 cfs/ft. If adequate water quality is not achieved prior to the ponded water surface reaching the initial weir crest elevation, the dredge plant must be shut-down until the surface water turbidity reaches acceptable limits, or until alternative measures such as the installation of turbidity screens or floating baffles are implemented. If the desired water quality is achieved at a ponding depth less than the initial weir crest elevation, the water surface should still be permitted to rise to the weir crest provided that dike integrity is not threatened.

Once flow over the weirs has begun and effluent of acceptable quality is being produced, as indicated by effluent sample analysis, the hydraulic head over the weir becomes the most readily used criterion for weir operation. For a design weir loading of 1.07 cfs/ft, the operational static head has been calculated to be 0.47 ft. or 5.6 inches, based on an empirical relationship developed for sharp-crested weirs.

Actual operating head over the weir can be measured on site by two methods. First, it can be determined by using a stage gage, located in the basin where velocities caused by the weir are small (at least 10 to 20 ft from the weir), to read the elevation of water surface and subtracting from it the elevation of the weir crest. The static head can also be determined indirectly by measuring the depth of flow over the weir. The ratio of depth of flow over the weir to static head has been shown to be 0.85 for sharp-crested weirs, yielding a design depth of flow for the Northeast Black Hammock Island facility of 0.40 ft or 4.8 inches. If the head over the weir, as measured by either method, falls below these design values as a result of unsteady dredge output or intermittent operation, effluent quality should increase. However, if the head exceeds these values, the ponding depth should be increased by adding a flash board, or dredging should be interrupted to prevent a decrease in effluent quality.

At all times, each of the four weir sections must be maintained at the same elevation to prevent flow concentration and a decrease in effluent quality related to an increase in weir loading. It is also important to prevent floating debris from collecting in front of the weir sections. This will result in an increase in the effective depth of withdrawal and a corresponding increase in effluent suspended solids concentration.

After dredging has been completed, the ponded water must be slowly released, allowing the flow over the weir to drop essentially to zero before the next flash board is removed. Monitoring of effluent quality should continue during this process, and if turbidity violates water quality standards the effluent must be retained until analysis of the interior surface waters indicates the suspended solids concentration to be within acceptable limits. The decanting process should continue in this manner until all ponded water is released over the weirs. Trenching and other dewatering techniques are considered post-dredging site operating procedures and are discussed in Section 4.0.

3.4 <u>Monitoring of Effluent</u>

Monitoring of effluent released from the Northeast Black Hammock Island disposal site will be an integral part of the operation of the facility. The containment area has been designed to produce effluent which meets the water quality standards for Class II waters as set forth in Chapter 17-3 of the Florida

Administrative Code. These rules require among other things that actual site compliance be documented by results obtained from a comprehensive monitoring program. Therefore, the monitoring program should be in place at all times during active disposal operations. Effluent samples should be taken and analyzed as often as is practical. The minimum recommended sampling frequency is two times per eight hour shift.

Although the turbidity of the effluent is but one of 29 parameters addressed in the Florida state water quality standards, compliance with these standards has been historically based on turbidity alone for several reasons. Turbidity, along with dissolved oxygen and alkalinity, is the parameter most reliably measured in the field, and the only one over which the containment area operator may exercise direct control. Moreover, turbidity is a strong indicator of general effluent quality since many contaminants, most notably the toxic metals, exhibit a strong affinity for fine particles. Thus, reducing turbidity should result in an overall improvement in effluent quality.

It is recognized, however, that the disturbance of contaminated sediments may result in the release of other pollutants, predominantly nutrients and hydrocarbons, which do not necessarily associate with fine particles. Thus, if the in-situ sediments contain elevated levels of these contaminants, turbidity may be a superficial indicator of effluent quality. Monitoring of effluent should therefore be based on the results of comprehensive elutriate and dry analysis of the sediment to be dredged prior to the commencement of dredging. The testing required under the effluent monitoring program should then focus on those contaminants whose presence in the sediment has been demonstrated. Because of the time delay associated with laboratory analysis and the relatively short duration of dredging (for the Northeast Black Hammock Island site, typically less than 60 hours of continuous dredge plant operation) the results of this analysis will necessarily determine the continuing permitability of the site for succeeding disposal operations.

Because effluent turbidity is a primary water quality parameter for disposal site operation, compliance with turbidity standards will control both the dredge plant output and the release of effluent. State turbidity standards are expressed in terms of nephelometric turbidity units (NTU), or the degree of transparency of the effluent relative to the transparency of the receiving water. Containment area design guidelines published by the U.S. Army Engineers Waterway Experiment Station (WES) under the Dredged Material Research Program (DMRP) relate containment area performance to the suspended solids concentration of the effluent. The translation of solids concentration, expressed as g/l for example, to a measure of turbidity is highly dependent on the characteristics of the suspended material. It would therefore be very useful for the operation of this site, as well as the design and operation of other similar sites, to use the effluent monitoring program in combination with the known sediment characteristics to relate the site design parameter of suspended solids concentration to the state performance criterion of turbidity or transparency. This should be a primary objective of the site monitoring program.

3.5 Groundwater Monitoring

Black Hammock Island is an area of upland, the majority of which is surrounded by salt marsh experiencing periodic tidal inundation. As would be expected under such conditions, preliminary sub-surface surveys have documented a relatively high water table less than 2.8 feet beneath the undisturbed soil surface at the specific locations sampled. Although it is anticipated that the Northeast Black Hammock Island containment area will impound brackish water pumped from the AIWW in connection with dredging operations only for relatively short periods (on the order of 2-3 weeks) once every 3 to 4 years, the possibility exists for chloride intrusion into the shallow aquifer. All potable and sanitary water used by the residents of Black Hammock Island is obtained from deep wells (typically exceeding 300 feet in depth) which tap the geologically isolated Floridan Aquifer. However, water for lawn irrigation may be drawn from the shallow aquifer if it proves suitable. Prudence dictates that prior to any construction or disposal activity shallow test wells be sunk within the planned on-site buffer regions on the north, west, and south sides of the containment area. A baseline chloride concentration should be determined under pre-construction conditions, and a regular monitoring program should be established to document any deviations from these conditions. If irrigation water is drawn from the shallow aquifer, saltwater intrusion could result. Therefore, it is important that an ongoing well monitoring program be kept in place to distinguish any changes in groundwater chloride concentrations which are attributable to the operation of the containment site.

4.0 POST-DREDGING SITE MANAGEMENT

Following the completion of each dredging event the third phase of disposal site operation occurs. This is referred to as the post-dredging phase. It continues until the next maintenance dredging event begins. During the post-dredging phase dredged material deposited within the containment area is managed so as to maximize the rate at which its moisture content is reduced. In so doing the material is made suitable for handling and removal from the site which is a primary objective of the site management plan. However, because of the permanent nature of the Northeast Black Hammock Island disposal site other management procedures between active dredging operations will also be required. These include a comprehensive monitoring and data collection effort to guide the efficient use and environmental compliance of the disposal area, the handling of stormwater runoff, the monitoring and maintenance of site habitat, mosquito control measures, and the provision for adequate ongoing site security. These are discussed in the following paragraphs.

4.1 Dewatering Operations

The organic silts which are anticipated to constitute the majority of the material to be deposited in the Northeast Black Hammock Island site will prove resistant to drying without the application of some limited dewatering procedures. Those methods which are most appropriate for the quantities of fine material and the thin lifts projected for the Northeast Black Hammock Island site are surface water removal, shallow trenching to promote continued drainage, and mechanical reworking of the dried deposition layer. Each procedure and its specific application to the present situation is discussed below.

The removal of ponded surface water (decanting) is necessary before significant evaporative drying of the fine grained material can occur. However, it is unlikely that all ponded water can be drained from the area of fine material deposition without some excavation to connect the weirs with the ponds which form in depressions in the depositional topography. During this phase of operations, it will be necessary to raise the elevation of the weir crests to prevent the premature release of the remaining ponded water which as a result of the excavation will contain high suspended solids concentrations.

Following the completion of decanting and the removal of all ponded water, a system of drainage trenches will be necessary to continue to lower the moisture content of the deposition layer. The shallow trenching required to adequately drain the relatively thin layers of fine material deposited in the site could best be accomplished by using the Riverine Utility Craft (RUC) developed for the U.S. Navy or a similar amphibious vehicle. However, due to the RUC's very limited availability and the small size of the Northeast Black Hammock Island site, it may prove to be more economical to use conventional low ground pressure equipment to dig the trenches.

Initial trenching should begin following the completion of decanting as soon as the consistency of the deposition material allows to drain the remaining ponded water to a sump excavated within the containment area adjacent to the weirs. Water should then be released over the weirs as soon as water quality standards can be met. More intensive trenching should wait until a significant crust (greater than 1-2 inches) has developed on the surface of the fine sediment slurry, allowing the formation of desiccation cracks, and retarding additional evaporative drying. A system of radial or parallel trenches should then be constructed to a depth dictated by the resistance to slumping of the semi-liquid layer beneath the crust. As the water table within the deposition layer is lowered by drainage and evaporation and the thickness of the crust increases, the trenches must be progressively deepened. At the Northeast Black Hammock Island site it is anticipated that following initial construction of the trenches, deepening to provide sufficient drainage for the relatively thin fine sediment deposition layer will be required no more than three times. Evaporative drying will continue until the crust extends throughout the entire depositional layer.

4.2 Grading the Deposition Material

If the inlet placement strategy discussed in Section 3.2 results in a deposit of fine material of sufficient thickness (greater than 1-2 feet) to allow efficient removal by conventional equipment, this should be done prior to grading. Removal of the fine material at this time offers several advantages. The primary advantage is the segregation of that fraction of sediment which is least desirable for recovery and re-use, thereby rendering the remaining coarser material more marketable. Removal of the fine sediment also prevents the subsequent formation of a depression near the weirs as the fine material continues to consolidate under pressure from succeeding deposits. And, while it is not anticipated that the sediment will be found to be significantly contaminated, many commonly occurring contaminants, most notably the toxic metals, exhibit a marked affinity for fine particles, and therefore will tend to be associated with the finer fraction of sediment. Removing this fraction to a landfill for storage or treatment will remove the accumulated contaminants as well.

Grading of the deposition layer should begin as soon as possible following either the completion of dewatering operations or the removal of the fine grained fraction, if appropriate. The grading should consist primarily of distributing the mounded coarser sediment (sand, gravel, etc.) over the remainder of the containment area so as to re-establish the initial uniform 0.2% downward slope from inlet to weir.

4.2.1 Control of Stormwater Runoff

Beyond simply preparing the site for the next disposal operation, as previously discussed (Section **2.1**), grading of the dewatered deposition material will accomplish several additional benefits. One is the control and release of stormwater runoff. A shallow and uniform slope toward the weirs will insure adequate drainage and eliminate the ponding of runoff in irregular depressions. It will also minimize flow velocities and the risk of channelization and erosion. In compliance with regulatory policy, a sump or retention area should be constructed adjacent to the weirs of adequate capacity (with the weir flash boards in place) to retain the runoff from the first inch of precipitation from a storm. For the Northeast Black Hammock Island containment basin plan area of 13.69 acres, a retention pond with a minimum capacity of approximately 50,000 ft^3 will be required. This capacity would be provided by a circular basin with a radius of 90 ft and an average depth of 2 ft. However, it is preferable to maintain the weir crests above this minimum elevation. A site operator would then be responsible for the gradual release of the ponded runoff at intervals to be determined by local weather conditions. It may also be necessary to provide shallow trenches or swales from the center of the retention basin to one or more weir sections so that the runoff may be quickly and completely released.

As discussed previously (Section 3.1), the clarified run-off will be transported from the terminus of the outlet manifold to MHW via culvert, following the same route as the return pipeline. However, construction details (required slope, culvert size, etc.) will be deferred to the final design phase.

Additional benefits gained by grading the mounded coarse material over the entire containment basin include providing a free-draining substrate in the area of fine sediment deposition by separating successive depositional layers of silts and clays, thereby improving subsequent dewatering of this material; and, by distributing the mounds of sands and gravel, re-establishing the effective plan area of the containment basin.

4.3 Material Rehandling/Reuse

As discussed in Section **1.0**, Northeast Black Hammock Island is one of eight proposed disposal areas designed to serve the long-term maintenance requirements of the Intracoastal Waterway within Nassau and Duval Counties. Throughout this report as well as the accompanying permit documentation it has been emphasized that although each site has been designed for a specific service life, it is to be operated as a permanent facility for the intermediate storage and re-handling of dredged maintenance material. This approach to site management obviously requires that at some point the dewatered material be removed from the containment areas for re-use or permanent storage at another location. The determination of the ultimate use of this material is discussed in the following paragraphs.

Based on a comprehensive analysis of dredging records, the bulked disposal volume projected over the 50-year design service life of the eight facilities totals over 5 million cubic yards of predominantly fine to medium quartz sand. Although relatively minor by the standards of some dredging operations, this volume still represents a significant quantity of potentially valuable construction material. Even if the possible return on the sale of this material were disregarded, the savings on the cost of permanent storage alone would justify a concentrated effort to determine, through a formal market analysis, the potential local market for fill or construction material.

If such an analysis determines that material resale and/or reuse is practical, it still must be demonstrated that the engineering properties of the dredged material satisfy the requirements of commercial interests. Moreover, while it is anticipated that much of the material can be used 'as is', having been partially segregated through differential settling, the potential for compartmentalized segregation of material during disposal or mechanical separation following dewatering should be explored if market conditions dictate. Or, more appropriate to the Northeast Black Hammock Island site, a major fraction of the material may be unsuitable for fill or other construction purposes because of high organic silt content. Thus, it might be used as capping for landfills, or as agricultural material.

If the market analysis determines that resale or reuse is not feasible, it will be necessary to locate and develop a centralized permanent storage facility. The appropriate location for such a facility would appear to be inland, where lower real estate values and development potential makes permanent storage more economically feasible. The optimal distance from the initial containment area to the permanent storage site would represent a compromise between lower land costs and higher transportation expense.

4.4 Monitoring of Containment Area Performance

Several monitoring programs relevant to site management between successive disposal operations have already been discussed. These include the monitoring of shallow aquifer groundwater for evidence of elevated chloride concentrations attributable to the containment basin and the analysis of the effluent (in this case stormwater runoff) released over the weirs. These programs should continue throughout the service life of the site, although between active disposal operations the sampling interval may be extended to coincide with regular site inspections required to maintain security.

Additional site monitoring in the form of topographic surveys of the containment area deposition surface is also recommended. These surveys consist of three basic types. The first is a post-dredging survey which should be performed as soon as possible following the completion of material dewatering operations and initial grading of the deposition surface. From this a refined estimate of the quantity of material deposited can be obtained. The second type of topographic survey would follow the completion of material removal and related grading operations. Results from this would be used to compute the quantity of material removed and the remaining site capacity. The third type of topographic survey is referred to here as a pre-dredging survey. During periods in which no material is removed between dredging events this survey is recommended prior to the commencement of disposal operations. Results obtained from it, in combination with information obtained from the previous post-dredging survey, can be used to determine the amount of material consolidation which has occurred, and to compute remaining site capacity.

In conjunction with the monitoring of consolidation, a series of core borings performed following the completion of de-watering would further define the progress of consolidation while providing a means to determine the engineering properties of the dewatered material and its suitability for re-use. Samples should be analyzed for grain size distribution, Atterberg limits, moisture and organic content, and other factors which may affect the marketability of the material.

4.5 <u>Monitoring of Habitat and Vegetation</u>

Despite the environmental considerations which have gone into the selection of the Northeast Black Hammock Island site and the design of the containment basin, it is clear that the construction and operation of a dredged material disposal facility will have a measurable impact on the habitat and environmental values of the area. The development of the site design and operational guidelines reflect the desire, as well as the permit requirement, to restrict significant adverse impacts related to habitat destruction to the containment area itself. Yet even within the containment basin, the destruction of existing habitat is not without some mitigating factors. Experience with similar disposal areas has demonstrated that some shore birds, most notably least terns, favor the coarse sandy substrate which will characterize portions of the site interior for nesting. This is particularly true in areas such as northeast Florida where development and population growth have reduced other available nesting sites. Moreover, informal surveys of similar existing disposal sites have documented a greater diversity of bird species using the containment area for feeding, foraging, roosting, etc., than adjacent undeveloped areas. These anecdotal reports should be verified through formal monitoring and data collection by qualified biologists, and the observations and recommendations of the monitoring team should guide site management procedures. These recommendations could include, for example, the timing of disposal operations to avoid nesting seasons, or the periodic retention of stormwater runoff to provide forage for wading birds.

Biological monitoring should also extend to the buffer zone which lies outside of the containment area, and to the pipeline easement and adjacent marshes as well. A comprehensive environmental survey completed prior to any construction would be required to establish baseline habitat and vegetation conditions. Periodic re-surveys should continue throughout the service life of the site. Degradation of habitat related to the interruption of natural drainage patterns or other aspects of site construction or operations should be noted, corrective action taken, and guidelines developed to minimize further adverse impact. Similarly, any beneficial aspects of site management should be recognized and encouraged, and the lessons learned should be applied to the future operation of this and other comparable disposal areas.

4.6 Mosquito Control

The basic approach of the mosquito control program for the Northeast Black Hammock Island disposal area will be physical control through the minimization of periods during which standing water exists inside the containment area. The stage of operation most prone to allow mosquito breeding is the dewatering of sediment when desiccation cracks form in the crust as the fine sediment shrinks through evaporative drying. Trenching procedures (Section 4.1) will accelerate the dewatering process by allowing much of the moisture within the cracks to drain to the weirs. However, adverse climatological conditions could delay the dewatering phase long enough to result in successful mosquito breeding within the desiccation cracks, requiring a short-term spray program coordinated through the Duval County Bio-Environmental Services.

4.7 Site Security

Disposal areas have typically been subject to a variety of unauthorized activities including illegal dumping, vandalism, hunting, and the destruction of dikes through the use of off-road vehicles. As discussed previously, the installation of security fencing and the presence of an on-site operator during all phases of active disposal and de-watering should reduce the potential for misuse. However, it is recommended that a mechanism for regular site inspections be established so that misuse can be identified and necessary measures taken. Moreover, all reports of unauthorized activity should be immediately investigated, and if such activity continues, local authorities should be notified.

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