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Bond Farm Hydrological Enhancement Impoundment

Authorized Agent:

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State 404 Program Individual Permit

Charlotte County
Permit No.: 0375475-004 SFI

Permit Issuance Date: December 7, 2021
Permit Expiration Date: December 7, 2026

State 404 Program Individual Permit

Permittee: Florida Fish and Wildlife Conservation Commission
Permit No: 0375475-004

PROJECT LOCATION

The activities authorized by this permit are located at 33150 Oil Well Road, Punta Gorda, Florida 33955, (Parcel ID #'s 422422400002, 422422400001, 422427200003, 42242700002, 422434200005, 422434200003) in Sections 22,27,34, Township 42S, Range 24E, in Charlotte County.

Mitigation will occur on 2,108 acres in the adjacent Babcock/Webb Wildlife Management Area.

PROJECT DESCRIPTION

The permittee is authorized to dredge 73.84 acres of freshwater wetlands and 7.49 acres of other surface waters.; fill 43.89 acres of wetlands and 13.09 acres of other surface waters.; and flood 448.40 acres of wetlands and 22.87 acres of other surface waters for construction of the 669-acre Bond Farm Flow Equalization Basin to alleviate extensive flooding on the Babcock-Webb Wildlife Management Area (WMA). The project requires approximately 394,404 cubic yards of fill and 483,630 cubic yards of excavation, which will impact a total of 566.72 acres in wetlands and 43.48 acres of surface waters, Class III Waters. The work consists of construction of a 538-acre pump operated impoundment, perimeter berm and seepage canals, on the 669 acres Bond Farm property, including a 9.67-acre area on the adjacent Babcock/Webb Wildlife Management Area. The project is a component of the Charlotte Harbor Flatwoods Initiative, whose intent is to restore historic freshwater flow in wetland systems to Charlotte Harbor and the Caloosahatchee River. Other surface waters will be withdrawn from the WMA during the wet season for storage on Bond Farm up to 4' depth and discharged after the wet season south to the headwaters of Powell Creek, Gator Slough and Prairie Pines Preserve. The wet-season surface water withdrawals from the Babcock-Webb WMA will help restore extensive freshwater wetlands and uplands across the WMA that are severely flooded.

Authorized activities are depicted on the attached exhibits.

To offset unavoidable impacts that will occur from these authorized activities, the permittee shall conduct hydrologic enhancement in 2,108 acres of the adjacent Babcock/Webb Wildlife Management Area. Surface water level reductions across the WMA are expected reduce vegetative stress, restore tree and shrub growth rates, reestablish natural wetland and upland vegetation composition, and facilitate a natural fluctuation of wetland water levels. Actual effects of surface water impoundment extend much further east and north and the ultimate operation of Bond Farm has the potential to provide even greater hydrologic restoration over time. A monitoring plan is provided to both document success on the mitigation area and also document hydrologic changes within the impoundment area.

AUTHORIZATIONS

004 - Bond Farm Hydrological Enhancement Impoundment

State 404 Program Individual Permit

The Department has determined that the activity qualifies for a State 404 Program Individual Permit. Therefore, the State 404 Program Permit is hereby granted, pursuant to Part IV of Chapter 373, Florida Statutes (F.S.), and Chapter 62-331, Florida Administrative Code (F.A.C.).

Other Authorizations

You are advised that authorizations or permits for this activity may be required by other federal, state, regional, or local entities including but not limited to local governments or municipalities. This permit does not relieve you from the requirements to obtain all other required permits or authorizations.

The activity described may be conducted only in accordance with the terms, conditions and attachments contained in this document. Issuance and granting of the permit and authorizations herein do not infer, nor guarantee, nor imply that future permits, authorizations, or modifications will be granted by the Department.

PERMIT CONDITIONS

The activities described must be conducted in accordance with:

- **The Specific Conditions**
- **The General Conditions**
- **The limits, conditions and locations of work shown in the attached drawings**
- **The term limits of this authorization**

You are advised to read and understand these conditions and drawings prior to beginning the authorized activities, and to ensure the work is conducted in conformance with all the terms, conditions, and drawings herein. If you are using a contractor, the contractor also should read and understand these conditions and drawings prior to beginning any activity. Failure to comply with these conditions, including any mitigation requirements, shall be grounds for the Department to revoke the permit and authorization and to take appropriate enforcement action. Operation of the facility is not authorized except when determined to be in conformance with all applicable rules and this permit and sovereignty submerged lands authorization, as described.

SPECIFIC CONDITIONS – ADMINISTRATIVE

1. All required submittals, such as certifications, monitoring reports, notifications, etc., shall be submitted to the Florida Department of Environmental Protection, South District Office, Submerged Lands and Environmental Resource Permitting, P.O. Box 2549, Fort Myers, FL 33902-2549 or via e-mail to FTMERP_Compliance@dep.state.fl.us. All submittals shall include the project name and indicated permit number when referring to this project.
Note: In the event of an emergency, the Permittee should contact the Department by calling (800)320-0519. During normal business hours, the permittee should call (239)344-5600.
2. All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. This permit shall expire on December 7, 2021 pursuant to 62-331.090(2), F.A.C. Any deviations must be authorized in a permit modification in accordance with rule 62-331.080, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under chapter 373, F.S.

3. Construction and operation of the project shall comply with applicable State Water Quality Standards, namely:
Rule 62-302.500, F.A.C. – Surface Waters: Minimum Criteria, General Criteria; and Rule 62-302.530, F.A.C. – Table: Surface Water Quality Criteria - Class III Waters.

SPECIFIC CONDITIONS - PRIOR TO ANY CONSTRUCTION

4. Wetland areas or water bodies, which are outside the specific limits of construction authorized by this permit, must be protected from erosion, siltation, scouring and dewatering. There shall be no discharge in violation of the water quality standards in Chapter 62-302, Florida Administrative Code. Turbidity/erosion controls shall be installed prior to clearing, excavation or placement of fill material, shall be maintained until construction is completed, disturbed areas are stabilized, and turbidity levels have fallen to less than **29 NTUs above background**. The turbidity and erosion control devices shall be removed within 14 days once these conditions are met.

SPECIFIC CONDITIONS – CONSTRUCTION ACTIVITIES

5. Construction activities shall occur in accordance with the Bond Farm Hydrological Enhancement Impoundment (HEI) Project, Technical Specifications, 4600003010-WO12R4, Task 3.34, dated August 5, 2020 and attached to this document.

SPECIFIC CONDITIONS – MITIGATION

6. Mitigation monitoring and success evaluation shall be in accordance with the Revised Monitoring Plan, Bond Farm Hydrological Enhancement Impoundment, dated April 10, 2020 and attached to this document

SPECIFIC CONDITIONS - LISTED SPECIES

7. Eastern Indigo Snake
The permittee shall comply with the attached U.S. Fish and Wildlife Service’s “Standard Protection Measures for the Eastern Indigo Snake” dated August 12, 2013 (Attachment 1). If an eastern indigo snake is encountered, the snake shall be allowed to vacate the area prior to additional site manipulation in the vicinity. Holes, cavities, and snake refugia shall be inspected each morning before planned site manipulation of a particular area, and if occupied by an indigo snake, no work shall commence until the snake has vacated the vicinity of the proposed work.
8. Wood Stork
The permittee shall comply with the approved wetland mitigation and monitoring requirements specified in the Florida Department of Environmental Protection State 404 permit, specifically the 973-acre wetland restoration area dedicated on the Babcock-Webb WMA for the onsite wetland impacts within the same core foraging areas.
9. Florida Bonneted Bat
The permittee shall comply with the attached U.S. Fish and Wildlife Service’s item #1 of

“Appendix D: Best Management Practices (BMP’s) for Development Projects” dated October 22, 2019; and to the greatest extent practicable items 2 – 13. (Attachment 2).

10. Red-cockaded Woodpecker

The permittee shall conduct an onsite cavity tree survey prior to removal of trees or earthwork. If cavity trees are discovered, a 200-foot buffer around all cavity trees will be implemented and a management plan will be developed. The permittee will coordinate with the U.S. Fish and Wildlife Service South Florida Ecological Service office at (772) 562-3909 for technical assistance. If nesting is discovered, the permittee will also notify the Florida Fish and Wildlife Conservation Commission by e-mail at ConservationPlanningServices@MyFWC.com.

11. Audubon’s Crested Caracara

The permittee shall conduct pre-construction surveys during the caracara nesting season to ensure nesting caracara are not present on-site. If evidence of caracara nesting is observed before construction, a management plan will be developed, and a 1500-meter nest avoidance buffer will be implemented. If nesting is discovered, the permittee will coordinate with the U.S. Fish and Wildlife Service South Florida Ecological Service office at (772) 562-3909 for technical assistance. If nesting is discovered, the permittee will also notify the Florida Fish and Wildlife Conservation Commission by e-mail at ConservationPlanningServices@MyFWC.com.

12. Bald Eagle

The permittee shall conduct preconstruction surveys for bald eagle nests. If a bald eagle nest were to be confirmed within 660-feet of the proposed action area prior to, or during construction, the permittee will coordinate with the U.S. Fish and Wildlife Service South Florida Ecological Service office at (772) 562-3909 for technical assistance. If nesting is discovered, the permittee will also notify the Florida Fish and Wildlife Conservation Commission by e-mail at ConservationPlanningServices@MyFWC.com.

13. Florida Sandhill Crane

The permittee shall adhere to the following conditions for sandhill cranes:

- A. Surveys for nesting Florida sandhill cranes shall be conducted in accordance with the Species Conservation Measures and Permitting Guidelines within the project boundary during the breeding season (February 1 – April 30) within 30 days prior to commencing any clearing or project activities, including quarterly maintenance mowing). Surveys shall include either one aerial survey or two ground surveys in accordance with the following methodologies:
 - I. Aerial Surveys:
 - a. Aerial transects shall cover 100% of the suitable nesting habitat.
 - b. Survey transects shall be conducted at a minimum altitude of 250 feet. Sandhill cranes may react differently to different types of aircraft, and altitude shall be adjusted to prevent disturbance.
 - II. Ground Surveys:
 - a. Surveys shall be conducted between dawn and 10 a.m. or between 4 p.m. and dusk.
 - b. The wet prairies, marshy lake margins, pastures, hydric flatwoods, and vegetated marshes shall be scanned along its periphery from as far away as

practical in order to observe nesting areas without disturbing any sandhill cranes.

- c. Observation points shall be spaced to provide approximately 100% coverage of suitable habitat.
- B. If active Florida sandhill crane nests are found, a buffer of 400 feet (122 meters) shall be demarcated around each nest site. The buffer zone shall be clearly visible to all personnel associated with the project. The perimeter of the buffer zone shall be demarcated with material with an open design that allows ingress and egress for adult cranes and chicks. Examples of acceptable materials include 3-4 foot (91-122 cm) tall stakes with a single line of string or rope, suspended at least 18 inches (46 cm) off the ground, or three strand barbed wire with the bottom wire at least 18 inches (46 cm) off the ground. Silt fencing is discouraged, but if it must be used, leave regularly spaced gaps at least every 0.3-mile that are either: sized at least 24 inches (61 cm) wide or the silt fencing is staggered to allow passage by chicks.
- C. No pedestrian traffic, vehicle operations, site preparation, staging, clearing, or project activities shall occur within the 400-foot (122-meter) buffer.
- D. The buffer zone materials may be removed when the eggs have hatched, and chicks are walking on their own.
- E. If sandhill crane nesting is discovered after site activities have begun, or if any of the conditions above cannot be met, the permittee shall contact the Florida Fish and Wildlife Conservation Commission Protected Species Permit Coordinator at (850) 921-5990 or WildlifePermits@MyFWC.com for more information.

14. State-Listed Wading Birds

The permittee shall adhere to the following conditions for state-listed wading birds:

- A. Prior to commencing any site preparation, staging, clearing, or project activities, including quarterly maintenance mowing, the permittee shall conduct surveys for wading birds in shrubby wetlands located within or adjacent to the site during the appropriate survey timeframe indicated in Attachment 3 and in accordance with the following methodology:
 - I. Direct count surveys shall be conducted of potential breeding sites that are narrow or small in which the observer can see all the way through the vegetation to identify all nests.
 - II. Direct counts of all nests shall be made from a minimum distance of 330 feet (100 meters) from the shrubby wetlands located in the southern and southeast portion.
- B. If there is evidence of active nests, a buffer of 330 feet (100 meters) shall be established around the nesting area(s). A nest is considered active when supporting essential behavioral patterns, which occur from the point of nest building when a breeding pair exhibits courtship behavior, is carrying nest material, and/or engaging in construction or repair of a nest until of the season become capable of sustained flight or permanently leave the nest. The buffer zone shall be clearly visible to all personnel associated with the project.
- C. If wading bird nesting is discovered after site activities have begun, or if any of the conditions above cannot be met, the permittee shall contact the Florida Fish and Wildlife Conservation Commission Protected Species Permit Coordinator at (850) 921-5990 or WildlifePermits@MyFWC.com for more information.

15. Least Terns and Nesting Shorebirds

- A. The permittee shall avoid or minimize construction activities from April 1st to July 31st.
- B. If construction cannot be avoided during this time, the permittee shall conduct onsite surveys prior to all land clearing and earthmoving activities to ensure least terns and other nesting shorebirds are not present.
- C. Prior to quarterly maintenance mowing activities during the shorebird nesting season (April 1 – July 31), the permittee shall conduct surveys to ensure least terns and other nesting shorebirds.
- D. If least tern or other shorebird nests are discovered, all project activities shall maintain a minimum buffer of 300 feet (91 meters) around active nests. Smaller, site-specific buffers may be established if approved in writing by the FWC regional shorebird contact.
 - I. The buffer zone shall be clearly visible to all personnel associated with the project. The permittee shall ensure that the perimeters of designated buffer zones are marked according to Florida Shorebird Alliance (FSA) Posting Guidelines (available at <http://flshorebirdalliance.org/resources/instructions-manuals.aspx>) with posts, twine and FWC-approved signs stating “Do Not Enter, Important Nesting Area” or similar language around the perimeter.
 - II. Posts shall not exceed 4 feet in height once installed. Symbolic fencing, consisting of twine, string, or rope, shall be placed between all posts at least 2.5 feet above the ground. The posting shall be maintained in good repair until breeding is completed (when all chicks have fledged) or terminated. Signs and fencing shall not be removed, repositioned, or otherwise modified by anyone other than the Bird Monitor.
 - III. No pedestrian traffic, operation of a vehicle, site preparation, staging, clearing, or other project activities shall occur within the 300-foot (91-meter) buffer zone.
- E. If maintaining the required buffer is not possible or if least tern nesting is observed after any project activities have started (pre-construction surveys, surveying, clearing, etc.), the permittee shall contact the FWC regional shorebird contact for more information.

16. Gopher Tortoise

The permittee will conduct pre-construction surveys for gopher tortoises along the perimeter berms.

- A. If gopher tortoise burrows are found, an avoidance buffer of 25 feet in all directions from the mouth of all burrows shall be established. The buffering shall not result in 50-foot diameter circles of undisturbed habitat (i.e., islands) surrounded by project activities. Silt fencing may be used to demarcate the buffers but shall not block gopher tortoise access to burrows.
- B. No site preparation, clearing, staging, or other project activities shall occur within the 25-foot buffer.
- C. If gopher tortoise burrows are found within the project activity area or if maintaining the required buffer is not possible, the permittee shall contact the Florida Fish and Wildlife Conservation Commission Gopher Tortoise Program Coordinator at (850) 921-1031 or GTPermits@MyFWC.com for additional information.

17. This permit does not authorize the permittee to cause any adverse impact to or “take” of state listed species and other regulated species of fish and wildlife. Compliance with state laws regulating the take of fish and wildlife is the responsibility of the owner or applicant associated with this project. Please refer to Chapter 68A-27 of the Florida Administrative Code for definitions of “take” and a list of fish and wildlife species. If listed species are observed onsite, FWC staff are available to provide decision support information or assist in obtaining the appropriate FWC permits. Most marine endangered and threatened species are statutorily protected and a “take” permit cannot be issued. Requests for further information or review can be sent to FWCConservationPlanningServices@MyFWC.com.

SPECIFIC CONDITIONS – OPERATION AND MAINTENANCE ACTIVITIES

18. Operation and maintenance activities shall be in accordance with the Bond Farm Hydrological Enhancement Impoundment (HEI) Project, Operations & Maintenance Manual, 4600003010-WO12R4, Task 3.34, dated August 5, 2020 and attached to this document.

GENERAL CONDITIONS FOR STATE 404 PROGRAM INDIVIDUAL PERMITS

(1) General Conditions under section 62-331.054, F.A.C.:

- (a) The permittee shall comply with all conditions of the permit, even if that requires halting or reducing the permitted activity to maintain compliance. Any permit violation constitutes a violation of Part IV of Chapter 373, F.S., and this Chapter, as well as a violation of the CWA.
- (b) The permittee shall take all reasonable steps to prevent any unauthorized dredging or filling in violation of this permit.
- (c) The permittee shall timely notify the Agency of any expected or known actual noncompliance.
- (d) Upon Agency request, the permittee shall provide information necessary to determine compliance status, or whether cause exists for permit modification, revocation, or termination.
- (e) Inspection and entry. The permittee shall allow the Agency, upon presentation of proper identification, at reasonable times to:
 - 1. Enter upon the permittee's premises where a regulated activity is located or where records must be kept under the conditions of the permit,
 - 2. Have access to and copy any records that must be kept under the conditions of the permit,
 - 3. Inspect operations regulated or required under the permit, and
 - 4. Sample or monitor, for the purposes of assuring permit compliance or as otherwise authorized by the CWA, any substances or parameters at any location.

(2) Applicable General Conditions under section 62-330.350(1), F.A.C., modified to contain applicable references under Chapter 62-331, F.A.C. (remove those that are not applicable):

(a) All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. Any deviations must be authorized in a permit modification in accordance with rule 62-331.080, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under chapter 373, F.S.

(b) A complete copy of this permit shall be kept at the work site of the permitted activity during the construction phase, and shall be available for review at the work site upon request by the Agency staff. The permittee shall require the contractor to review the complete permit prior to beginning construction.

(c) Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation, June 2007), and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), which are both incorporated by reference in subparagraph 62-330.050(9)(b)5., F.A.C., unless a project-specific erosion and sediment control plan is approved or other water quality control measures are required as part of the permit.

(d) At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the Agency a fully executed Form 62-330.350(1), "Construction Commencement Notice," (October 1, 2013), (<http://www.flrules.org/Gateway/reference.asp?No=Ref-02505>), incorporated by reference herein, indicating the expected start and completion dates. A copy of this form may be obtained from the Agency, as described in subsection 62-330.010(5), F.A.C., and shall be submitted electronically or by mail to the Agency. However, for activities involving more than one acre of construction that also require a NPDES stormwater construction general permit, submittal of the Notice of Intent to Use Generic Permit for Stormwater Discharge from Large and Small Construction Activities, DEP Form 62-621.300(4)(b), shall also serve as notice of commencement of construction under this chapter and, in such a case, submittal of Form 62-330.350(1) is not required.

(e) Unless the permit is transferred under rule 62-331.100, F.A.C., the permittee is liable to comply with the plans, terms, and conditions of the permit for the life of the project or activity.

(f) Within 30 days after completing construction of the entire project, or any independent portion of the project, the permittee shall provide the following to the Agency, as applicable:

1. For an individual, private single-family residential dwelling unit, duplex, triplex, or quadruplex – "Construction Completion and Inspection Certification for Activities Associated with a Private Single-Family Dwelling Unit" [Form 62-330.310(3)]; or

2. For all other activities – “As-Built Certification and Request for Conversion to Operation Phase” [Form 62-330.310(1)].

3. If available, an Agency website that fulfills this certification requirement may be used in lieu of the form.

(g) If the final operation and maintenance entity is a third party:

1. Prior to sales of any lot or unit served by the activity and within one year of permit issuance, or within 30 days of as-built certification, whichever comes first, the permittee shall submit, as applicable, a copy of the operation and maintenance documents (see sections 12.3 thru 12.3.4 of Volume I) as filed with the Florida Department of State, Division of Corporations, and a copy of any easement, plat, or deed restriction needed to operate or maintain the project, as recorded with the Clerk of the Court in the County in which the activity is located.

2. Within 30 days of submittal of the as-built certification, the permittee shall submit “Request for Transfer of Environmental Resource Permit to the Perpetual Operation and Maintenance Entity” [Form 62-330.310(2)] to transfer the permit to the operation and maintenance entity, along with the documentation requested in the form. If available, an Agency website that fulfills this transfer requirement may be used in lieu of the form.

(h) The permittee shall notify the Agency in writing of changes required by any other regulatory agency that require changes to the permitted activity, and any required modification of this permit must be obtained prior to implementing the changes.

(i) This permit does not:

1. Convey to the permittee any property rights or privileges, or any other rights or privileges other than those specified herein or in chapter 62-330, F.A.C.;

2. Convey to the permittee or create in the permittee any interest in real property;

3. Relieve the permittee from the need to obtain and comply with any other required federal, state, and local authorization, law, rule, or ordinance; or

4. Authorize any entrance upon or work on property that is not owned, held in easement, or controlled by the permittee.

(j) Prior to conducting any activities on state-owned submerged lands or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund, the permittee must receive all necessary approvals and authorizations under chapters 253 and 258, F.S. Written authorization that requires formal execution by the Board of Trustees of the Internal Improvement Trust Fund shall not be considered received until it has been fully executed.

(k) The permittee shall hold and save the Agency harmless from any and all damages, claims, or liabilities that may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any project authorized by the permit.

(l) The permittee shall notify the Agency in writing:

1. Immediately if any previously submitted information is discovered to be inaccurate; and
2. Within 30 days of any conveyance or division of ownership or control of the property or the system, other than conveyance via a long-term lease, and the new owner shall request transfer of the permit in accordance with rule 62-330.340, F.A.C. This does not apply to the sale of lots or units in residential or commercial subdivisions or condominiums where the stormwater management system has been completed and converted to the operation phase.

(m) Upon reasonable notice to the permittee, Agency staff with proper identification shall have permission to enter, inspect, sample and test the project or activities to ensure conformity with the plans and specifications authorized in the permit.

(n) If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, stone tools, dugout canoes, metal implements, historic building materials, or any other physical remains that could be associated with Native American, early European, or American settlement are encountered at any time within the project site area, the permitted project shall cease all activities involving subsurface disturbance in the vicinity of the discovery. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance Review Section (DHR), at (850)245-6333, as well as the appropriate permitting agency office. Project activities shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and the proper authorities notified in accordance with section 872.05, F.S. For project activities subject to prior consultation with the DHR and as an alternative to the above requirements, the permittee may follow procedures for unanticipated discoveries as set forth within a cultural resources assessment survey determined complete and sufficient by DHR and included as a specific permit condition herein.

(o) Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under rule 62-330.201, F.A.C., provides otherwise.

(p) The permittee shall provide routine maintenance of all components of the stormwater management system to remove trapped sediments and debris. Removed materials shall be disposed of in a landfill or other uplands in a manner that does not require a permit under chapter 62-331, F.A.C., or cause violations of state water quality standards.

NOTICE OF RIGHTS

This action is final and effective on the date filed with the Clerk of the Department unless a petition for an administrative hearing is timely filed under Sections 120.569 and 120.57, F.S., before the deadline for filing a

petition. On the filing of a timely and sufficient petition, this action will not be final and effective until further order of the Department. Because the administrative hearing process is designed to formulate final agency action, the subsequent order may modify or take a different position than this action.

Petition for Administrative Hearing

A person whose substantial interests are affected by the Department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. Pursuant to Rules 28-106.201 and 28-106.301, F.A.C., a petition for an administrative hearing must contain the following information:

- (a) The name and address of each agency affected and each agency's file or identification number, if known;
- (b) The name, address, any e-mail address, any facsimile number, and telephone number of the petitioner, if the petitioner is not represented by an attorney or a qualified representative; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination;
- (c) A statement of when and how the petitioner received notice of the agency decision;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A concise statement of the ultimate facts alleged, including the specific facts that the petitioner contends warrant reversal or modification of the agency's proposed action;
- (f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

The petition must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at Agency_Clerk@dep.state.fl.us. Also, a copy of the petition shall be mailed to the applicant at the address indicated above at the time of filing.

Time Period for Filing a Petition

In accordance with Rule 62-110.106(3), F.A.C., petitions for an administrative hearing by the applicant and persons entitled to written notice under Section 120.60(3), F.S., must be filed within 21 days of receipt of this written notice. Petitions filed by any persons other than the applicant, and other than those entitled to written notice under Section 120.60(3), F.S., must be filed within 21 of publication of the notice or within 21 days of receipt of the written notice, whichever occurs first. You cannot justifiably rely on the finality of this decision unless notice of this decision and the right of substantially affected persons to challenge this decision has been duly published or otherwise provided to all persons substantially affected by the decision. While you are not required to publish notice of this action, you may elect to do so pursuant Rule 62-110.106(10)(a).

The failure to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under [Sections 120.569](#) and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a

motion in compliance with Rule 28-106.205, F.A.C. If you do not publish notice of this action, this waiver will not apply to persons who have not received written notice of this action.

Extension of Time

Under Rule 62-110.106(4), F.A.C., a person whose substantial interests are affected by the Department's action may also request an extension of time to file a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. Requests for extension of time must be filed with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at Agency_Clerk@dep.state.fl.us, before the deadline for filing a petition for an administrative hearing. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon.

Mediation

Mediation is not available in this proceeding.

FLAWAC Review

The applicant, or any party within the meaning of Section 373.114(1)(a) or 373.4275, F.S., may also seek appellate review of this order before the Land and Water Adjudicatory Commission under Section 373.114(1) or 373.4275, F.S. Requests for review before the Land and Water Adjudicatory Commission must be filed with the Secretary of the Commission and served on the Department within 20 days from the date when this order is filed with the Clerk of the Department.

Judicial Review

Once this decision becomes final, any party to this action has the right to seek judicial review pursuant to Section 120.68, F.S., by filing a Notice of Appeal pursuant to Florida Rules of Appellate Procedure 9.110 and 9.190 with the Clerk of the Department in the Office of General Counsel (Station #35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000) and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice must be filed within 30 days from the date this action is filed with the Clerk of the Department.

Permittee Signature

Pursuant to Rule 62-331.052(3)(a)1, a permit becomes effective when it is signed by both the applicant and the Department. Signing indicates, as permittee, you accept and agree to comply with the terms of this permit. You have **60 days after receipt of this proposed permit** with which to sign and return to the Department for final approval. Failure to return within this timeframe will result in administrative withdrawal of your permit application. After receipt of the signed proposal, the Department will return to you the final signed permit, listing the permit's effective date and expiration date.

Katherine Burke
Digitally signed by Katherine Burke
Date: 2021.12.01 14:49:21 -05'00'

(Permittee)
Katherine Burke

December 1, 2021

(Date)

(Permittee Name – Printed)

This permit becomes effective when the designated Department official has signed below.
Executed in Fort Myers, Florida. STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Megan Mills

Megan Mills
Program Administrator
Submerged Lands & Environmental
Resource Program

Attachments:

Project Drawings 92 pages
Construction Commencement Notice/Form 62-330.350(1)
As-built Certification and Request for Conversion to Operational Phase/ Form 62-330.310(1)
Request for Transfer to the Perpetual Operation Entity/Form 62-330.310(2)
Request to Transfer Permit/Form 62-330.340(1)
Operation and Maintenance Inspection Certification/Form 62-330.311(1)
Monitoring Plan
O&M Plan
Technical Specifications

Copies furnished to:

FWC, Imperiled Species Management Section, ConservationPlanningServices@MyFWC.com
Charlotte County Property Appraiser, rp@ccappraiser.com

CERTIFICATE OF SERVICE

The undersigned hereby certifies that this permit, including all copies, were mailed before the close of
business on December 7, 2021, to the above listed persons.

FILING AND ACKNOWLEDGMENT

FILED, on this date, under 120.52(7) of the
Florida Statutes, with the designated Department Clerk,
receipt of which is hereby acknowledged.

Christian Reistad

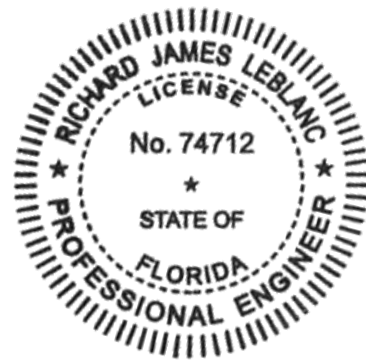


FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

620 SOUTH MERIDIAN STREET TALLAHASSEE, FLORIDA 32399

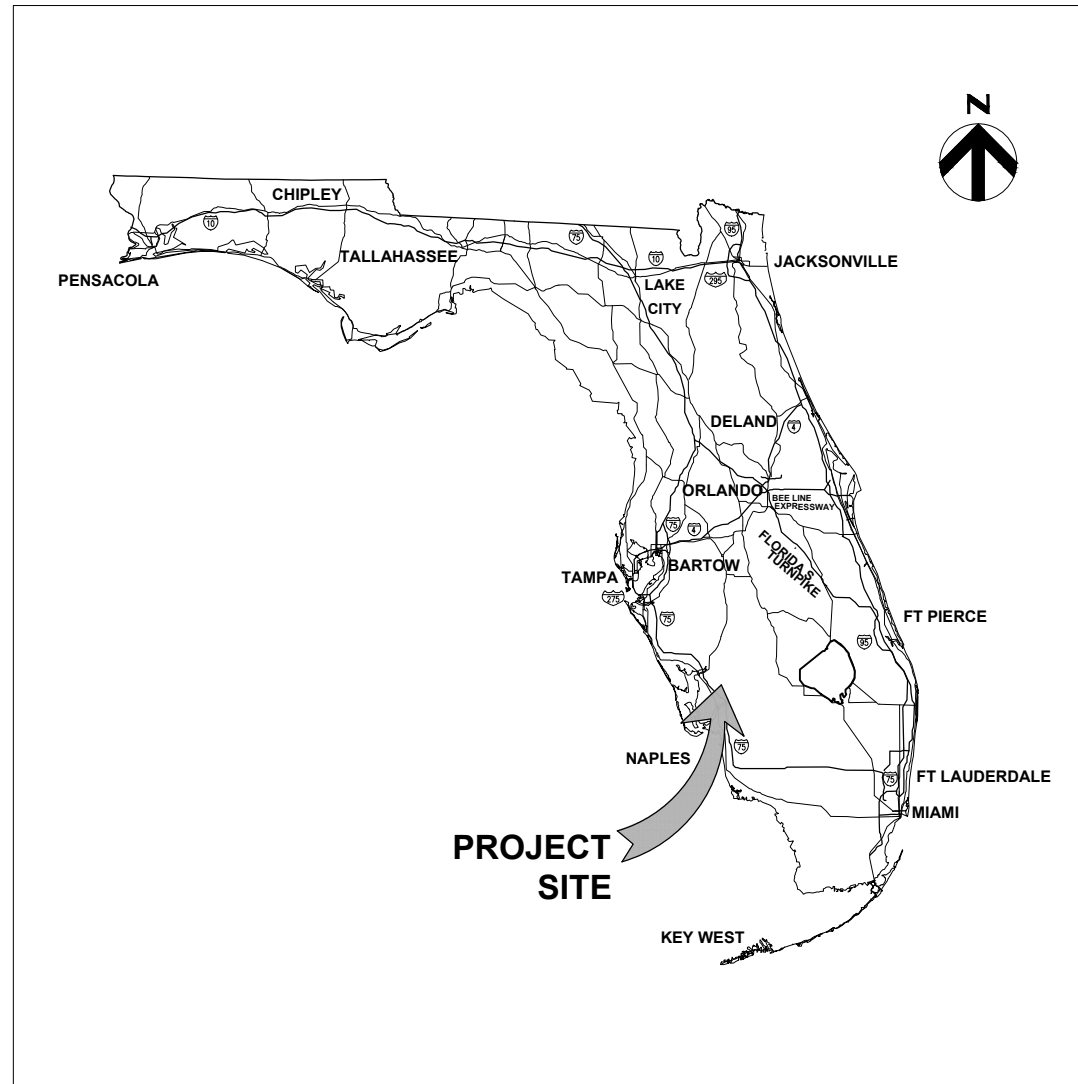


BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT CHARLOTTE COUNTY, FLORIDA



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VICINITY MAP
SCALE: NOT TO SCALE

Ready to Advertise, Phase 1

HDR Project No. 10061267
AUGUST 2020

CALL BEFORE YOU DIG

IT IS THE CONTRACTORS RESPONSIBILITY TO PLACE A CALL TO SUNSHINE STATE ONE CALL OF FLORIDA TO PREVENT THE DAMAGE OF UTILITIES THAT MAY EXIST WITHIN THE CONSTRUCTION AREA. DIAL 811 OR (800) 432-4770 TO REQUEST A LOCATE TICKET A MINIMUM OF 2 FULL BUSINESS DAYS IN ADVANCE OF BEGINNING CONSTRUCTION.

HDR Engineering, Inc CA 4213
4830 W. Kennedy Blvd. Suite 400
Tampa, FL 33609

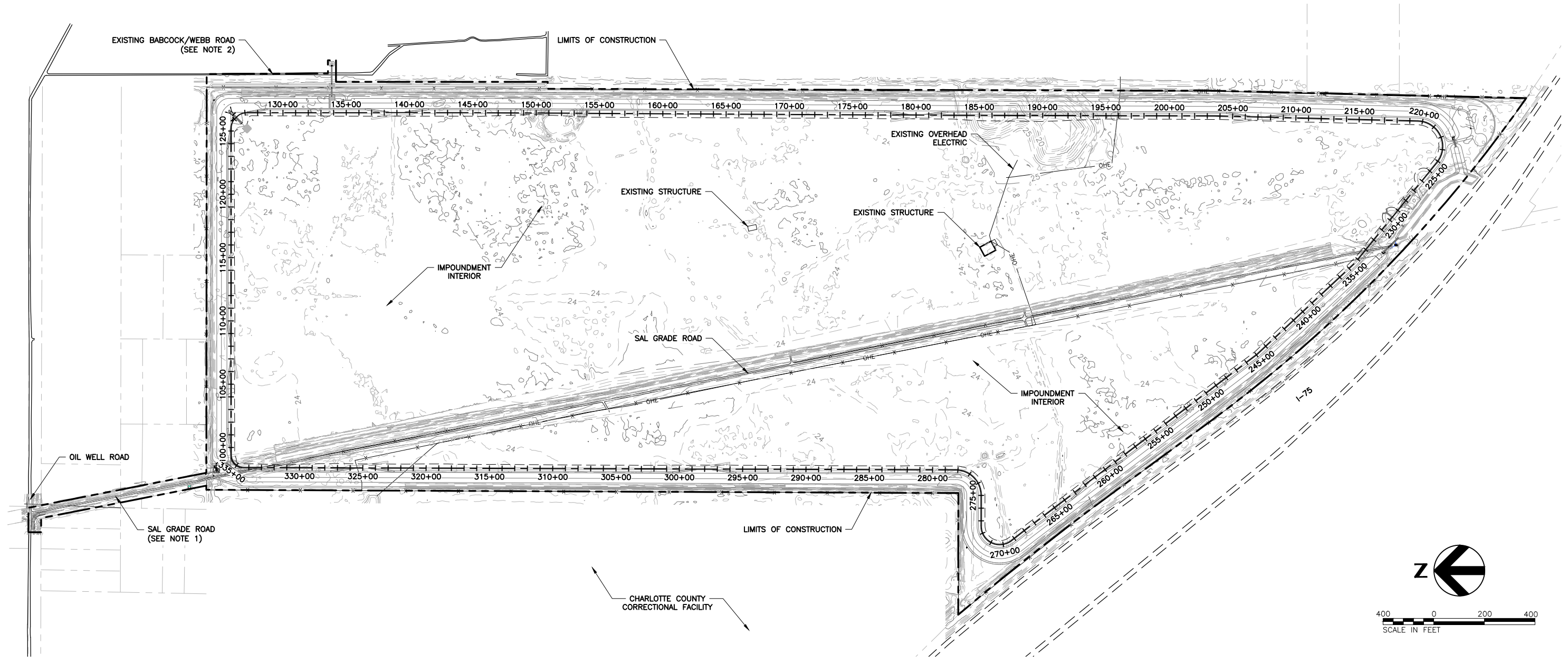
Richard LeBlanc, PE
FL PE# 74712

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- NOTES:
1. THE PRIMARY ACCESS ROAD FOR THIS PROJECT IS EXISTING SAL GRADE ROAD. PORTIONS OF THE INTERSECTION OF SAL GRADE ROAD AND OIL WELL ROAD SHALL BE MODIFIED AND EXTENDED AS SHOWN IN DRAWING C115 TO ACCOMMODATE CONSTRUCTION TRAFFIC.
 2. EXISTING BABCOCK/WEBB ROAD ALONG THE EAST SIDE OF THE CONSTRUCTION LIMITS MAY BE USED FOR SECONDARY ACCESS TO THE SITE. THIS ROAD MAY BE IN POOR CONDITION AND NOT SUITABLE FOR HEAVY CONSTRUCTION TRAFFIC. IF DAMAGED DURING THE COURSE OF CONSTRUCTION, THIS ROAD SHALL BE REPAIRED TO EXISTING OR BETTER CONDITION.
 3. CONTRACTOR MAY STAGE MATERIALS WITHIN THE CONSTRUCTION LIMITS EXCEPT IN AREAS THAT ARE TO BE PROTECTED OR RESTORED AS DETERMINED BY FWC. STAGING AREAS LOCATED WITHIN THE IMPOUNDMENT MAY BE LEFT IN PLACE IN ACCORDANCE WITH THE SPECIFICATIONS FOR DISPOSAL OF MATERIAL. STAGING AREAS LOCATED OUTSIDE OF THE IMPOUNDMENT SHALL BE REMOVED, GRADED TO DRAIN AND GRASSED PRIOR TO FINAL COMPLETION.



4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

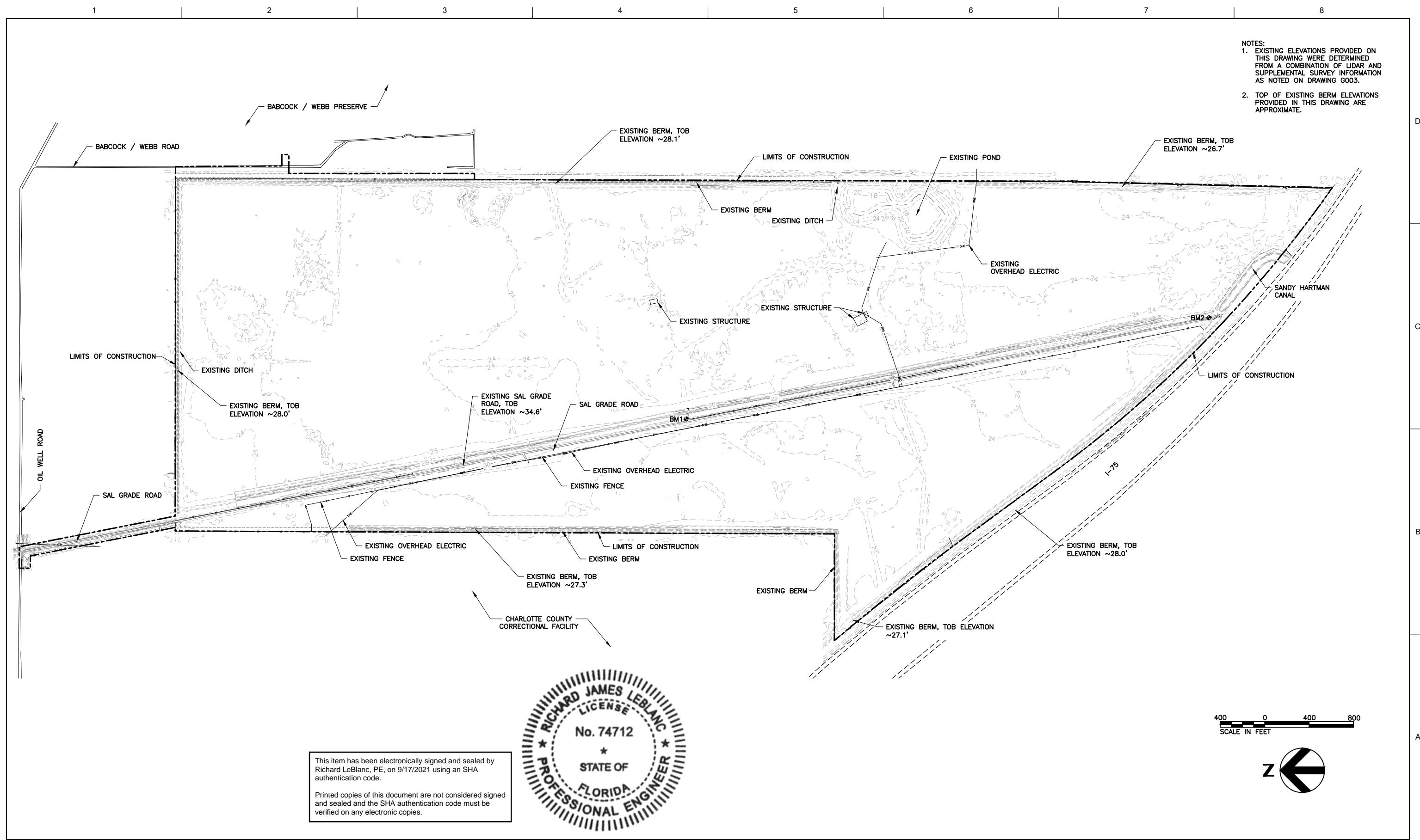
GENERAL CONTRACTOR ACCESS AND STAGING PLAN

0 1" 2"
READY TO ADVERTISE

SHEET 4 of 92
SCALE 1" = 400'

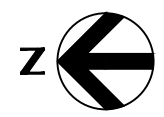
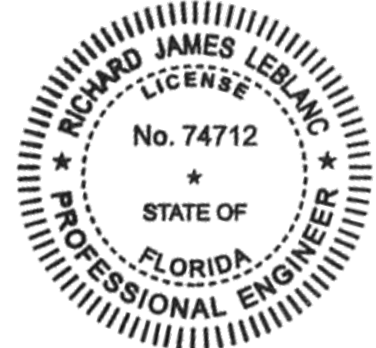
DRAWING
G004

- NOTES:
- EXISTING ELEVATIONS PROVIDED ON THIS DRAWING WERE DETERMINED FROM A COMBINATION OF LIDAR AND SUPPLEMENTAL SURVEY INFORMATION AS NOTED ON DRAWING G003.
 - TOP OF EXISTING BERM ELEVATIONS PROVIDED IN THIS DRAWING ARE APPROXIMATE.



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

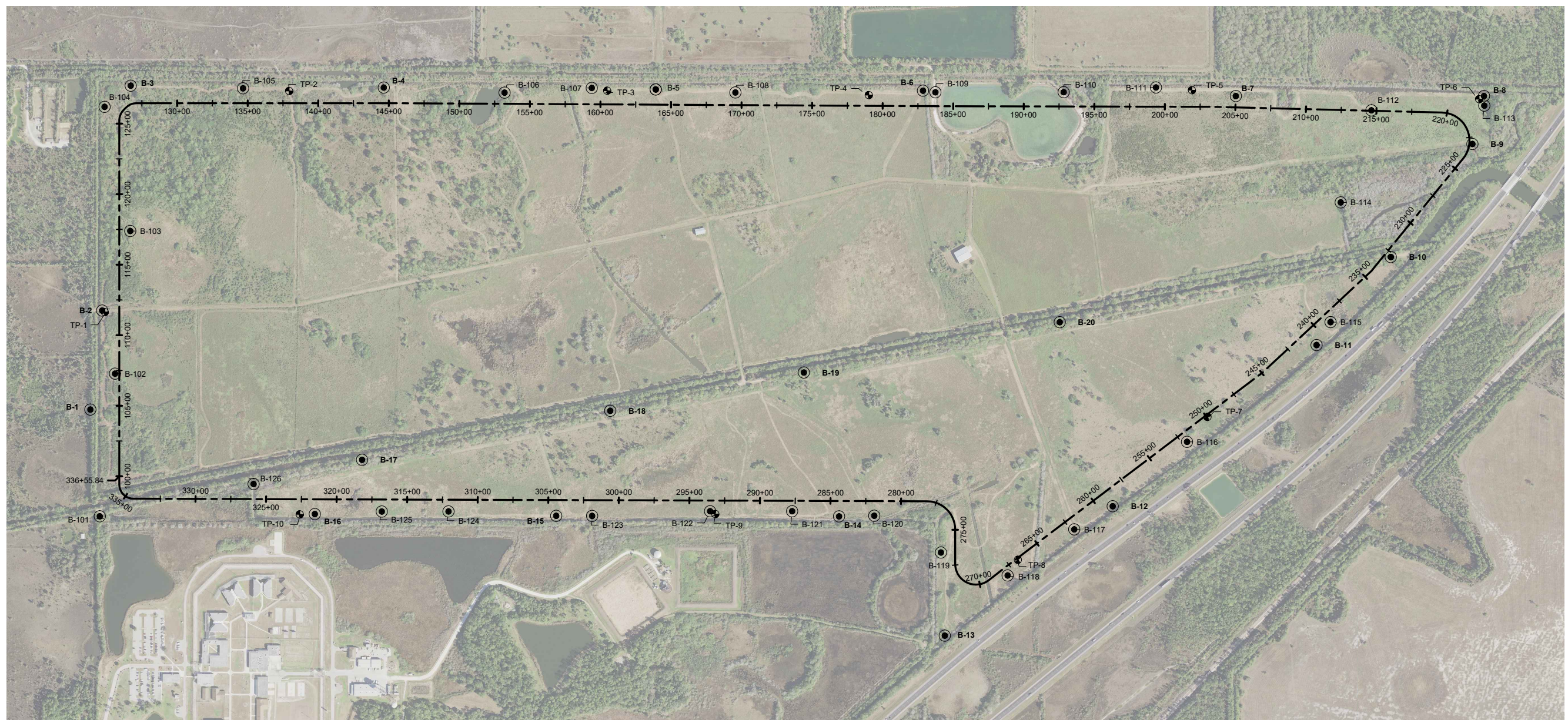
GENERAL EXISTING SITE PLAN

0 1" 2"
 READY TO ADVERTISE

SHEET 5 of 92
 SCALE 1" = 400'

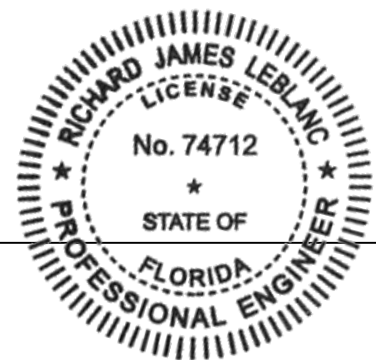
DRAWING **G005**

- NOTES:
- BORINGS PERFORMED ON 6/22/2017, 6/23/2017, 7/3/2017, 7/5/2017, 7/7/2017, AND 12/9/2019 THROUGH 12/12/2019.
 - TEST PITS PERFORMED ON 12/12/2019



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RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

GEOTECHNICAL GEOTECHNICAL BORINGS LOCATION MAP

0 1" 2"
 READY TO ADVERTISE

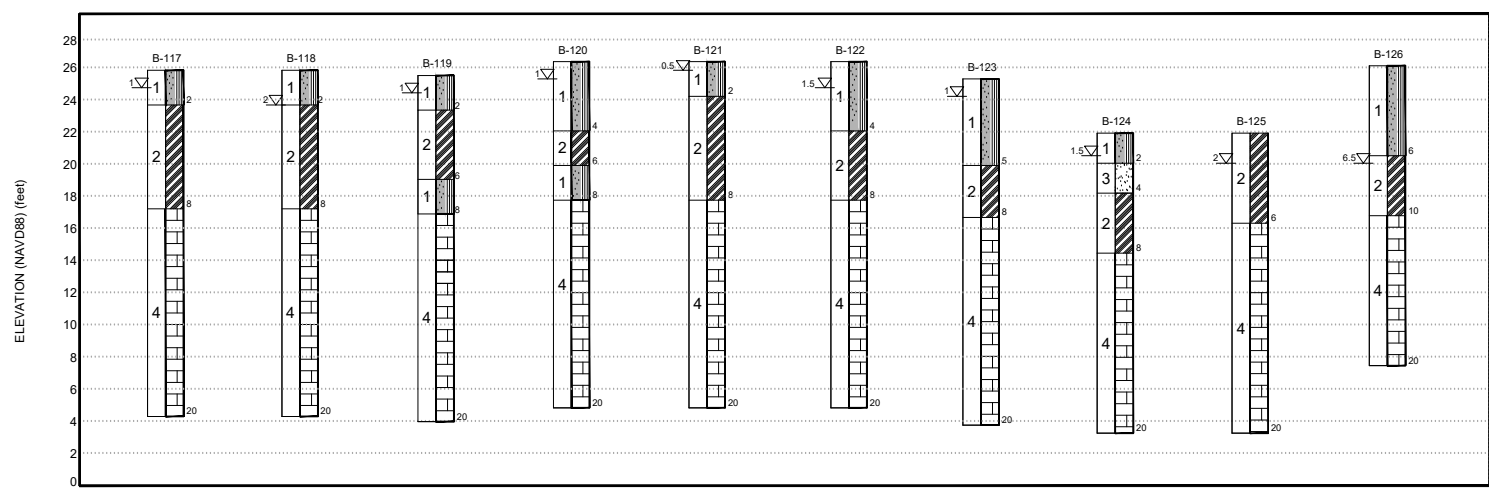
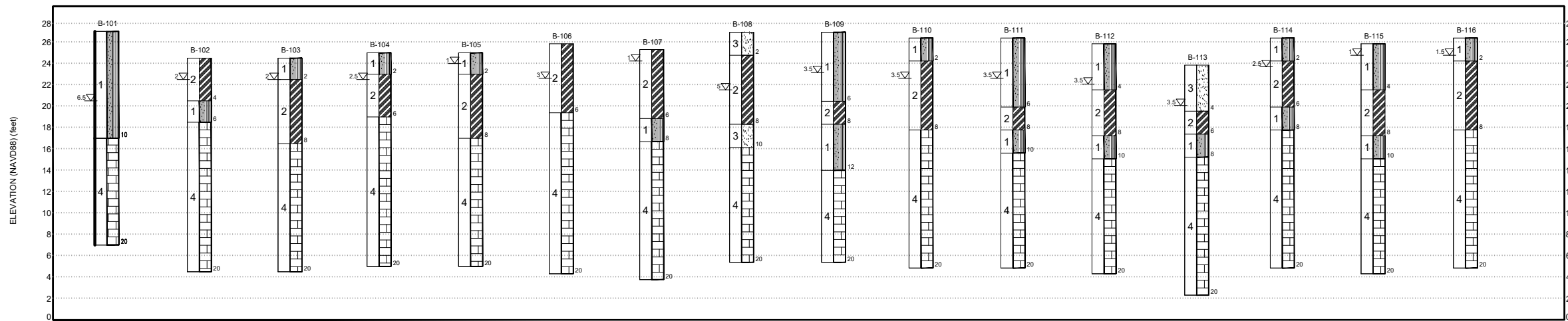
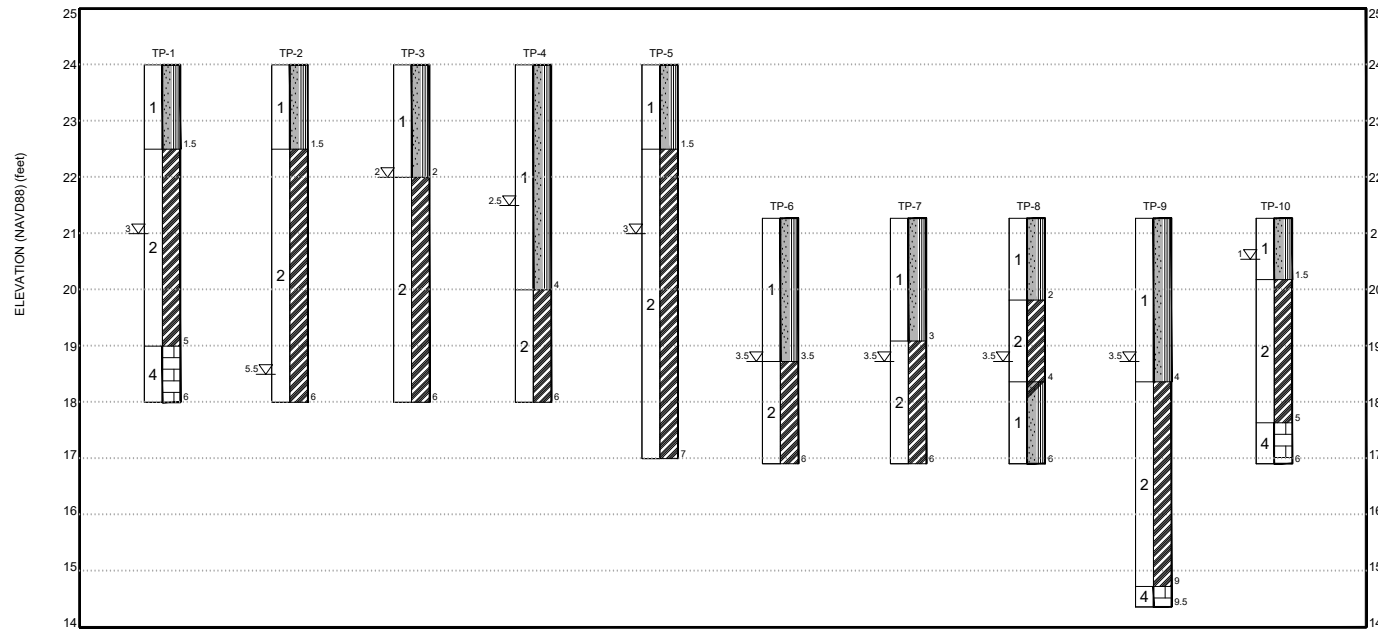
SHEET 6 of 92
 SCALE 1" = 400'

DRAWING **B100**



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267



- NOTES:
1. GROUNDWATER LEVELS ARE TEMPORAL. THE LEVELS SHOWN ARE REPRESENTATIVE OF THE DATE AND TIME OF THE GEOTECHNICAL EXPLORATION. SIGNIFICANT CHANGES ARE POSSIBLE OVER TIME.
 2. NUMBERS ADJACENT TO SOIL COLUMN INDICATE DEPTH BELOW GROUND SURFACE.



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LEGEND

- Poorly-graded Sand with Silt
- Limestone
- Clayey Sand
- First Water Observation
- Silty Sand

LAYER	LAYER NAME	GENERAL DESCRIPTION
1	SAND	Poorly graded sand with trace to some silt (SP, SP-SM)
2	CLAYEY SAND	Slightly clayey to clayey sand (SP-SC, SC)
3	SILTY SAND	Silty sand (SM)
4	LIMESTONE	Limestone, soft to hard
5	SILT	SILT (MH)
6	CLAY	CLAY (CH)



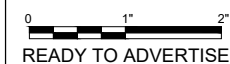
PROJECT MANAGER SUSAN RAY, PE		
ISSUE	DATE	DESCRIPTION
PROJECT NUMBER	10061267	

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

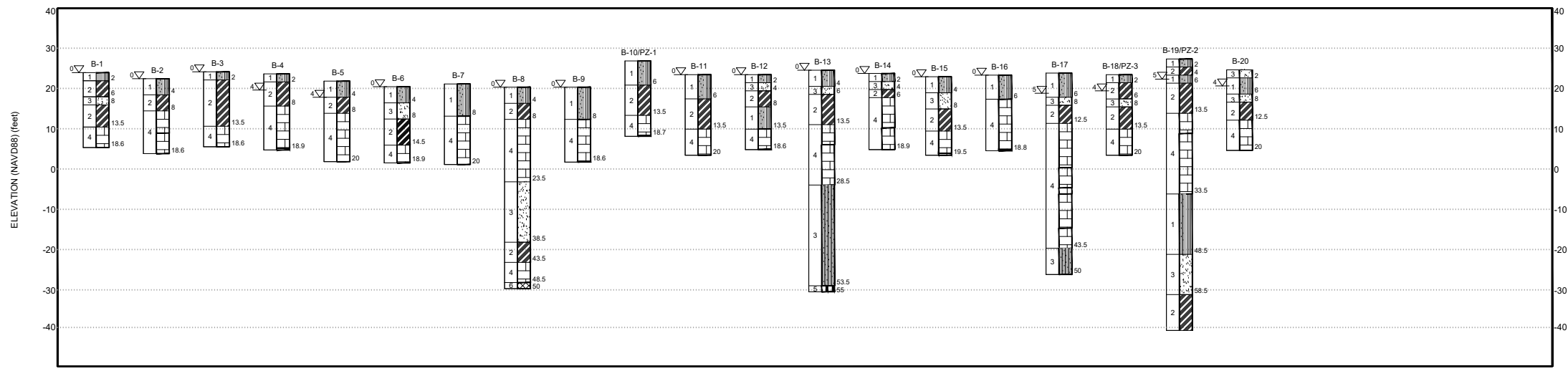
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

GEOTECHNICAL GEOTECHNICAL LOGS AND NOTES (1 OF 2)



SHEET 7 of 92
 SCALE NOT TO SCALE

DRAWING **B200**



- NOTES:
- GROUNDWATER LEVELS ARE TEMPORAL. THE LEVELS SHOWN ARE REPRESENTATIVE OF THE DATE AND TIME OF THE GEOTECHNICAL EXPLORATION. SIGNIFICANT CHANGES ARE POSSIBLE OVER TIME.
 - NUMBERS ADJACENT TO SOIL COLUMN INDICATE DEPTH BELOW GROUND SURFACE.

LEGEND

- Poorly-graded Sand with Silt
- Limestone
- Clayey Sand
- First Water Observation
- Silty Sand

LAYER	LAYER NAME	GENERAL DESCRIPTION
1	SAND	Poorly graded sand with trace to some silt (SP, SP-SM)
2	CLAYEY SAND	Slightly clayey to clayey sand (SP-SC, SC)
3	SILTY SAND	Silty sand (SM)
4	LIMESTONE	Limestone, soft to hard
5	SILT	SILT (MH)
6	CLAY	CLAY (CH)



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**

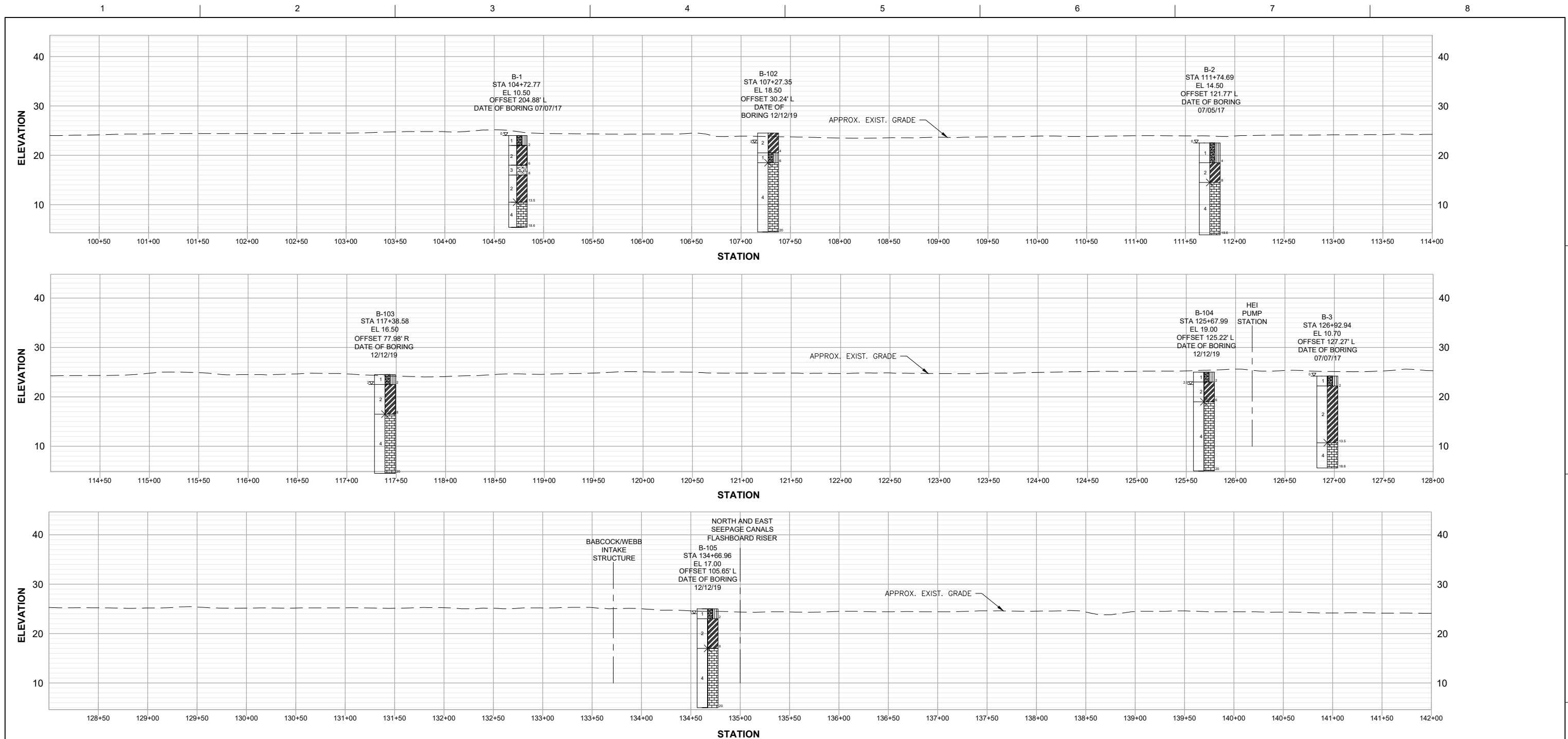
FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

**GEOTECHNICAL
 GEOTECHNICAL LOGS AND NOTES
 (2 OF 2)**

0 1" 2"
 READY TO ADVERTISE

SHEET 8 of 92
 SCALE NOT TO SCALE

DRAWING **B201**



NOTES:

- GROUNDWATER LEVELS ARE TEMPORAL. THE LEVELS SHOWN ARE REPRESENTATIVE OF THE DATE AND TIME OF THE GEOTECHNICAL EXPLORATION. SIGNIFICANT CHANGES ARE POSSIBLE OVER TIME.
- NUMBERS ADJACENT TO SOIL COLUMN INDICATE DEPTH BELOW GROUND SURFACE.
- EXISTING GRADE IS SHOWN FOR THE EMBANKMENT CENTERLINE AND IS APPROXIMATE FROM THE SURVEY DATA REFERENCED ON DRAWING G003 AND DOES NOT CORRESPOND TO THE EXISTING GRADE AT THE BORINGS. BORINGS ARE OFFSET FROM THE CENTERLINE AS INDICATED.
- REFER TO DRAWINGS B200 AND B201 FOR A LARGER DETAILED VIEW OF BORING LOGS SHOWN IN THIS PROFILE.

- BORINGS REPRESENT A SPECIFIC LOCATION AS INDICATED AND MAY NOT ACCURATELY PORTRAY THE PRECISE CONDITIONS BETWEEN BORINGS.
- ELEVATIONS PROVIDED FOR THESE BORINGS INDICATE TOP OF LIMESTONE AT THE BORING LOCATION.

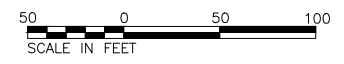
LEGEND

- POORLY-GRADED SAND WITH SILT
- LIMESTONE
- CLAYEY SAND
- FIRST WATER OBSERVATION
- SILTY SAND

LAYER	LAYER NAME	GENERAL DESCRIPTION
1	SAND	Poorly graded sand with trace to some silt (SP, SP-SM)
2	CLAYEY SAND	Slightly clayey to clayey sand (SP-SC, SC)
3	SILTY SAND	Silty sand (SM)
4	LIMESTONE	Limestone, soft to hard
5	SILT	SILT (MH)
6	CLAY	CLAY (CH)



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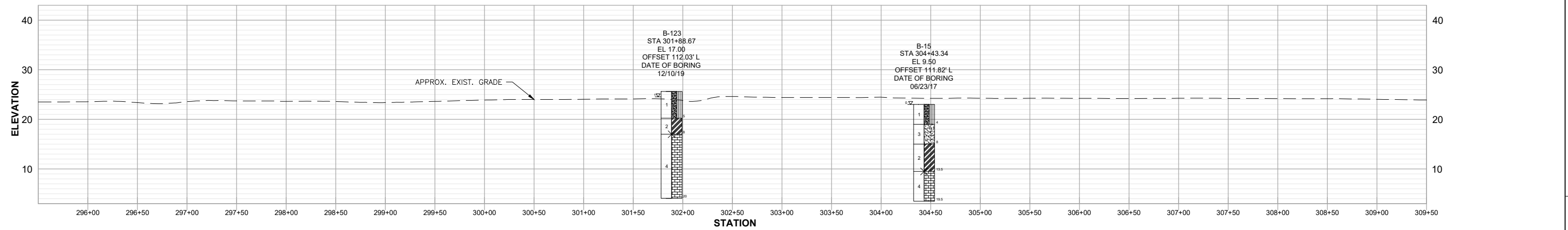
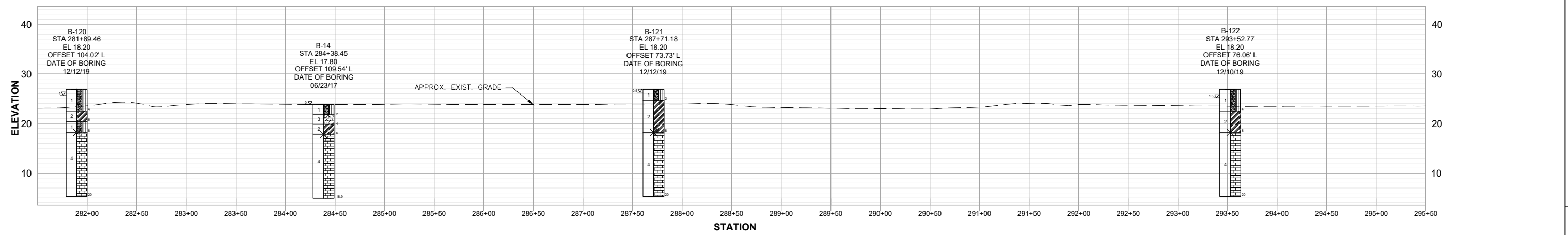
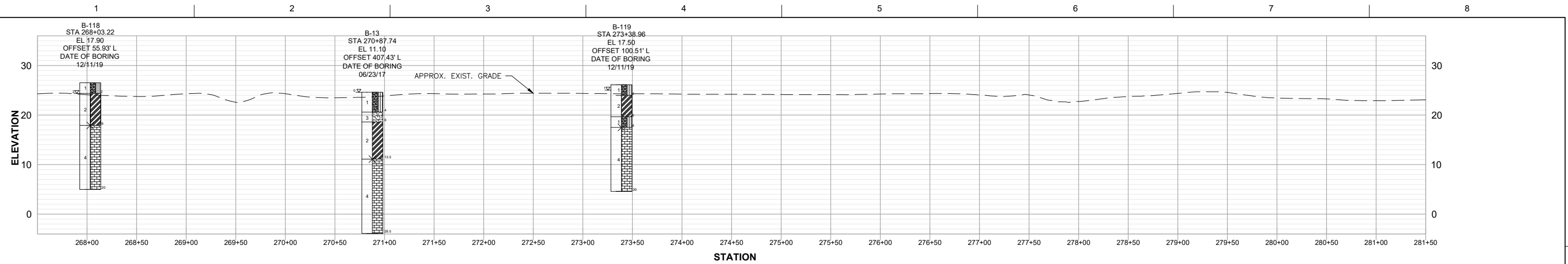
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

GEOTECHNICAL BORING PROFILES STATIONING LOCATIONS (1 OF 6)
SHEET 9 of 92
SCALE H:1"=50' V:1"=10'
DRAWING **B202**



NOTES:

- GROUNDWATER LEVELS ARE TEMPORAL. THE LEVELS SHOWN ARE REPRESENTATIVE OF THE DATE AND TIME OF THE GEOTECHNICAL EXPLORATION. SIGNIFICANT CHANGES ARE POSSIBLE OVER TIME.
- NUMBERS ADJACENT TO SOIL COLUMN INDICATE DEPTH BELOW GROUND SURFACE.
- EXISTING GRADE IS SHOWN FOR THE EMBANKMENT CENTERLINE AND IS APPROXIMATE FROM THE SURVEY DATA REFERENCED ON DRAWING G003 AND DOES NOT CORRESPOND TO THE EXISTING GRADE AT THE BORINGS. BORINGS ARE OFFSET FROM THE CENTERLINE AS INDICATED.
- REFER TO DRAWINGS B200 AND B201 FOR A LARGER DETAILED VIEW OF BORING LOGS SHOWN IN THIS PROFILE.

- BORINGS REPRESENT A SPECIFIC LOCATION AS INDICATED AND MAY NOT ACCURATELY PORTRAY THE PRECISE CONDITIONS BETWEEN BORINGS.
- ELEVATIONS PROVIDED FOR THESE BORINGS INDICATE TOP OF LIMESTONE AT THE BORING LOCATION.

LEGEND

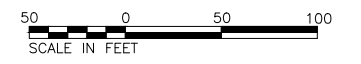
- POORLY-GRADED SAND WITH SILT
- LIMESTONE
- CLAYEY SAND
- FIRST WATER OBSERVATION
- SILTY SAND

LAYER	LAYER NAME	GENERAL DESCRIPTION
1	SAND	Poorly graded sand with trace to some silt
2	CLAYEY SAND	Slightly clayey to clayey sand (SP-SC, SC)
3	SILTY SAND	Silty sand (SM)
4	LIMESTONE	Limestone, soft to hard
5	SILT	SILT (MH)
6	CLAY	CLAY (CH)



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PROJECT MANAGER SUSAN RAY, PE		
ISSUE	DATE	DESCRIPTION
PROJECT NUMBER	10061267	

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

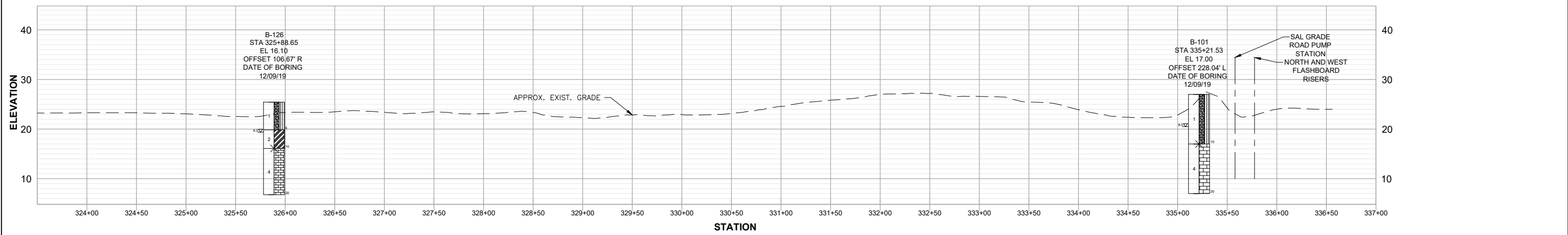
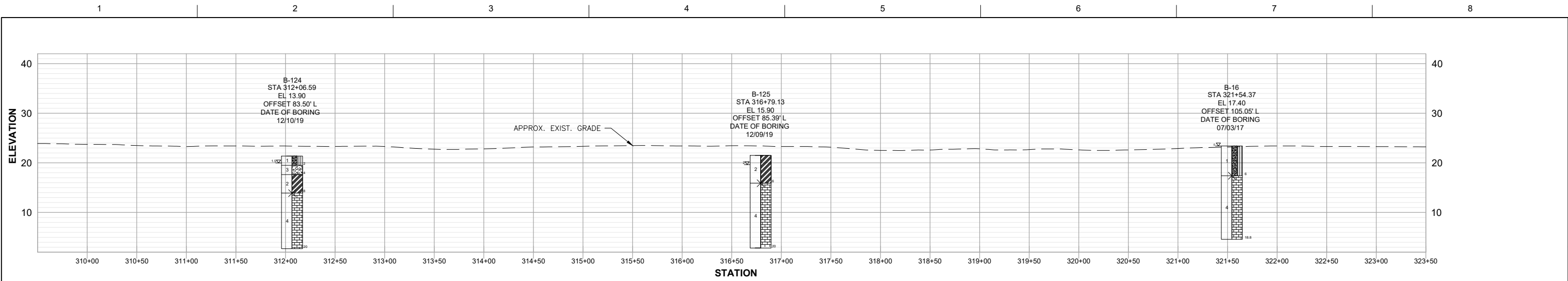
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL BORING PROFILES STATIONING LOCATIONS (5 OF 6)

0 1" 2"
READY TO ADVERTISE

SHEET 13 of 92
SCALE H:1"=50' V:1"=10'

DRAWING **B206**



- NOTES:
- GROUNDWATER LEVELS ARE TEMPORAL. THE LEVELS SHOWN ARE REPRESENTATIVE OF THE DATE AND TIME OF THE GEOTECHNICAL EXPLORATION. SIGNIFICANT CHANGES ARE POSSIBLE OVER TIME.
 - NUMBERS ADJACENT TO SOIL COLUMN INDICATE DEPTH BELOW GROUND SURFACE.
 - EXISTING GRADE IS SHOWN FOR THE EMBANKMENT CENTERLINE AND IS APPROXIMATE FROM THE SURVEY DATA REFERENCED ON DRAWING 0003 AND DOES NOT CORRESPOND TO THE EXISTING GRADE AT THE BORINGS. BORINGS ARE OFFSET FROM THE CENTERLINE AS INDICATED.
 - REFER TO DRAWINGS B200 AND B201 FOR A LARGER DETAILED VIEW OF BORING LOGS SHOWN IN THIS PROFILE.
 - BORINGS REPRESENT A SPECIFIC LOCATION AS INDICATED AND MAY NOT ACCURATELY PORTRAY THE PRECISE CONDITIONS BETWEEN BORINGS.
 - ELEVATIONS PROVIDED FOR THESE BORINGS INDICATE TOP OF LIMESTONE AT THE BORING LOCATION.

LEGEND

- POORLY-GRADED SAND WITH SILT
- LIMESTONE
- CLAYEY SAND
- FIRST WATER OBSERVATION
- SILTY SAND

LAYER	LAYER NAME	GENERAL DESCRIPTION
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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

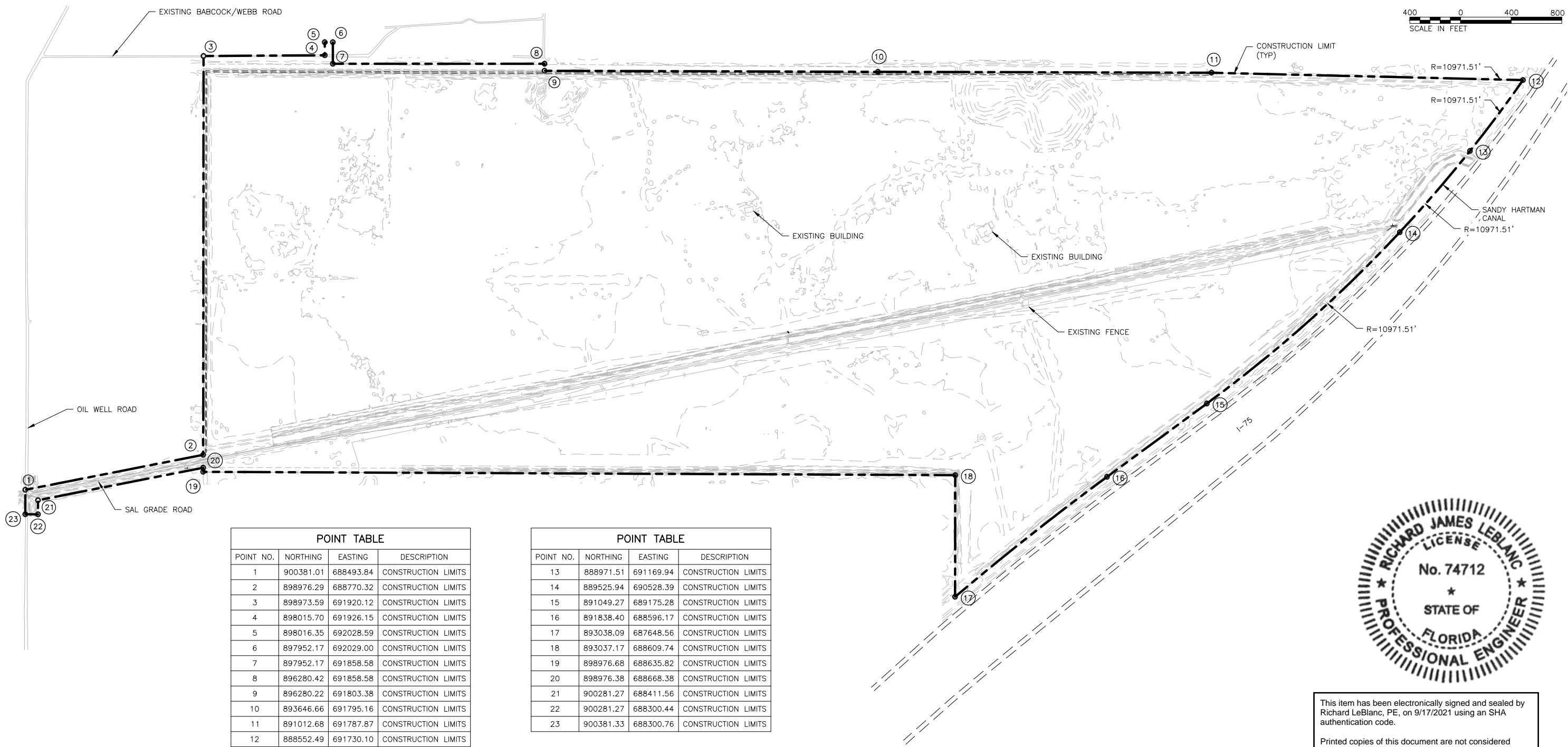
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
BORING PROFILES STATIONING LOCATIONS
(6 OF 6)**

0 1" 2"
READY TO ADVERTISE

SHEET 14 of 92
SCALE H:1"=50' V:1"=10'

DRAWING **B207**



POINT TABLE			
POINT NO.	NORTHING	EASTING	DESCRIPTION
1	900381.01	688493.84	CONSTRUCTION LIMITS
2	898976.29	688770.32	CONSTRUCTION LIMITS
3	898973.59	691920.12	CONSTRUCTION LIMITS
4	898015.70	691926.15	CONSTRUCTION LIMITS
5	898016.35	692028.59	CONSTRUCTION LIMITS
6	897952.17	692029.00	CONSTRUCTION LIMITS
7	897952.17	691858.58	CONSTRUCTION LIMITS
8	896280.42	691858.58	CONSTRUCTION LIMITS
9	896280.22	691803.38	CONSTRUCTION LIMITS
10	893646.66	691795.16	CONSTRUCTION LIMITS
11	891012.68	691787.87	CONSTRUCTION LIMITS
12	888552.49	691730.10	CONSTRUCTION LIMITS

POINT TABLE			
POINT NO.	NORTHING	EASTING	DESCRIPTION
13	888971.51	691169.94	CONSTRUCTION LIMITS
14	889525.94	690528.39	CONSTRUCTION LIMITS
15	891049.27	689175.28	CONSTRUCTION LIMITS
16	891838.40	688596.17	CONSTRUCTION LIMITS
17	893038.09	687648.56	CONSTRUCTION LIMITS
18	893037.17	688609.74	CONSTRUCTION LIMITS
19	898976.68	688635.82	CONSTRUCTION LIMITS
20	898976.38	688668.38	CONSTRUCTION LIMITS
21	900281.27	688411.56	CONSTRUCTION LIMITS
22	900281.27	688300.44	CONSTRUCTION LIMITS
23	900381.33	688300.76	CONSTRUCTION LIMITS



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ISSUE	DATE	DESCRIPTION

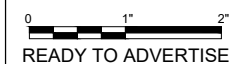
PROJECT MANAGER SUSAN RAY, PE	
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
CONSTRUCTION LIMITS**

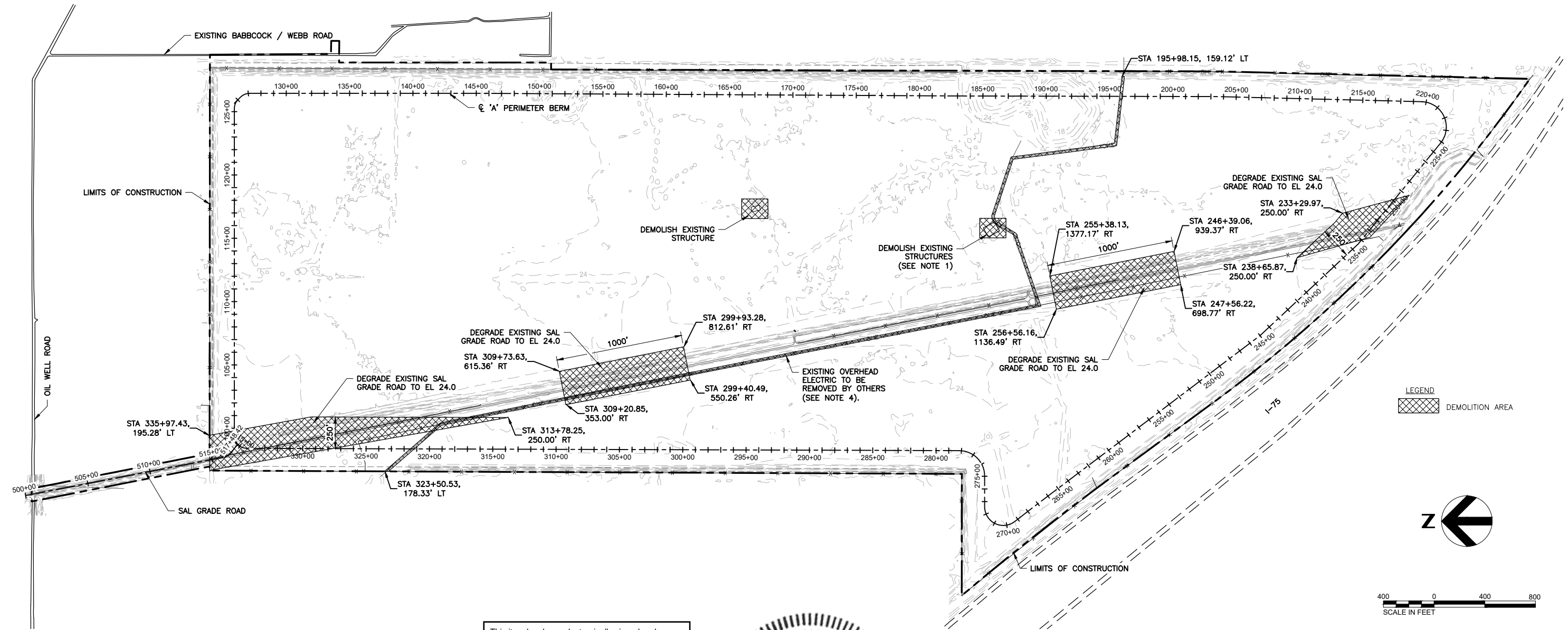


SHEET 15 of 92
SCALE 1" = 400'

DRAWING
C001

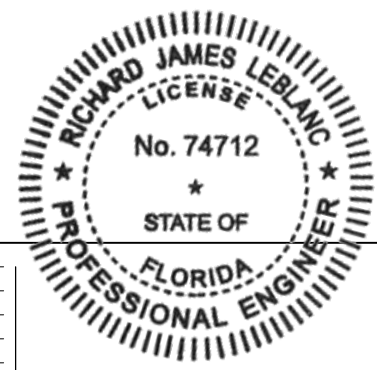
NOTES:

- EXISTING BUILDING MAY HAVE SEPTIC SYSTEMS. SEPTIC SYSTEM SHALL BE ABANDONED IN ACCORDANCE WITH LOCAL STATE REQUIREMENTS.
- A PRE-DEMOLITION ASBESTOS SURVEY WAS PERFORMED ON THE BUILDINGS. THE ASSOCIATED REPORT IS PROVIDED TO THE CONTRACTOR AS REFERENCE MATERIAL IN SPECIFICATION SECTION 01010.
- FENCING WITHIN THE CONSTRUCTION LIMITS SHALL BE REMOVED. FENCING ALONG THE CONSTRUCTION LIMITS BELONGING TO ADJACENT PROPERTY OWNERS SHALL REMAIN AND BE PROTECTED DURING CONSTRUCTION. IF NECESSARY TO TEMPORARILY REMOVE FENCING TO REMAIN DURING PERFORMANCE OF THE WORK, CONTRACTOR SHALL COORDINATE WITH THE ADJACENT PROPERTY OWNER AND REPLACE FENCING IN KIND. NO FENCING SHALL BE REMOVED WITHOUT PRIOR NOTICE TO THE OWNER.
- EXISTING POWER WILL BE REMOVED BY THE UTILITY COMPANY. CONTRACTOR SHALL COORDINATE WITH UTILITY COMPANY. REFER TO ELECTRICAL SHEETS FOR ADDITIONAL INFORMATION.
- PORTIONS OF EXISTING SAL GRADE ROAD TO BE DEGRADED SHALL BE REMOVED TO THE ELEVATION NOTED AT A MINIMUM. EXISTING CANALS, DITCHES, OR OTHER FEATURES LOWER THAN THE NOTED ELEVATION MAY REMAIN.
- REMOVE CULVERTS ENCOUNTERED WITHIN CONSTRUCTION LIMITS. WHEN CULVERTS ARE PARTIALLY LOCATED WITHIN THE CONSTRUCTION LIMITS THEY SHALL BE REMOVED TO THE FURTHEST EXTENT POSSIBLE AND THE REMAINING PORTIONS OF CULVERT SHALL BE ABANDONED IN PLACE.



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RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

HDR
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609
 CA 4213

ISSUE	DATE	DESCRIPTION

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

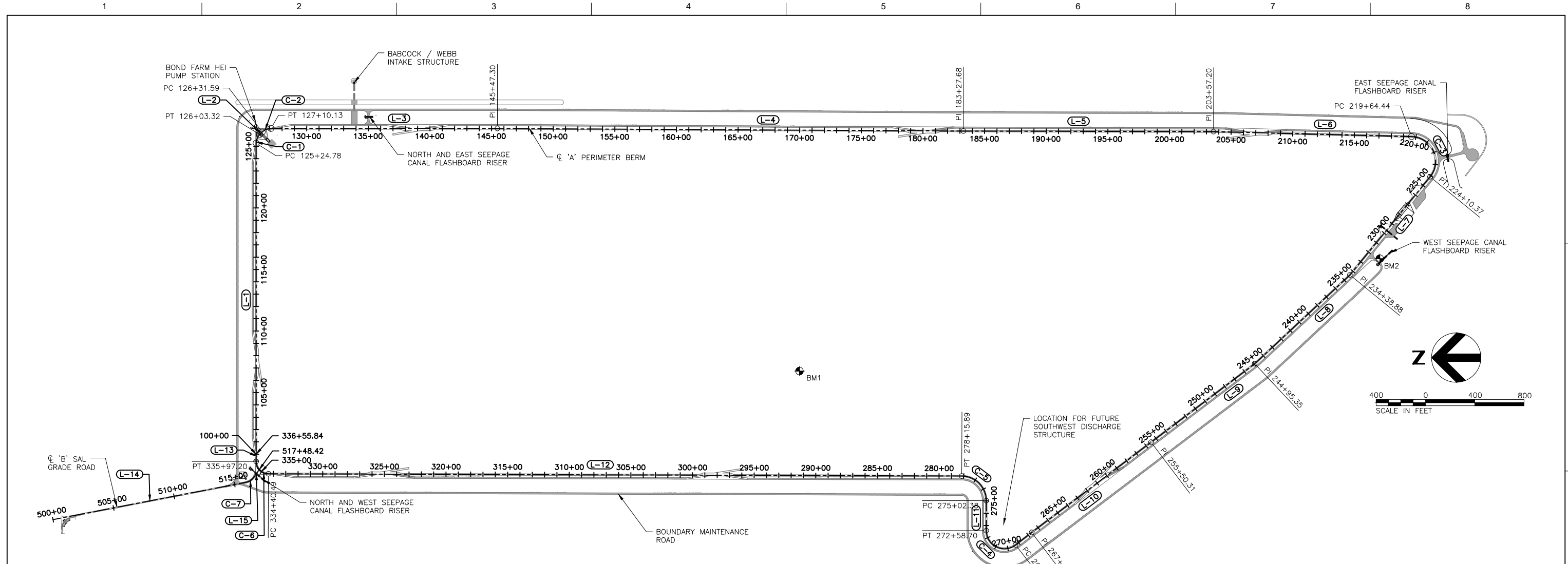
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

CIVIL DEMOLITION PLAN

0 1" 2"
 READY TO ADVERTISE

SHEET 16 of 92
 SCALE 1" = 400'

DRAWING
C002



ALIGNMENT LINE TABLE - Q'B' SAL GRADE ROAD

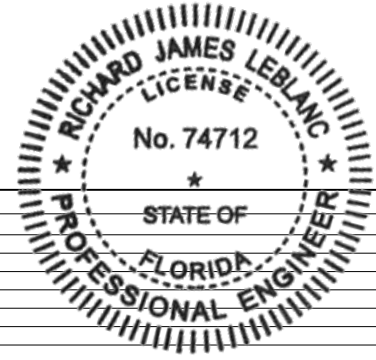
LINE NO.	STATION START/STOP	LENGTH	DIRECTION	START POINT	END POINT
L-14	500+00.00 - 516+00.00	1600.00	S10° 56' 49"E	N 900428.82 E 688438.98	N 898857.93 E 688742.83
L-15	516+67.56 - 517+48.42	80.86	S54° 15' 40"E	N 898802.92 E 688779.52	N 898755.69 E 688845.15

ALIGNMENT CURVE TABLE - Q'B' SAL GRADE ROAD

CURVE NO.	PI STATION	ΔL	RADIUS	TANGENT	LENGTH	CHORD DIRECTION	CHORD LENGTH
C-7	516+35.30	040°59'59.53"	94.42'	35.30'	67.56'	S33°42'06.41"E	66.13'

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ALIGNMENT CURVE TABLE - Q'A' PERIMETER BERM

CURVE NO.	PI STATION	ΔL	RADIUS	TANGENT	LENGTH	CHORD DIRECTION	CHORD LENGTH
C-1	125+66.20	045°00'00.26"	100.00'	41.42'	78.54'	S67°30'00.44"E	76.54'
C-2	126+73.01	045°00'00.26"	100.00'	41.42'	78.54'	S22°30'00.18"E	76.54'
C-3	223+72.41	127°46'44.97"	199.96'	407.97'	445.93'	S65°19'24.60"W	359.10'
C-4	272+30.87	127°48'24.67"	147.17'	300.45'	328.28'	N26°05'47.66"E	264.33'
C-5	277+01.73	089°48'54.57"	200.00'	199.36'	313.51'	N45°05'32.71"E	282.39'
C-6	335+40.13	089°48'54.57"	99.97'	99.65'	156.71'	N45°05'32.71"E	141.15'

HORIZONTAL AND VERTICAL CONTROL BENCHMARKS

NAME	NORTHING	EASTING	ELEVATION	DESCRIPTION
BM1	894373.00	689645.00	26.80	SET 4"x4" CONCRETE MONUMENT WITH ALUMINUM DISK STAMPED "McKIM & CREED LB7917 BM1"
BM2	889665.00	690558.00	27.20	SET 4"x4" CONCRETE MONUMENT WITH ALUMINUM DISK STAMPED "McKIM & CREED LB7917 BM2"

ALIGNMENT LINE TABLE - Q'A' PERIMETER BERM

LINE NO.	STATION START/STOP	LENGTH	DIRECTION	START POINT	END POINT
L-1	100+00.00 - 125+24.78	2524.78	N89° 59' 59"E	N 898780.89 E 688970.16	N 898780.90 E 691494.93
L-2	126+03.32 - 126+31.59	28.27	S45° 00' 00"E	N 898751.61 E 691565.64	N 898731.62 E 691585.63
L-3	127+10.13 - 145+47.30	1837.17	S00° 00' 00"E	N 898660.91 E 691614.92	N 898623.73 E 691614.92
L-4	145+47.30 - 183+27.68	3780.38	S00° 18' 57"W	N 896823.73 E 691614.92	N 893043.41 E 691594.09
L-5	183+27.68 - 203+57.20	2029.52	S00° 08' 14"W	N 893043.41 E 691594.09	N 891013.90 E 691589.23
L-6	203+57.20 - 219+64.44	1607.24	S01° 26' 02"W	N 891013.90 E 691589.23	N 889407.16 E 691549.01
L-7	224+10.37 - 234+38.88	1028.51	N50° 47' 13"W	N 889257.24 E 691222.70	N 889907.47 E 690425.81
L-8	234+38.88 - 244+95.35	1056.46	N43° 01' 40"W	N 889907.47 E 690425.81	N 890679.77 E 689704.93
L-9	244+95.35 - 255+50.31	1054.96	N37° 09' 20"W	N 890679.77 E 689704.93	N 891520.58 E 689067.75
L-10	255+50.31 - 267+64.51	1214.20	N37° 06' 41"W	N 891520.58 E 689067.75	N 892488.86 E 688335.15
L-11	272+58.70 - 275+02.38	243.68	N90° 00' 00"E	N 892857.32 E 688349.71	N 892857.32 E 688593.39
L-12	278+15.89 - 334+40.49	5624.59	N00° 11' 05"E	N 893056.68 E 688793.39	N 898061.24 E 688811.54
L-13	335+97.20 - 336+55.84	58.65	N90° 00' 00"E	N 898780.89 E 688911.51	N 898780.89 E 688970.16

HDR
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE

PROJECT NUMBER	10061267
----------------	----------

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

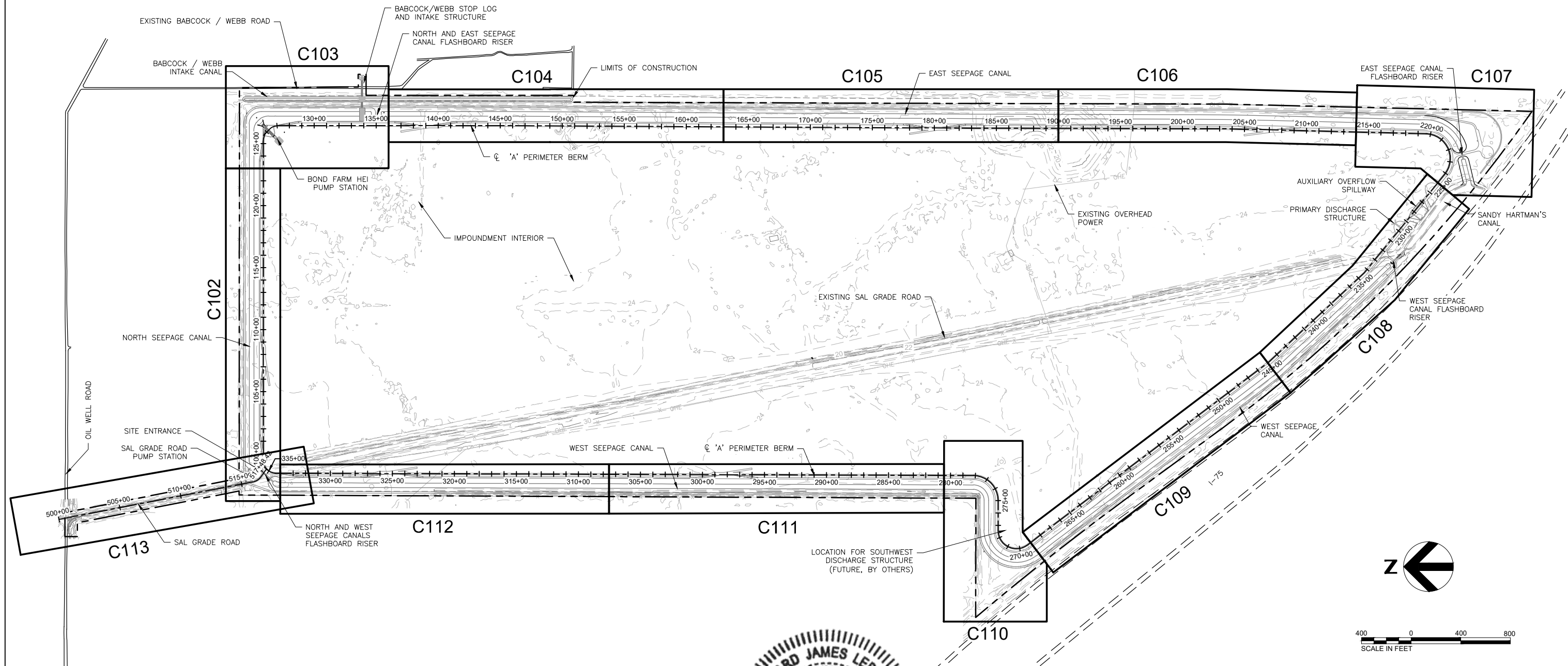
**CIVIL
SITE GEOMETRY PLAN**

0 1" 2"
READY TO ADVERTISE

SHEET 17 of 92
SCALE 1" = 400'

DRAWING
C100

NOTES:
 1. EXISTING BUILDING MAY HAVE SEPTIC SYSTEMS. SEPTIC SYSTEM SHALL BE ABANDONED IN ACCORDANCE WITH LOCAL & STATE REQUIREMENTS.



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

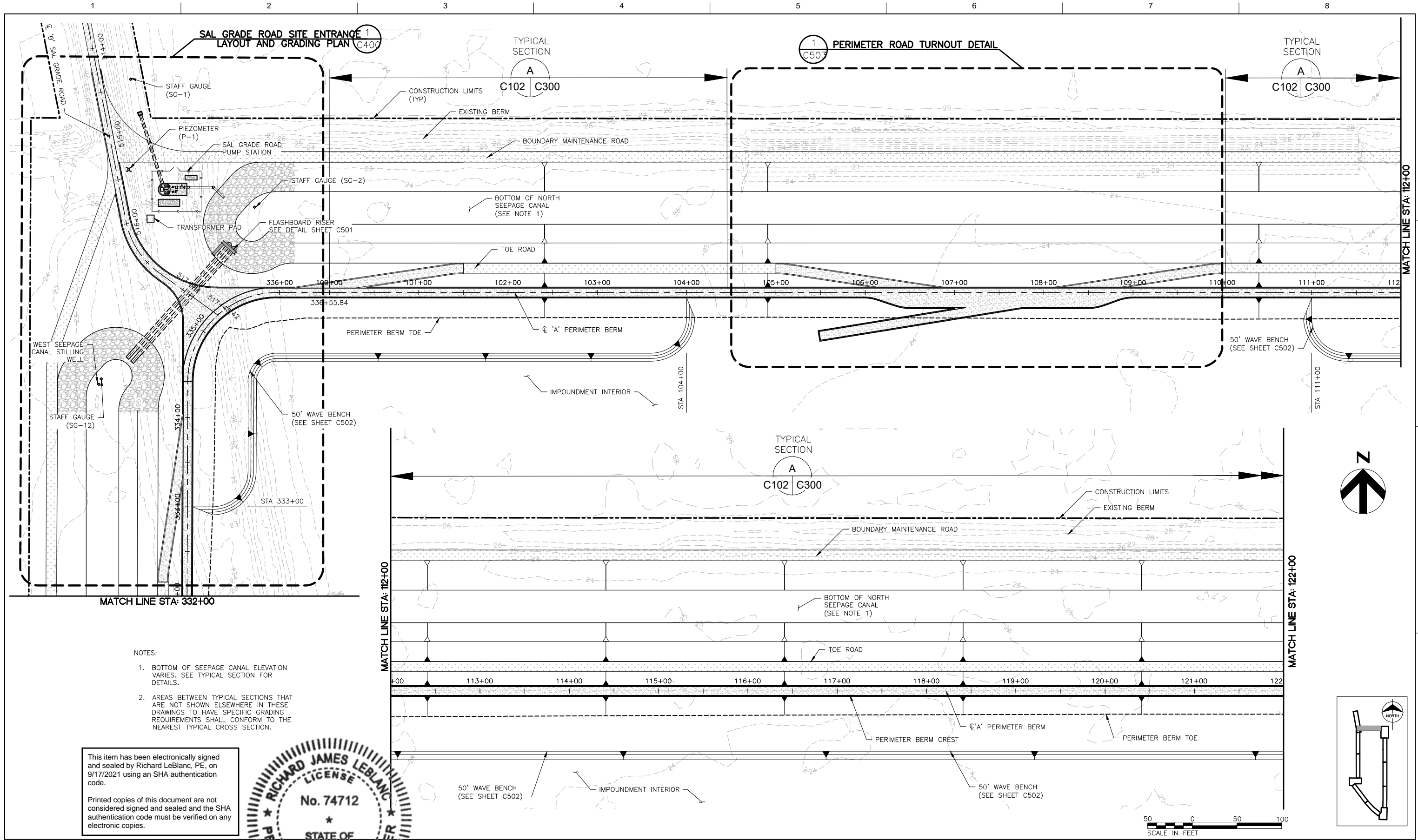
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
 FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

CIVIL OVERALL SITE PLAN AND KEY MAP

0 1" 2"
 READY TO ADVERTISE

SHEET 18 of 92
 SCALE 1" = 400'

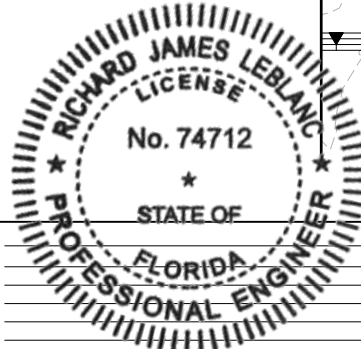
DRAWING **C101**



- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.

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PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

CIVIL SITE PLAN (1 OF 12)

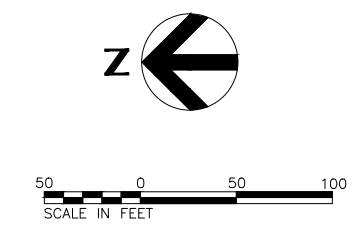
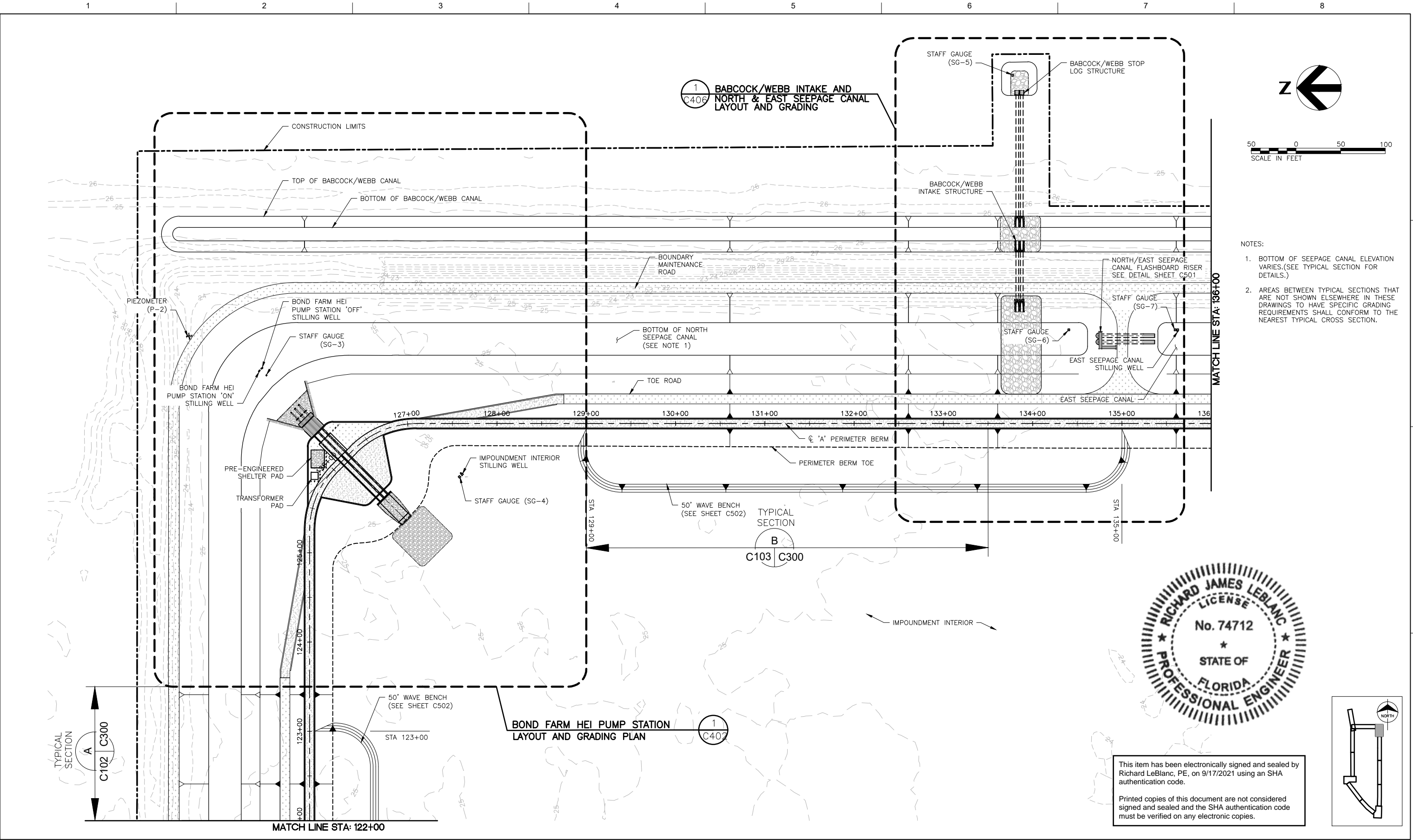


0 1" 2"
 READY TO ADVERTISE

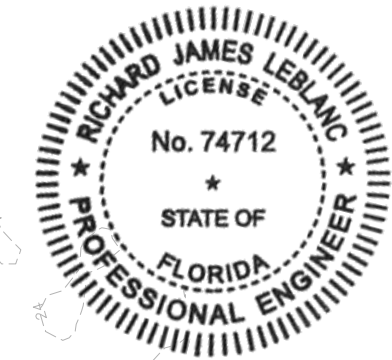
SHEET 19 of 92
 SCALE 1" = 50'

DRAWING
C102



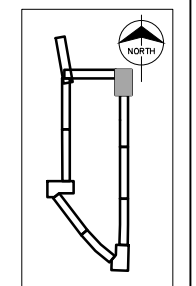


- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES.(SEE TYPICAL SECTION FOR DETAILS.)
 2. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.



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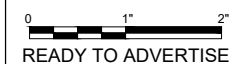
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
ELECTRICAL ENGINEER	JORGE PLASENCIA, P.E.
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**

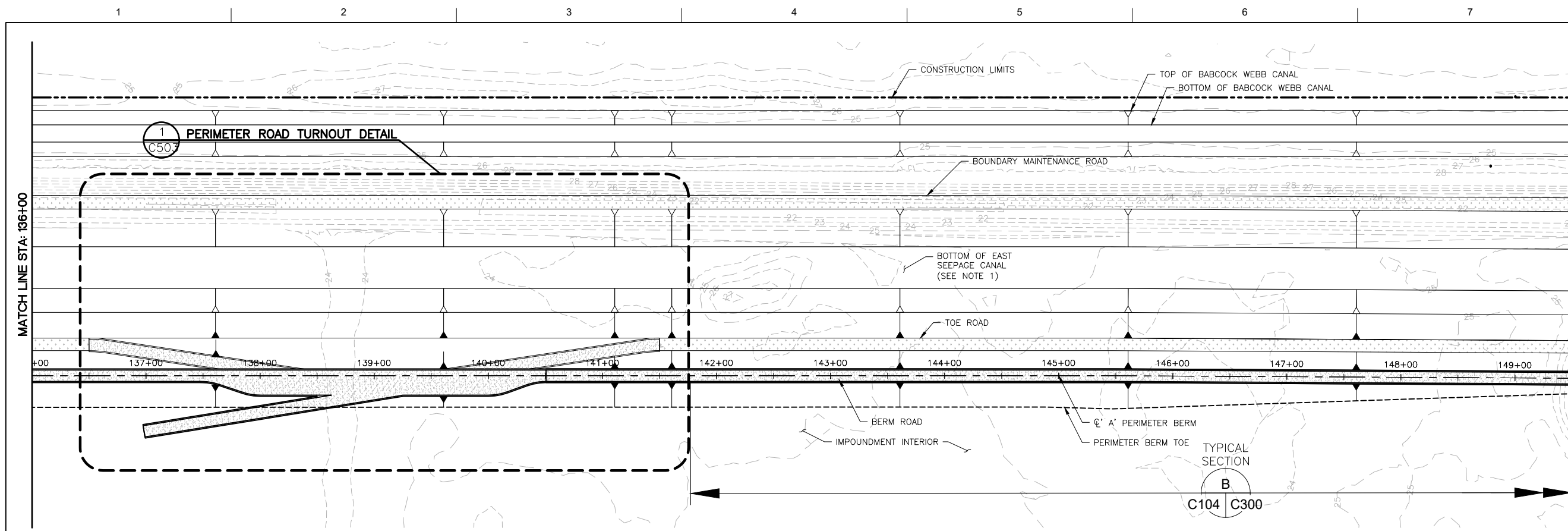
FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399



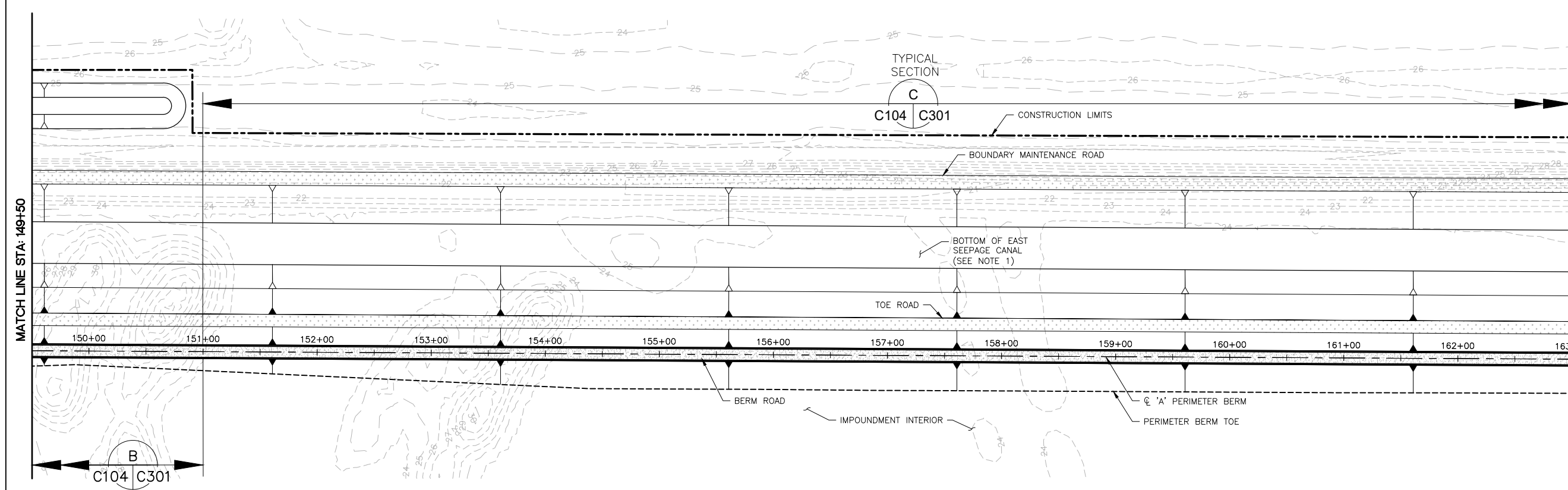
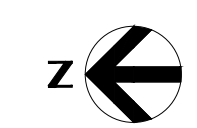
**CIVIL
 SITE PLAN (2 OF 12)**

SHEET 20 of 92
 SCALE 1" = 50'

DRAWING
C103

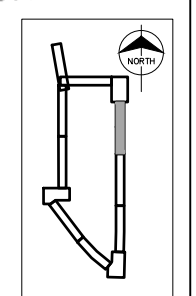


- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. EXISTING POND SHALL BE DRAINED AND BACKFILLED WITH SELECT FILL MATERIAL TO EL 24.0. PRIOR TO BACKFILLING, ORGANIC MATERIAL SHALL BE REMOVED AND THE SUBSURFACE PREPARED IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
 3. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.



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ISSUE	DATE	DESCRIPTION

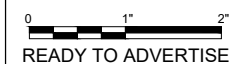
PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**

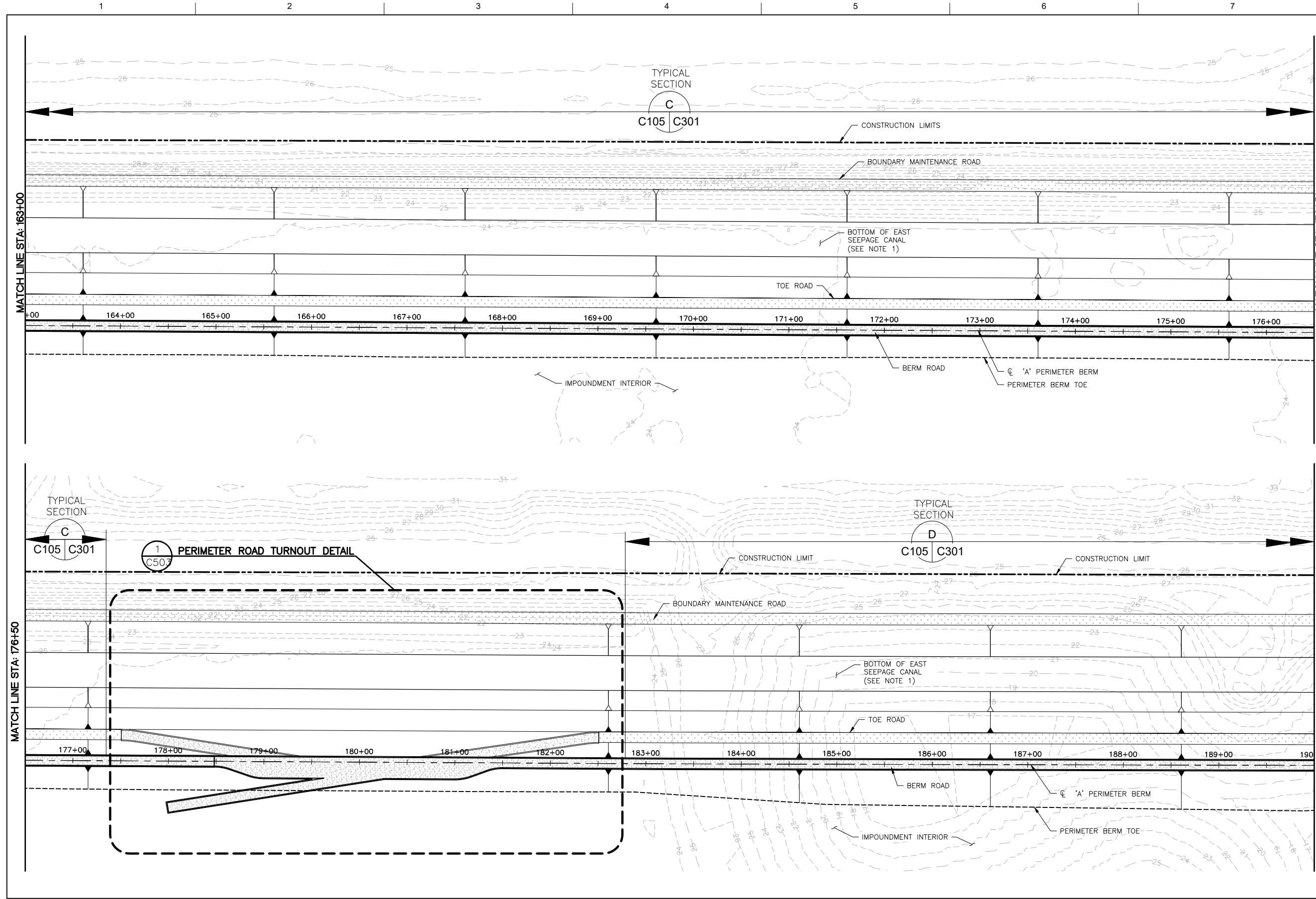
FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

**CIVIL
 SITE PLAN (3 OF 12)**



SHEET 21 of 92
 SCALE 1" = 50'

DRAWING
C104

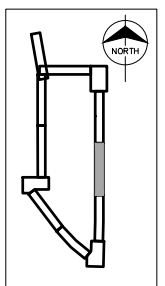


- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. EXISTING POND SHALL BE DRAINED AND BACKFILLED WITH SELECT FILL MATERIAL TO EL 24.0. PRIOR TO BACKFILLING, ORGANIC MATERIAL SHALL BE REMOVED AND THE SUBSURFACE PREPARED IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
 3. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.



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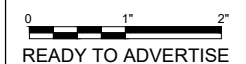


ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

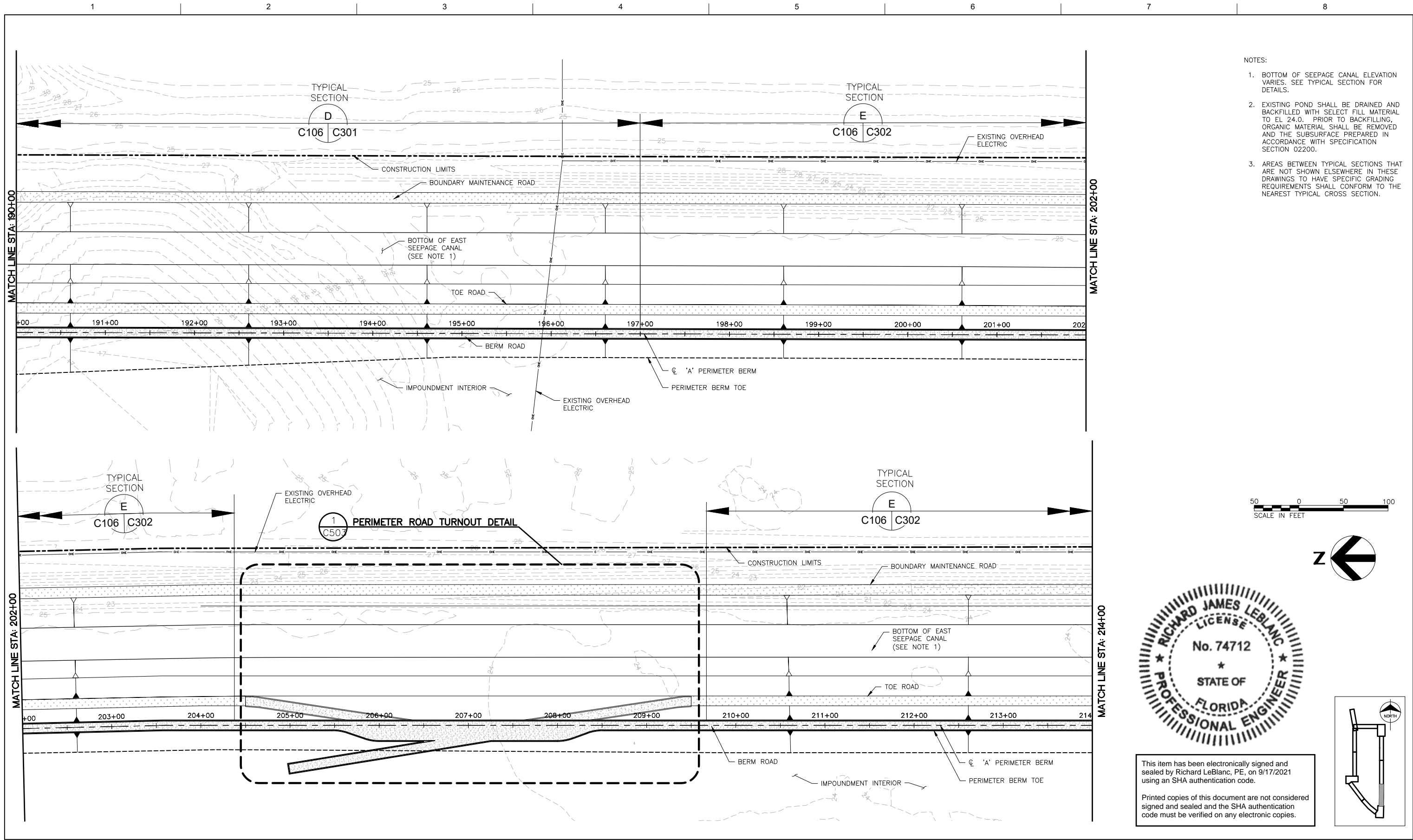
**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**
 FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399



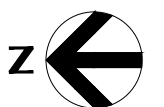
**CIVIL
 SITE PLAN (4 OF 12)**

SHEET 22 of 92
 SCALE 1" = 50'

DRAWING
C105



- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. EXISTING POND SHALL BE DRAINED AND BACKFILLED WITH SELECT FILL MATERIAL TO EL 24.0. PRIOR TO BACKFILLING, ORGANIC MATERIAL SHALL BE REMOVED AND THE SUBSURFACE PREPARED IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
 3. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.



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4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

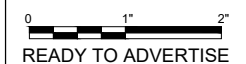
PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL SITE PLAN (5 OF 12)



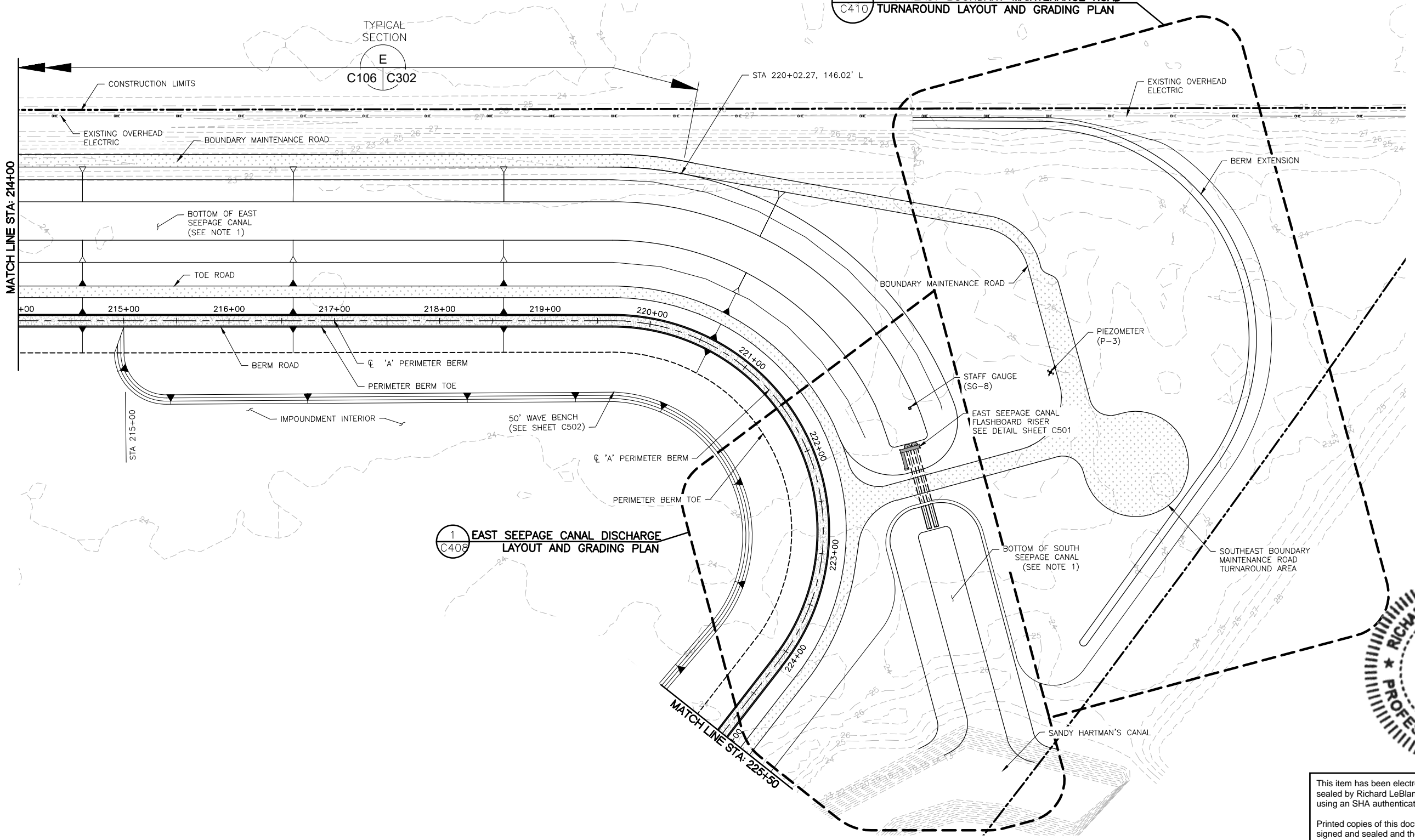
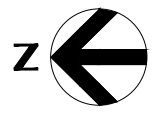
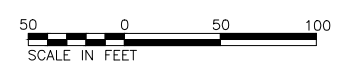
SHEET 23 of 92
SCALE 1" = 50'

DRAWING
C106

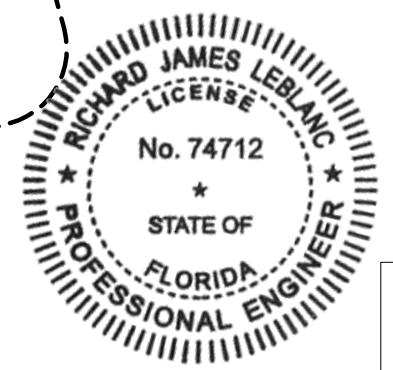
2
C410 SOUTHEAST BOUNDARY MAINTENANCE ROAD
TURNAROUND LAYOUT AND GRADING PLAN

TYPICAL SECTION
E
C106 C302

- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.

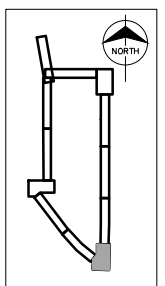


1
C408 EAST SEEPAGE CANAL DISCHARGE
LAYOUT AND GRADING PLAN



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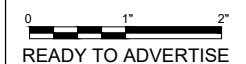
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

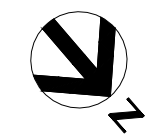
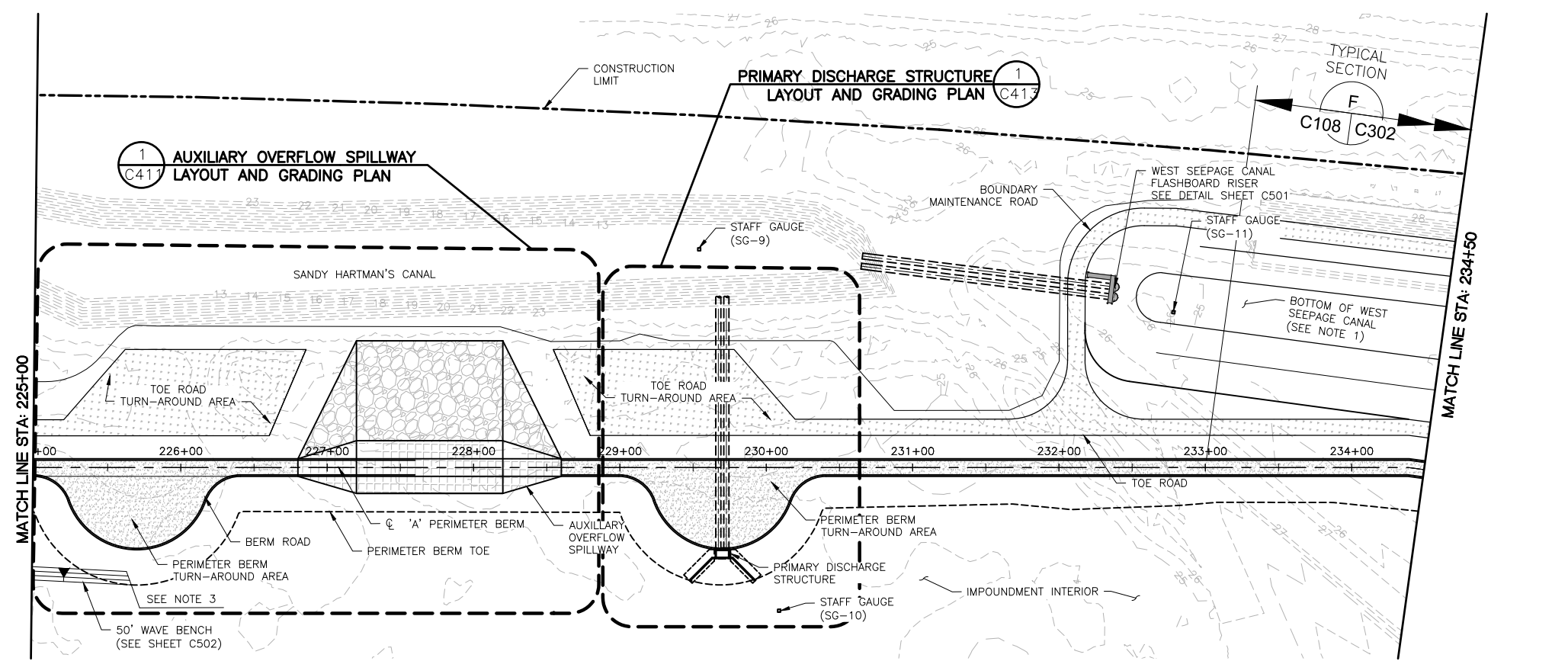
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399



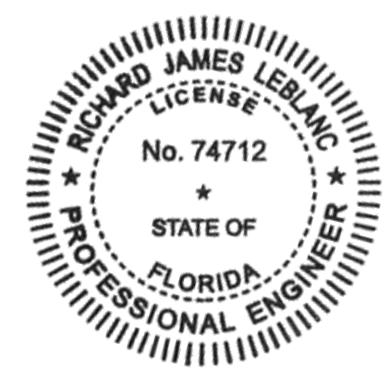
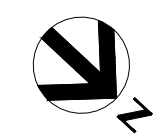
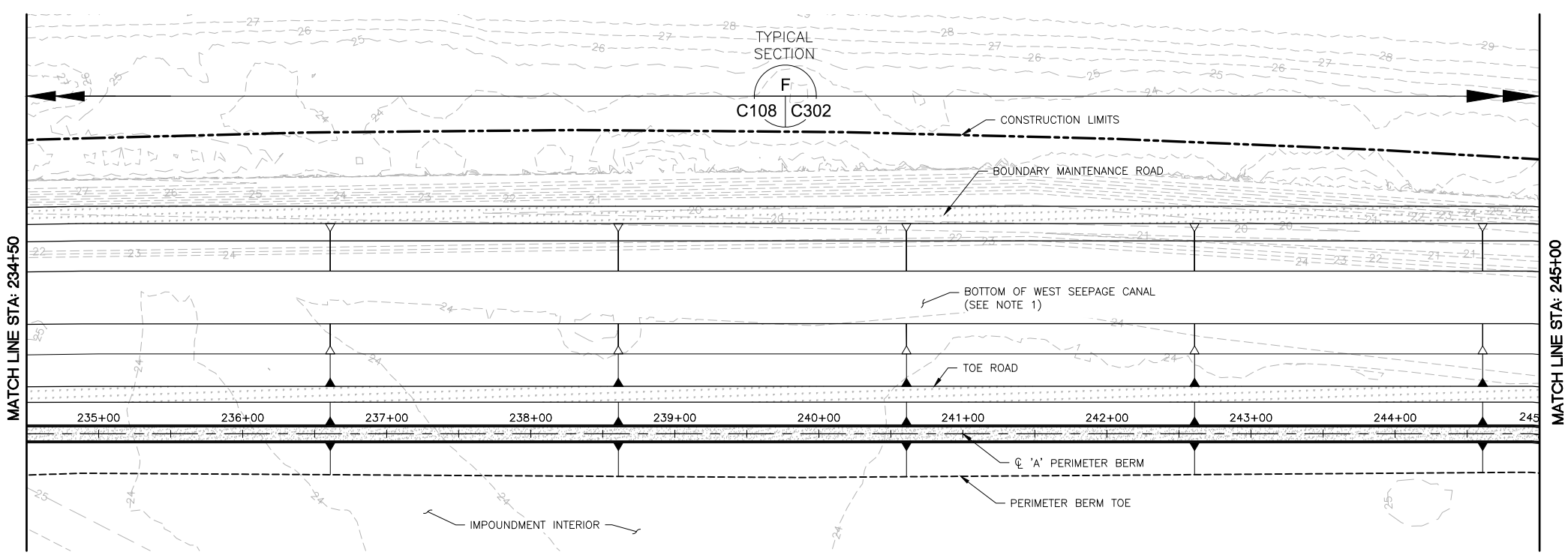
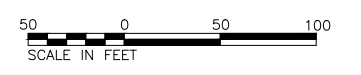
**CIVIL
SITE PLAN (6 OF 12)**

SHEET 24 of 92
SCALE 1" = 50'

DRAWING
C107

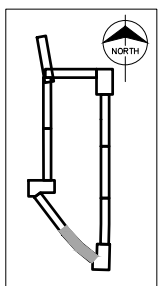


- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.
 3. TERMINATE 50' WAVE BENCH INTO SLOPE OF THE PERIMETER BERM TURN-AROUND AREA. GRADING SHALL BE SMOOTHED TO PREVENT FORMATION OF A GROIN AT THE INTERFACE.



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ISSUE	DATE	DESCRIPTION

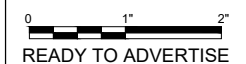
PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

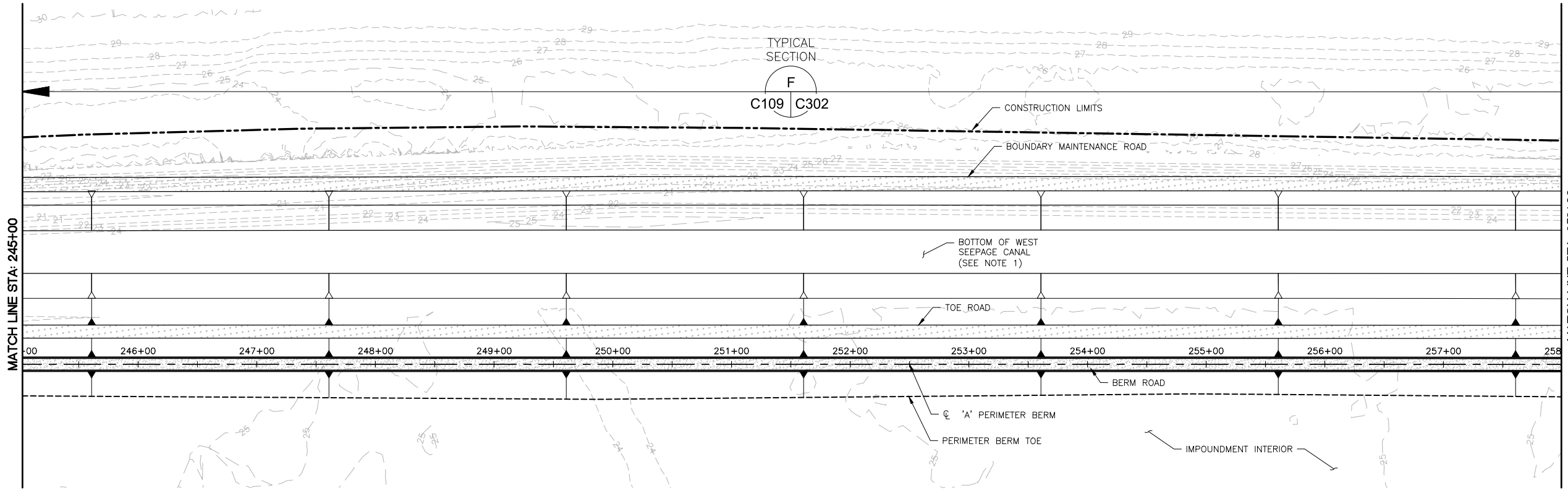
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

CIVIL SITE PLAN (7 OF 12)

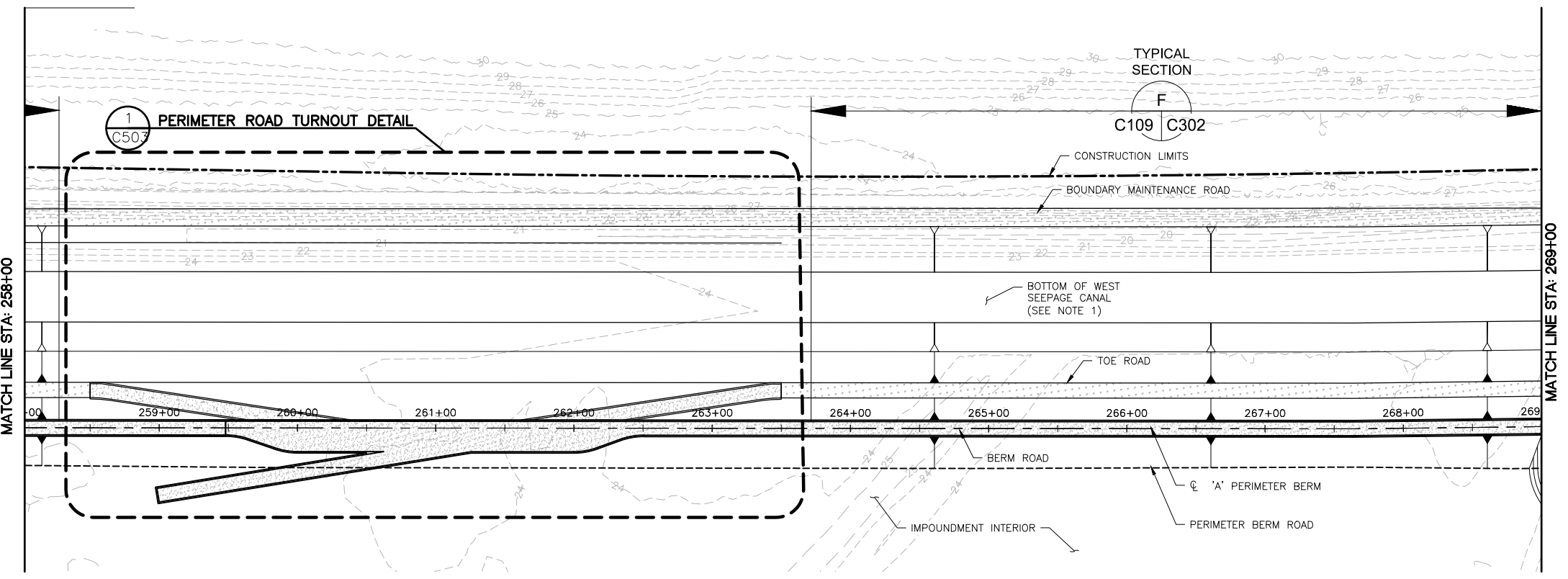
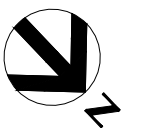


SHEET 25 of 92
 SCALE 1" = 50'

DRAWING
C108

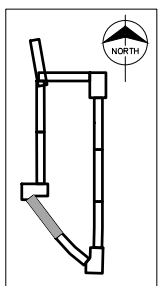


- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.



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ISSUE	DATE	DESCRIPTION

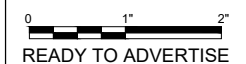
PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**

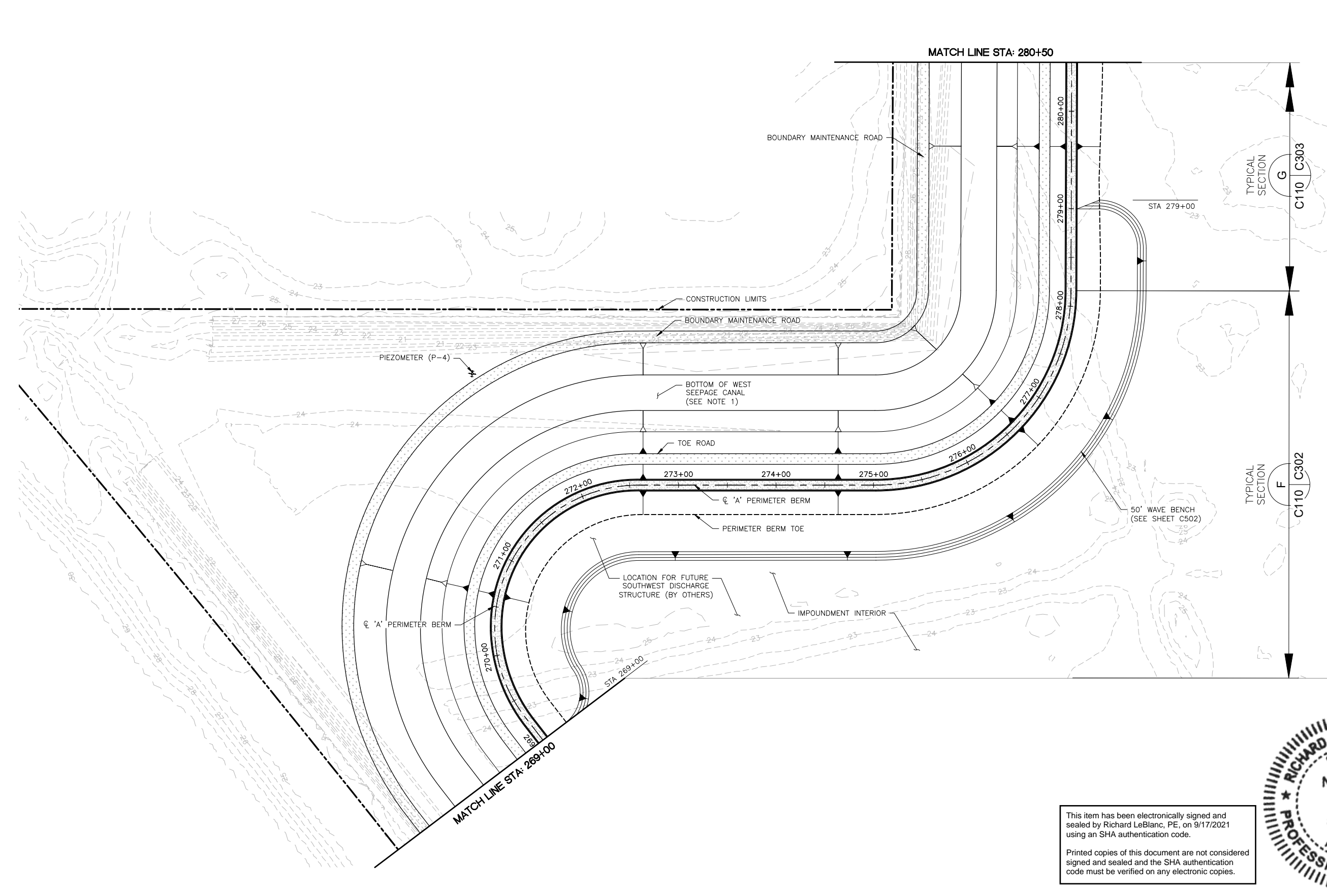
FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

**CIVIL
 SITE PLAN (8 OF 12)**

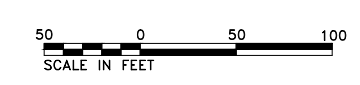


SHEET 26 of 92
 SCALE 1" = 50'

DRAWING
C109

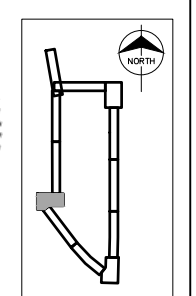
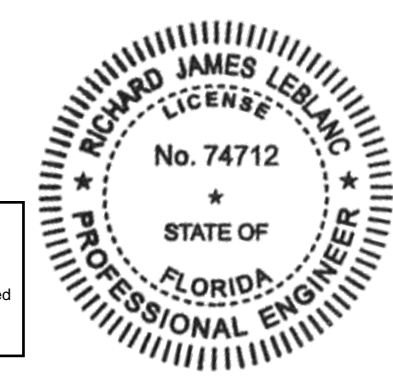


- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.



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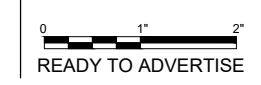
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
ELECTRICAL ENGINEER	JORGE PLASENCIA, P.E.
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

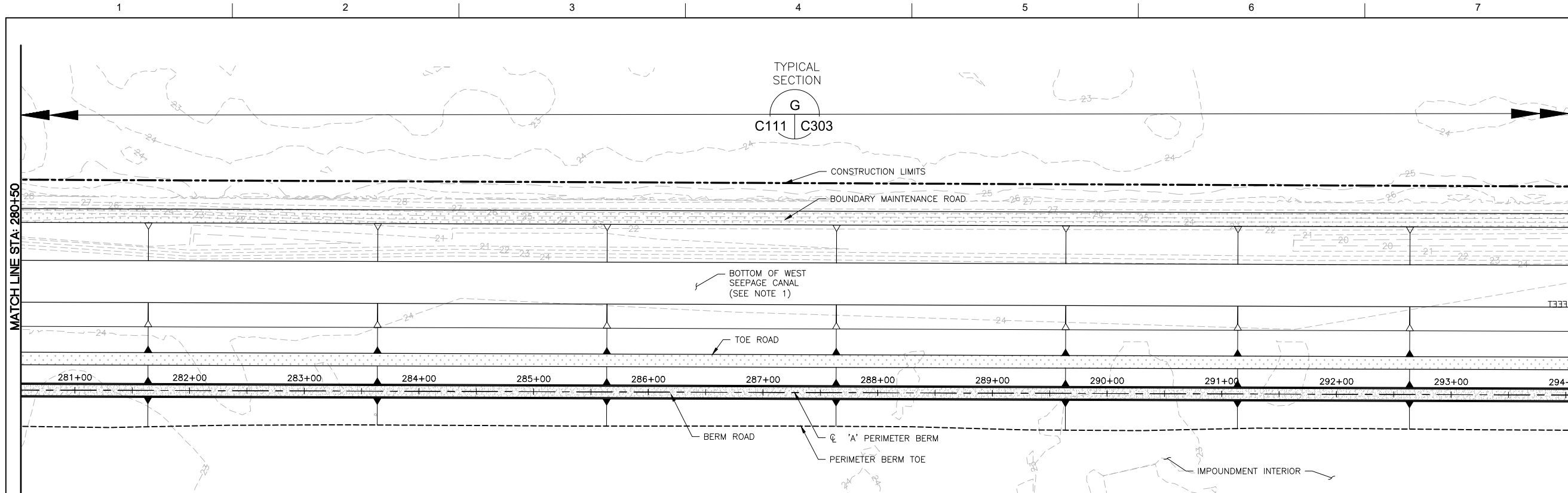
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399



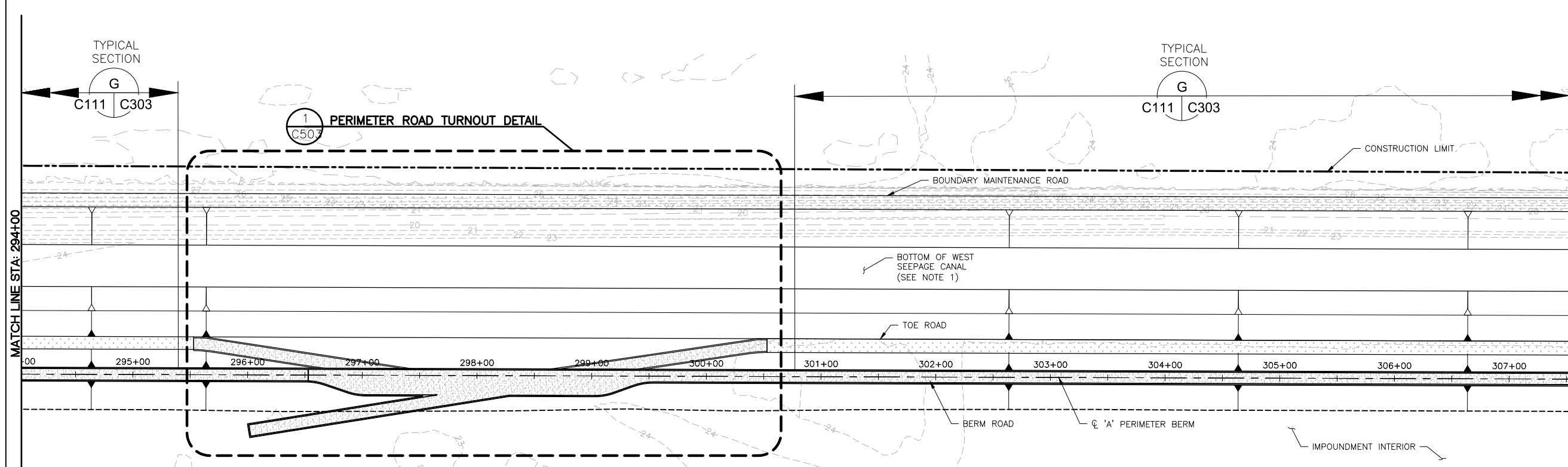
**CIVIL
SITE PLAN (9 OF 12)**

SHEET 27 of 92
SCALE 1"=50'

DRAWING
C110

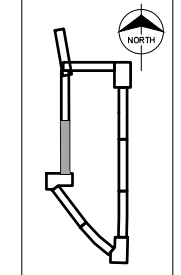
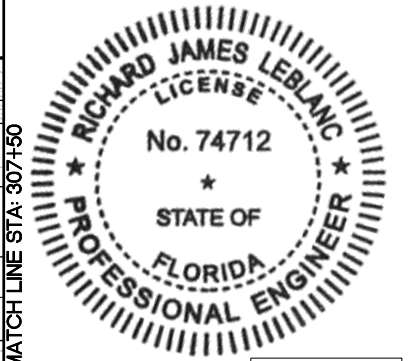


- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.



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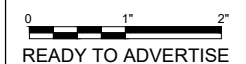
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**

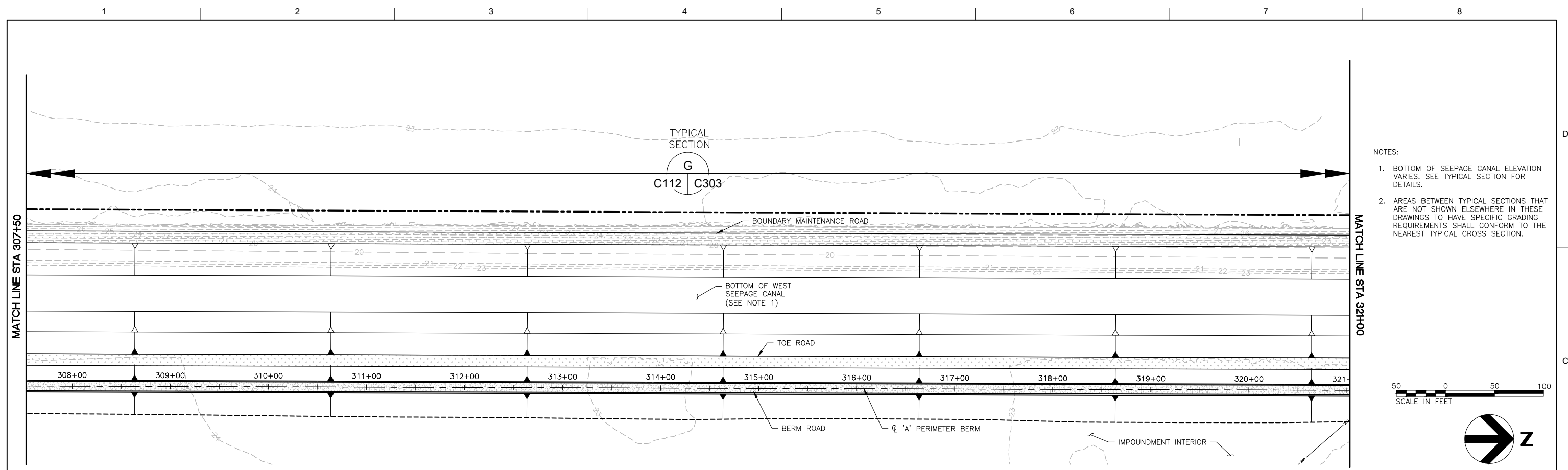
FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399



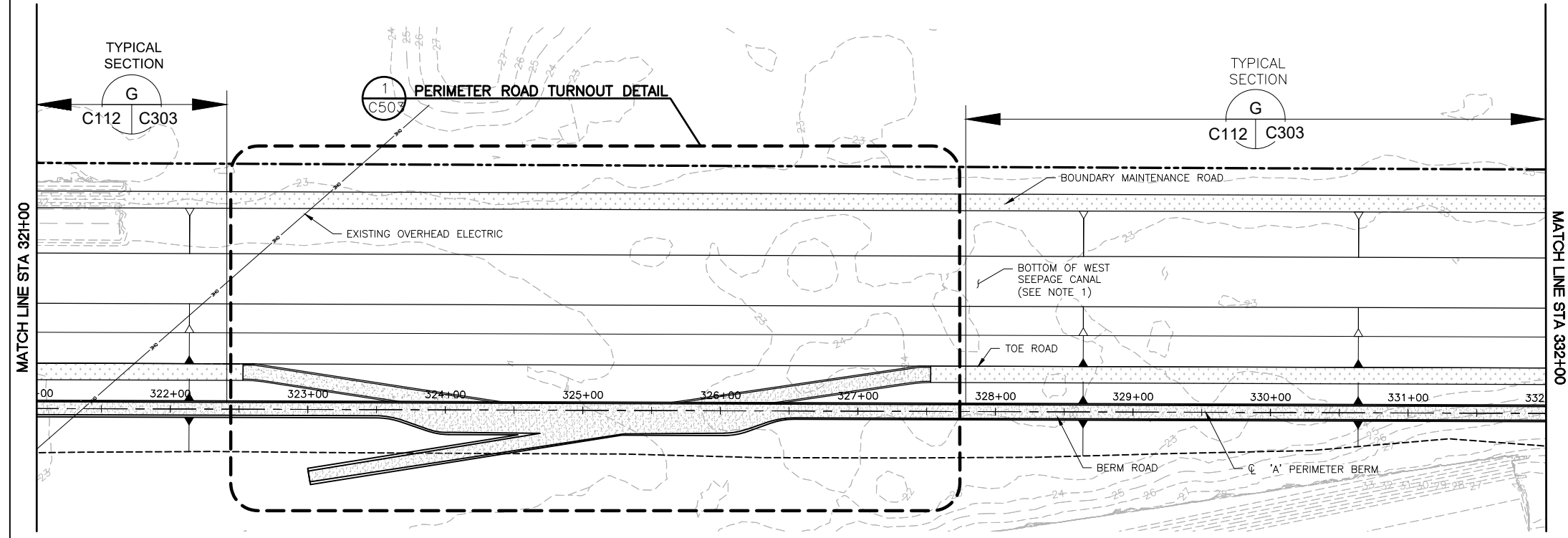
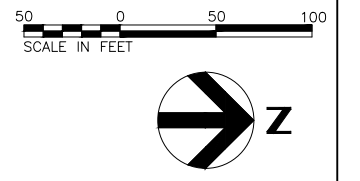
**CIVIL
 SITE PLAN (10 OF 12)**

SHEET 28 of 92
 SCALE 1"=50'

DRAWING
C111

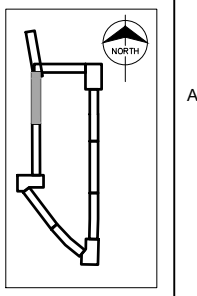


- NOTES:
1. BOTTOM OF SEEPAGE CANAL ELEVATION VARIES. SEE TYPICAL SECTION FOR DETAILS.
 2. AREAS BETWEEN TYPICAL SECTIONS THAT ARE NOT SHOWN ELSEWHERE IN THESE DRAWINGS TO HAVE SPECIFIC GRADING REQUIREMENTS SHALL CONFORM TO THE NEAREST TYPICAL CROSS SECTION.



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

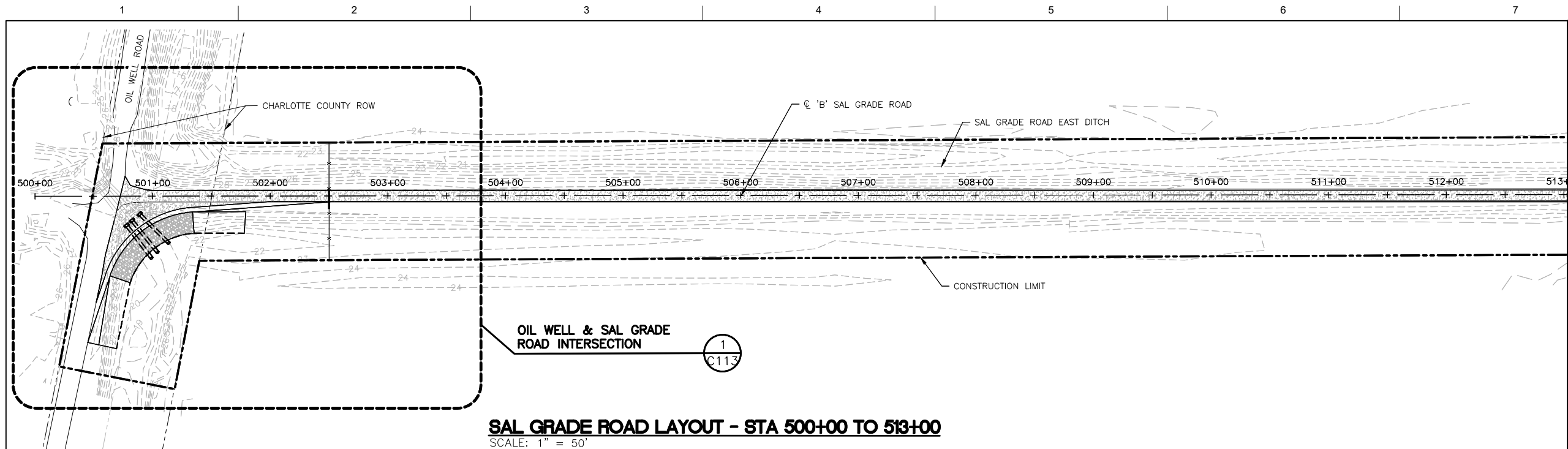
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
SITE PLAN (11 OF 12)**

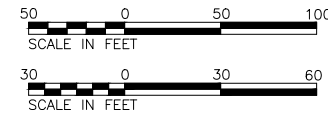
0 1" 2"
READY TO ADVERTISE

SHEET 29 of 92
SCALE 1"=50'

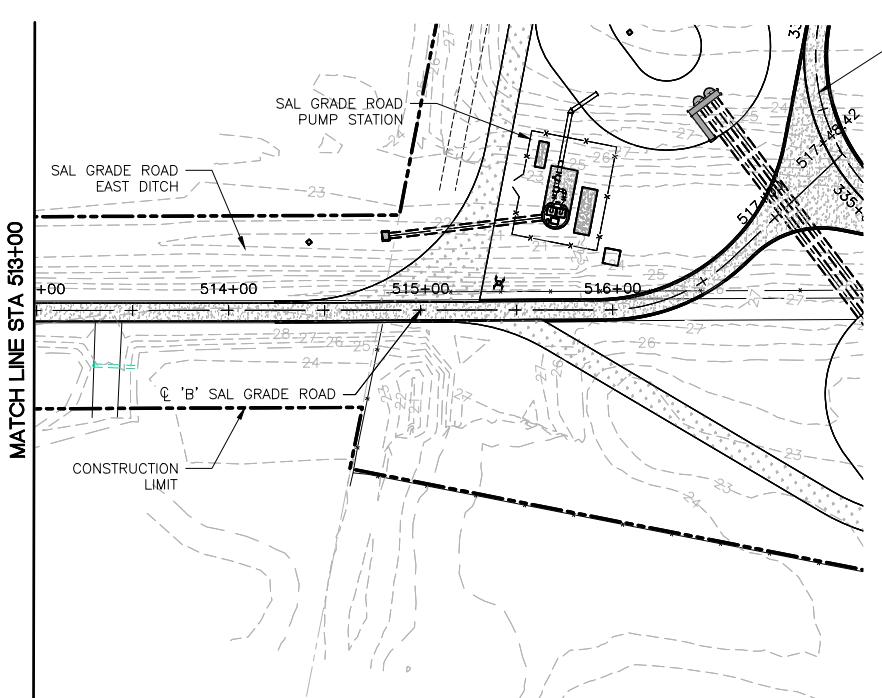
DRAWING
C112



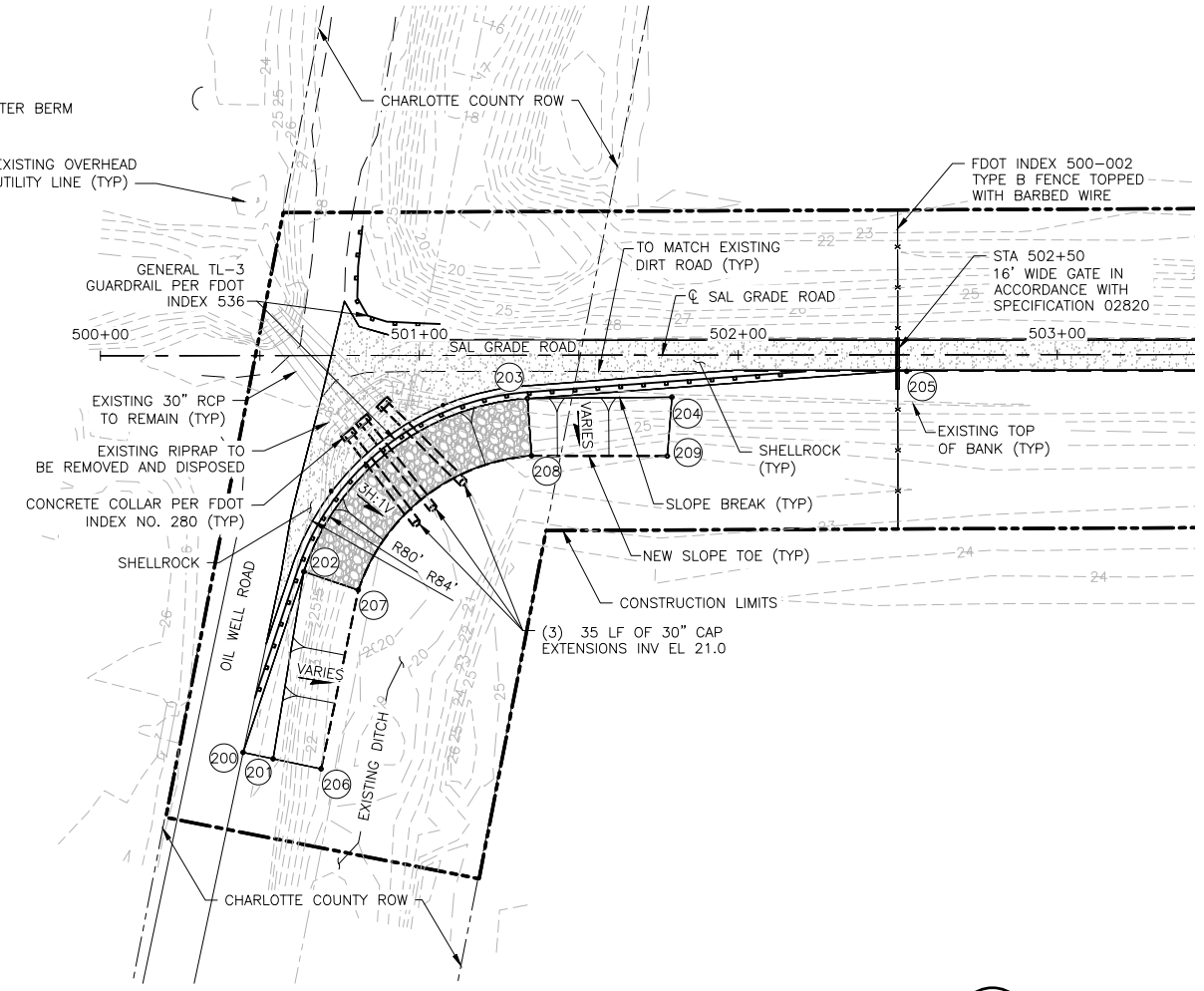
SAL GRADE ROAD LAYOUT - STA 500+00 TO 513+00
SCALE: 1" = 50'



- NOTES:
- CONTRACTOR IS RESPONSIBLE FOR MAINTENANCE OF TRAFFIC ON OIL WELL ROAD.
 - SLOPE DEFINED BY POINTS NO. 202, 203, 207 AND 208 IS TO BE CONSTRUCTED AT 3H:1V AND TO BE PROTECTED WITH RIPRAP TYPE B IN ACCORDANCE WITH DETAIL SHOWN ON DRAWING C502.
 - SLOPE DEFINED BY POINTS NO. 201, 202, 206 AND 207 VARIES FROM 3H:1V TO MATCH EXISTING GRADES.
 - SLOPE DEFINED BY POINTS NO. 203, 204, 208 AND 209 VARIES FROM 3H:1V TO MATCH EXISTING GRADES.



SAL GRADE ROAD LAYOUT - STA 513+00 TO 517+48.42
SCALE: 1" = 50'



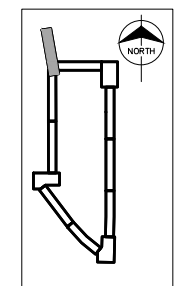
OIL WELL ROAD/SAL GRADE ROAD INTERSECTION
SCALE: 1" = 30'

OIL WELL/SAL GRADE ROAD INTERSECTION				
POINT #	STATION	OFFSET	EL	DESCRIPTION
200	500+44.62	124.37' R	27.13'	EDGE OF EXISTING ROAD
201	500+54	126.41' R	28.08'	DITCH TOP OF BANK
202	500+63.73	67.77' R	27.00'	DITCH TOP OF BANK
203	501+33.90	13.56' R	27.00'	DITCH TOP OF BANK
204	501+79.18	13.21' R	28.09'	DITCH TOP OF BANK
205	502+52.87	5.17' R	27.80'	EDGE OF EXISTING ROAD
206	500+69.07	129.58' R	21.05'	DITCH TOE OF BANK
207	500+80.79	73.53' R	21.00'	DITCH TOE OF BANK
208	501+35.17	31.51' R	21.00'	DITCH TOE OF BANK
209	501+77.74	31.63' R	22.00'	DITCH TOE OF BANK



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
SITE PLAN (12 OF 12)**

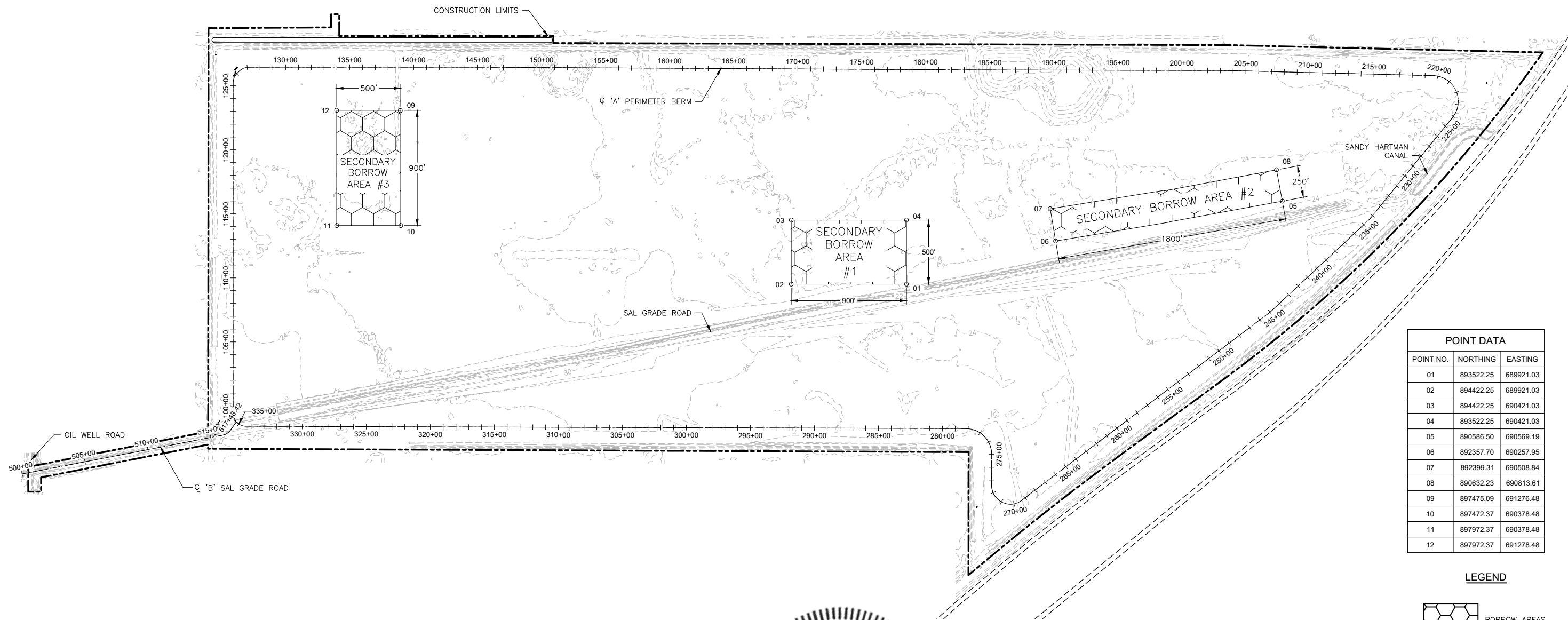
0 1" 2"
READY TO ADVERTISE

SHEET 30 of 92
SCALE 1"=50'

DRAWING
C113



- NOTES:
- EXCAVATION OF SEEPAGE CANALS SHALL SERVE AS THE PRIMARY SOURCE OF BORROW.
 - BORROW WITHIN THE SECONDARY BORROW LIMITS IS RESTRICTED TO THE THREE BORROW AREAS SHOWN ON THIS SHEET. ADDITIONAL BORROW AREAS MAY ONLY BE AUTHORIZED BY FWC IN WRITING.
 - BORROW WITHIN THE SECONDARY BORROW LIMITS SHALL NOT EXCEED 8 FEET IN DEPTH.
 - IF LIMESTONE IS ENCOUNTERED WITHIN THE SECONDARY BORROW LIMITS, THE CONTRACTOR SHOULD BE PREPARED WITH DEWATERING EQUIPMENT TO QUICKLY ADDRESS FLOWING GROUNDWATER INTO THE EXCAVATION.



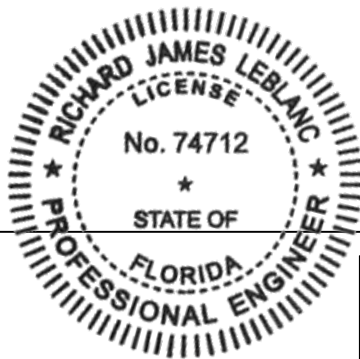
POINT DATA		
POINT NO.	NORTHING	EASTING
01	893522.25	689921.03
02	894422.25	689921.03
03	894422.25	690421.03
04	893522.25	690421.03
05	890586.50	690569.19
06	892357.70	690257.95
07	892399.31	690508.84
08	890632.23	690813.61
09	897475.09	691276.48
10	897472.37	690378.48
11	897972.37	690378.48
12	897972.37	691278.48

LEGEND

	BORROW AREAS
--	--------------

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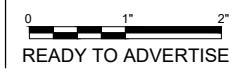


RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL BORROW MANAGEMENT PLAN



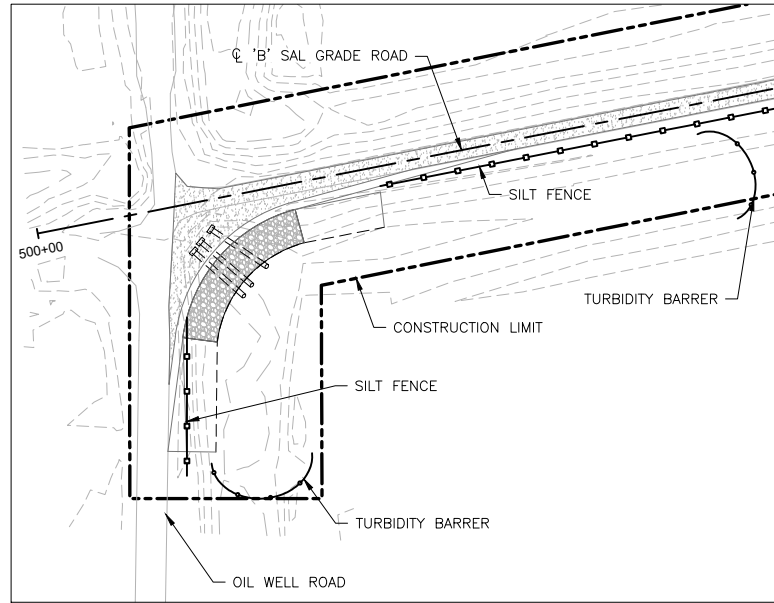
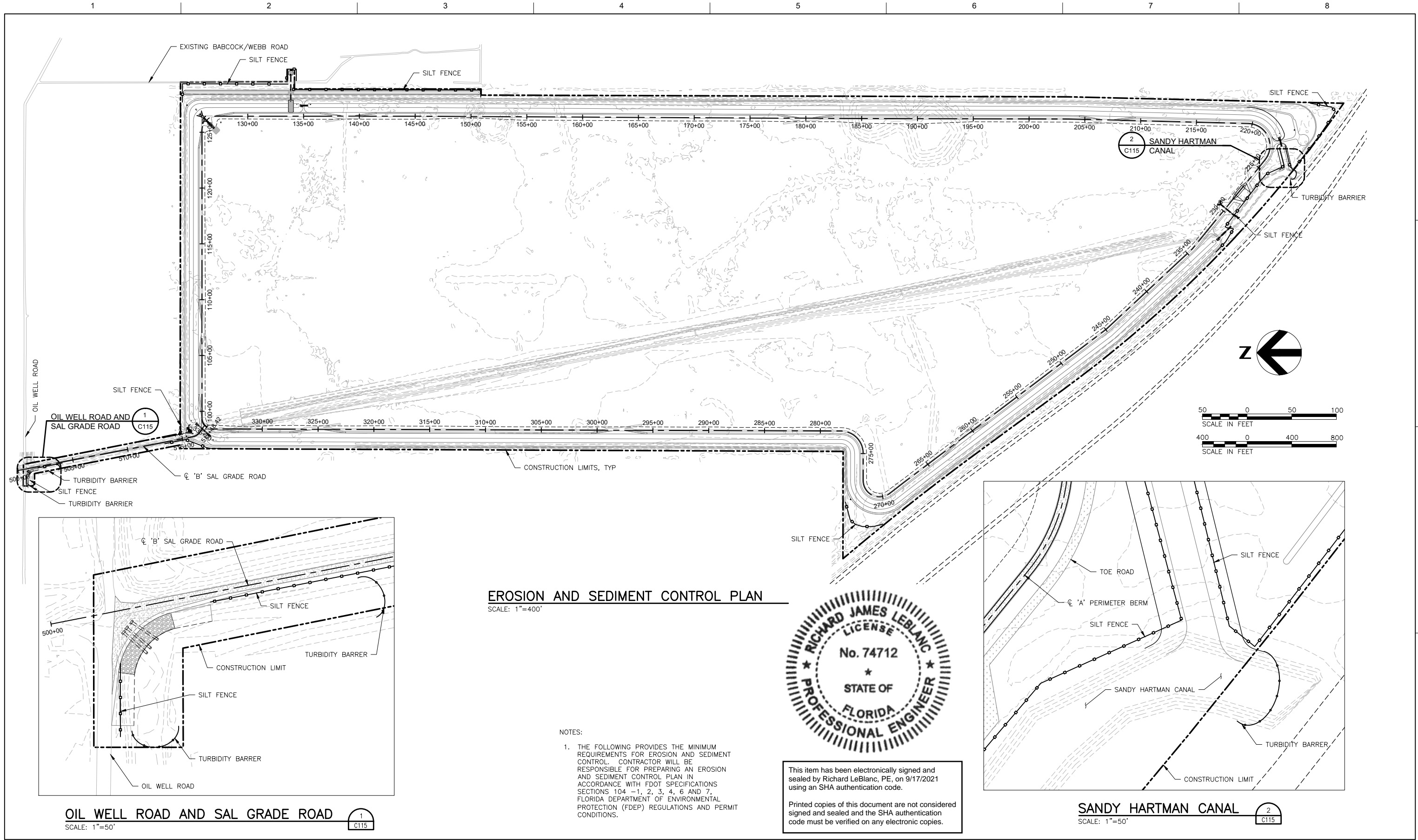
SHEET 31 of 92
SCALE 1" = 400'

DRAWING
C114



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267



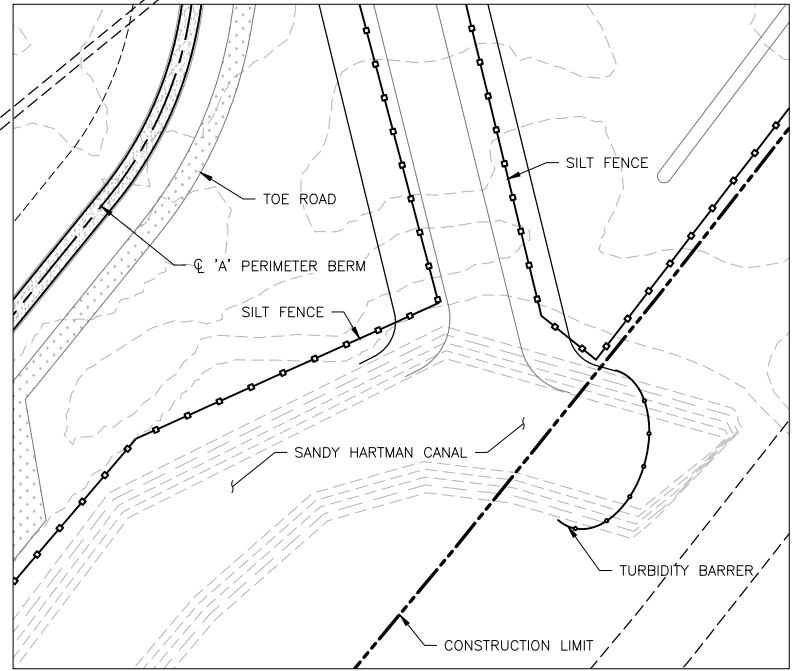
OIL WELL ROAD AND SAL GRADE ROAD
SCALE: 1"=50'
C115

EROSION AND SEDIMENT CONTROL PLAN
SCALE: 1"=400'



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- NOTES:
1. THE FOLLOWING PROVIDES THE MINIMUM REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL. CONTRACTOR WILL BE RESPONSIBLE FOR PREPARING AN EROSION AND SEDIMENT CONTROL PLAN IN ACCORDANCE WITH FDOT SPECIFICATIONS SECTIONS 104-1, 2, 3, 4, 6 AND 7, FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP) REGULATIONS AND PERMIT CONDITIONS.



SANDY HARTMAN CANAL
SCALE: 1"=50'
C115



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

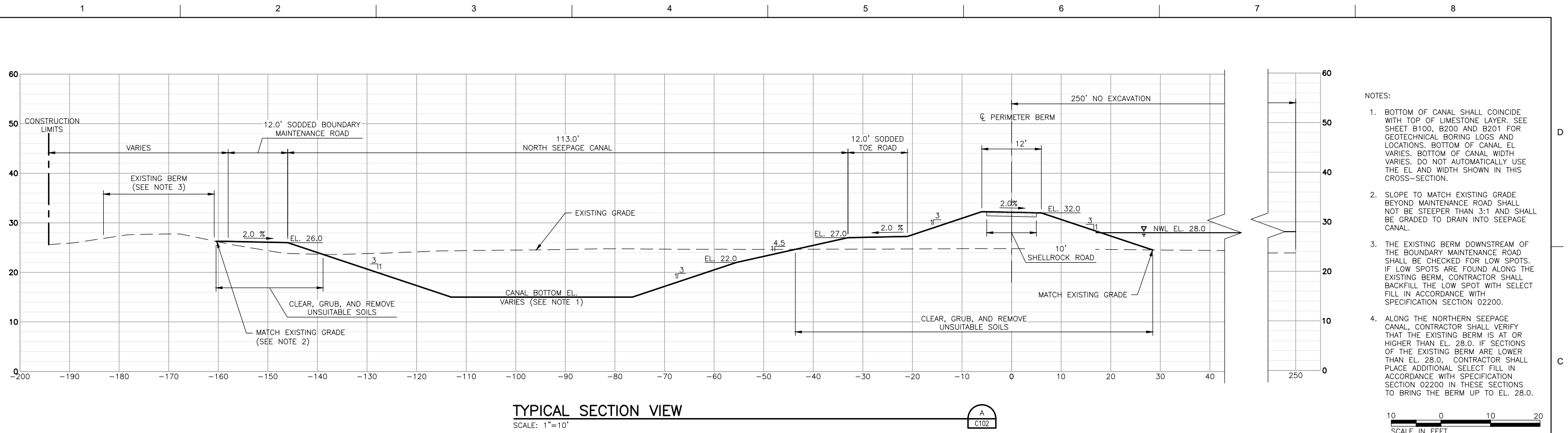
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL EROSION AND SEDIMENT CONTROL PLAN

0 1" 2"
READY TO ADVERTISE

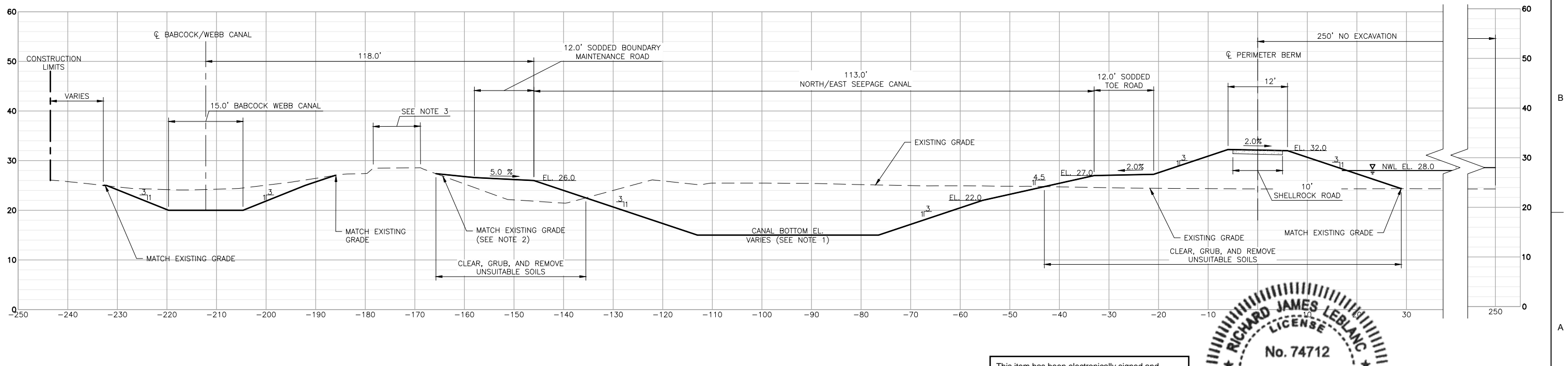
SHEET 32 of 92
SCALE 1"=400'

DRAWING **C115**



TYPICAL SECTION VIEW
SCALE: 1"=10'

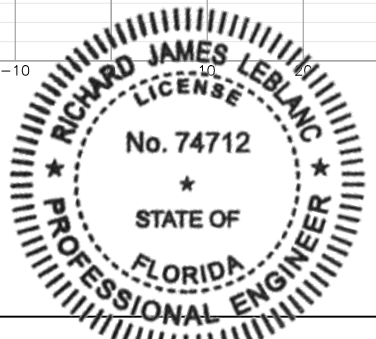
- NOTES:
1. BOTTOM OF CANAL SHALL COINCIDE WITH TOP OF LIMESTONE LAYER. SEE SHEET B100, B200 AND B201 FOR GEOTECHNICAL BORING LOGS AND LOCATIONS. BOTTOM OF CANAL EL VARIES. BOTTOM OF CANAL WIDTH VARIES. DO NOT AUTOMATICALLY USE THE EL AND WIDTH SHOWN IN THIS CROSS-SECTION.
 2. SLOPE TO MATCH EXISTING GRADE BEYOND MAINTENANCE ROAD SHALL NOT BE STEEPER THAN 3:1 AND SHALL BE GRADED TO DRAIN INTO SEEPAGE CANAL.
 3. THE EXISTING BERM DOWNSTREAM OF THE BOUNDARY MAINTENANCE ROAD SHALL BE CHECKED FOR LOW SPOTS. IF LOW SPOTS ARE FOUND ALONG THE EXISTING BERM, CONTRACTOR SHALL BACKFILL THE LOW SPOT WITH SELECT FILL IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
 4. ALONG THE NORTHERN SEEPAGE CANAL CONTRACTOR SHALL VERIFY THAT THE EXISTING BERM IS AT OR HIGHER THAN EL. 28.0. IF SECTIONS OF THE EXISTING BERM ARE LOWER THAN EL. 28.0, CONTRACTOR SHALL PLACE ADDITIONAL SELECT FILL IN ACCORDANCE WITH SPECIFICATION SECTION 02200 IN THESE SECTIONS TO BRING THE BERM UP TO EL. 28.0.



TYPICAL SECTION VIEW
SCALE: 1"=10'

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ISSUE	DATE	DESCRIPTION

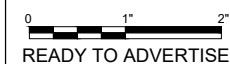
PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION

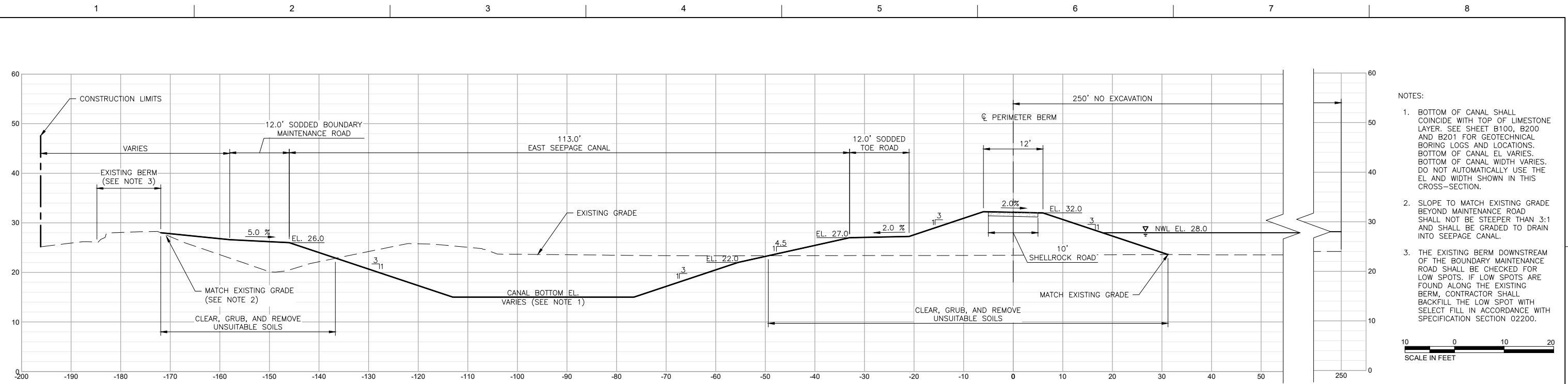
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399



**CIVIL
TYPICAL SECTIONS (1 OF 4)**

SHEET 33 of 92
SCALE 1"=10'

DRAWING
C300

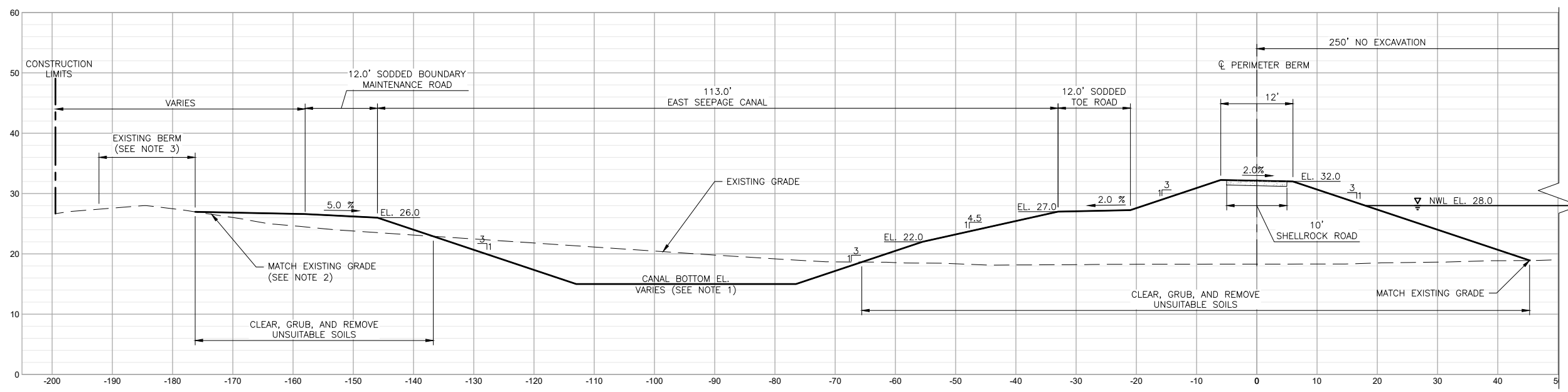


TYPICAL SECTION VIEW

SCALE: 1"=10'



- NOTES:
1. BOTTOM OF CANAL SHALL COINCIDE WITH TOP OF LIMESTONE LAYER. SEE SHEET B100, B200 AND B201 FOR GEOTECHNICAL BORING LOGS AND LOCATIONS. BOTTOM OF CANAL WIDTH VARIES. BOTTOM OF CANAL EL VARIES. DO NOT AUTOMATICALLY USE THE EL AND WIDTH SHOWN IN THIS CROSS-SECTION.
 2. SLOPE TO MATCH EXISTING GRADE BEYOND MAINTENANCE ROAD SHALL NOT BE STEEPER THAN 3:1 AND SHALL BE GRADED TO DRAIN INTO SEEPAGE CANAL.
 3. THE EXISTING BERM DOWNSTREAM OF THE BOUNDARY MAINTENANCE ROAD SHALL BE CHECKED FOR LOW SPOTS. IF LOW SPOTS ARE FOUND ALONG THE EXISTING BERM, CONTRACTOR SHALL BACKFILL THE LOW SPOT WITH SELECT FILL IN ACCORDANCE WITH SPECIFICATION SECTION 02200.



TYPICAL SECTION VIEW

SCALE: 1"=10'



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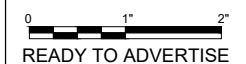
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

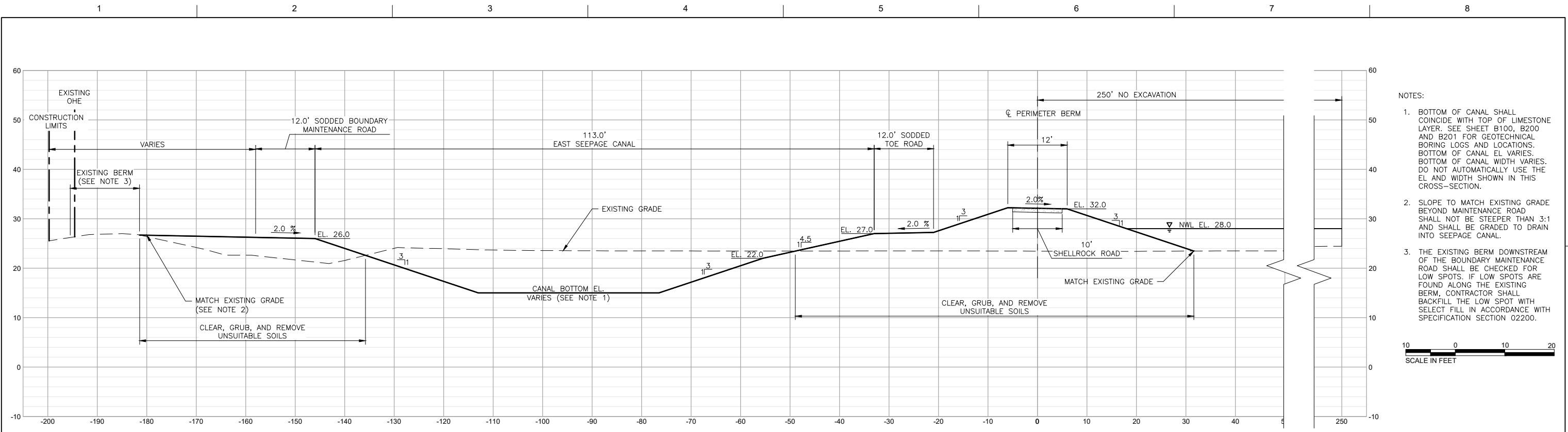
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399



**CIVIL
TYPICAL SECTIONS (2 OF 4)**

SHEET 34 of 92
SCALE 1"=10'

DRAWING
C301

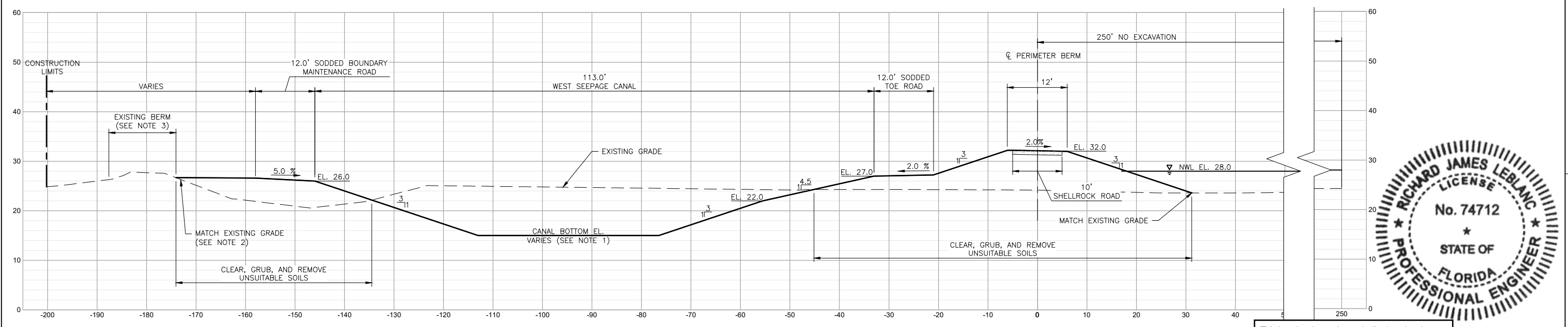


TYPICAL SECTION VIEW

SCALE: 1"=10'

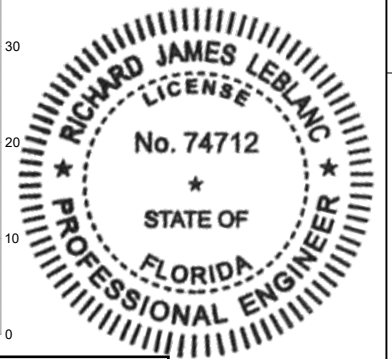


- NOTES:
1. BOTTOM OF CANAL SHALL COINCIDE WITH TOP OF LIMESTONE LAYER. SEE SHEET B100, B200 AND B201 FOR GEOTECHNICAL BORING LOGS AND LOCATIONS. BOTTOM OF CANAL EL VARIES. BOTTOM OF CANAL WIDTH VARIES. DO NOT AUTOMATICALLY USE THE EL AND WIDTH SHOWN IN THIS CROSS-SECTION.
 2. SLOPE TO MATCH EXISTING GRADE BEYOND MAINTENANCE ROAD SHALL NOT BE STEEPER THAN 3:1 AND SHALL BE GRADED TO DRAIN INTO SEEPAGE CANAL.
 3. THE EXISTING BERM DOWNSTREAM OF THE BOUNDARY MAINTENANCE ROAD SHALL BE CHECKED FOR LOW SPOTS. IF LOW SPOTS ARE FOUND ALONG THE EXISTING BERM, CONTRACTOR SHALL BACKFILL THE LOW SPOT WITH SELECT FILL IN ACCORDANCE WITH SPECIFICATION SECTION 02200.



TYPICAL SECTION VIEW

SCALE: 1"=10'



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

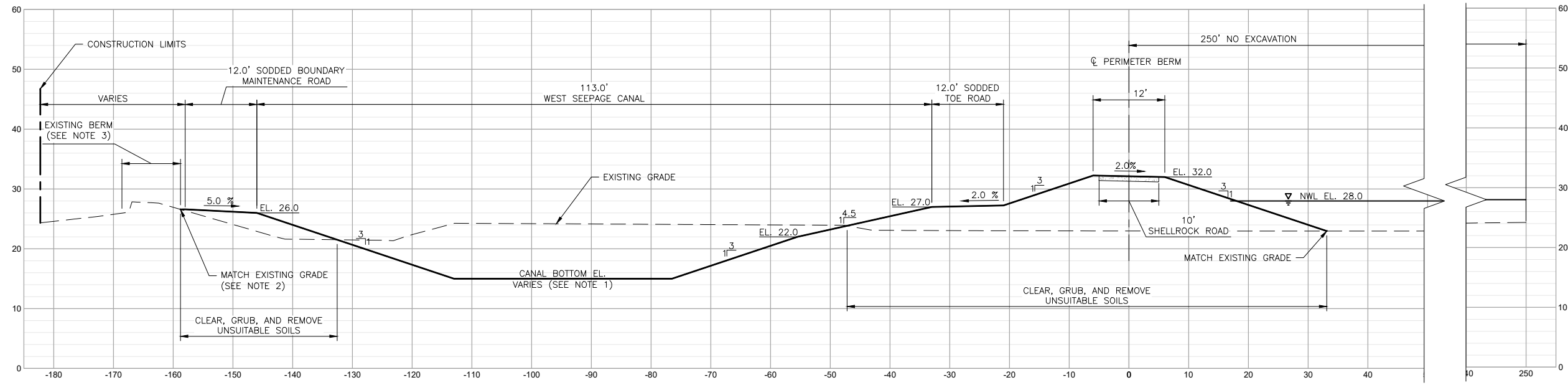
**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
TYPICAL SECTIONS (3 OF 4)**

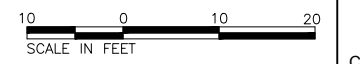
0 1" 2"
READY TO ADVERTISE

SHEET 35 of 92
SCALE 1"=10'

DRAWING
C302



- NOTES:
1. BOTTOM OF CANAL SHALL COINCIDE WITH TOP OF LIMESTONE LAYER. SEE SHEET B100, B200 AND B201 FOR GEOTECHNICAL BORING LOGS AND LOCATIONS. BOTTOM OF CANAL EL VARIES. BOTTOM OF CANAL WIDTH VARIES. DO NOT AUTOMATICALLY USE THE EL AND WIDTH SHOWN IN THIS CROSS-SECTION.
 2. SLOPE TO MATCH EXISTING GRADE BEYOND MAINTENANCE ROAD SHALL NOT BE STEEPER THAN 3:1 AND SHALL BE GRADED TO DRAIN INTO SEEPAGE CANAL.
 3. THE EXISTING BERM DOWNSTREAM OF THE BOUNDARY MAINTENANCE ROAD SHALL BE CHECKED FOR LOW SPOTS. IF LOW SPOTS ARE FOUND ALONG THE EXISTING BERM, CONTRACTOR SHALL BACKFILL THE LOW SPOT WITH SELECT FILL IN ACCORDANCE WITH SPECIFICATION SECTION 02200.



TYPICAL SECTION VIEW
SCALE: 1"=10'



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE	
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

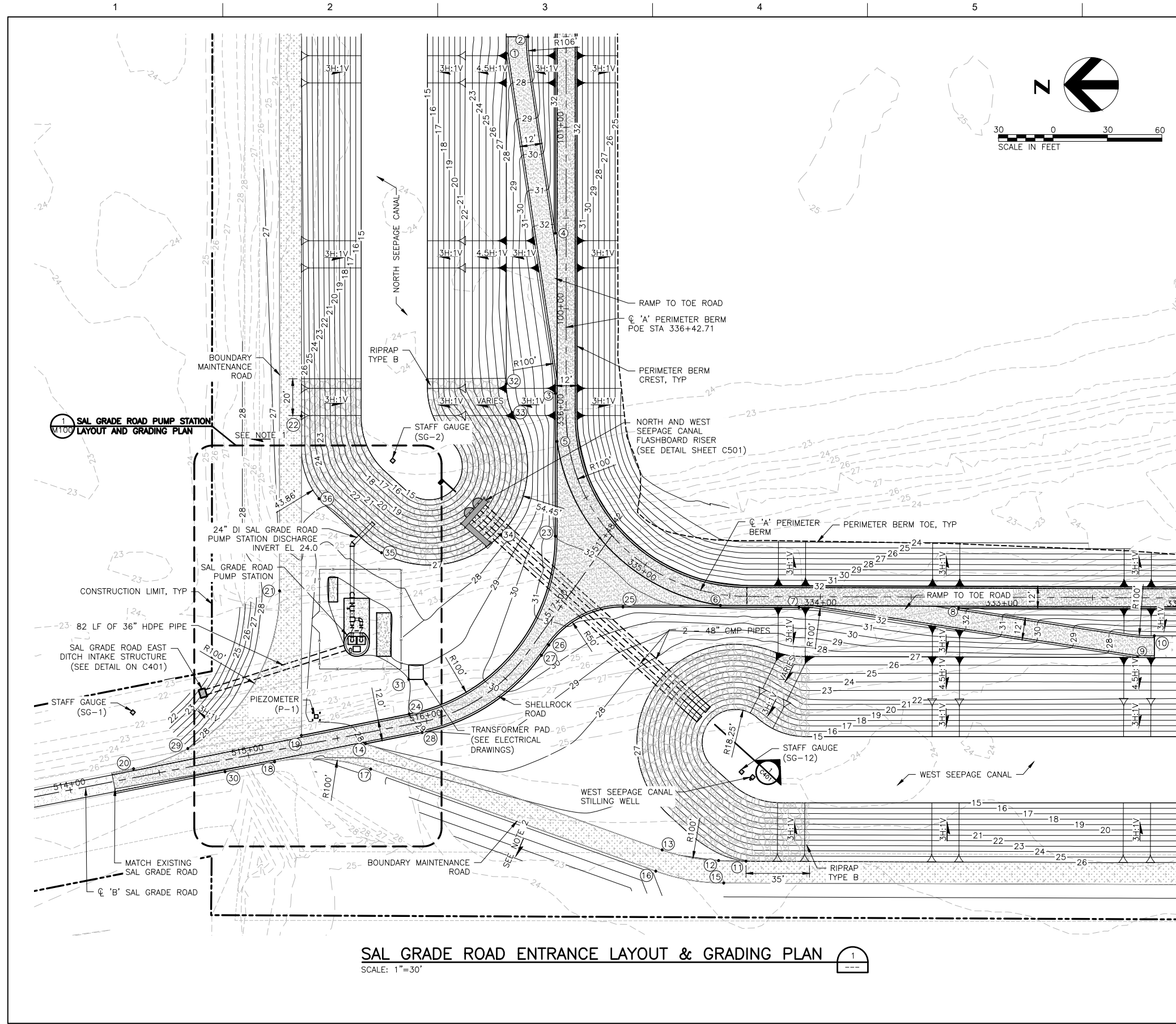
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
TYPICAL SECTIONS (4 OF 4)**

0 1" 2"
READY TO ADVERTISE

SHEET 36 of 92
SCALE 1"=10'

DRAWING
C303



SAL GRADE ROAD ENTRANCE POINTS				
POINT #	STATION	OFFSET	EL	DESCRIPTION
1	101+40.81	33.00 L	27.0	BOTTOM OF RAMP
2	101+50	21.00 L	27.2	BOTTOM OF RAMP
3	336+09.19	6.00 L	32.2	TOP OF RAMP
4	100+41.69	6.00 L	32.2	TOP OF RAMP
5	335+83.45	6.00 L	32.2	SHELLROCK ROAD
6	334+54.23	6.00 L	32.2	SHELLROCK ROAD
7	334+11.75	6.00 L	32.2	TOP OF RAMP
8	333+23.65	6.00 L	32.2	TOP OF RAMP
9	332+24.92	33.00 L	27.0	BOTTOM OF RAMP
10	332+15.73	21.00 L	27.2	BOTTOM OF RAMP
11	334+40.49	146.00 L	26.0	MAINTENANCE ROAD
12	334+46.62	146.13 L	26.0	MAINTENANCE ROAD PC
13	334+59.53	144.36 L	26.1	MAINTENANCE ROAD PT
14	335+26.15	177.78 L	28.0	MAINTENANCE ROAD
15	334+45.23	158.39 L	26.2	MAINTENANCE ROAD PC
16	334+59.98	156.52 L	26.2	MAINTENANCE ROAD PT
17	335+21.80	185.04 L	26.2	MAINTENANCE ROAD PC
18	335+33.96	223.35 L	27.5	MAINTENANCE ROAD PT
19	335+34.94	202.85 L	27.8	MAINTENANCE ROAD
20	335+44.95	290.67 L	27.8	MAINTENANCE ROAD PC
21	335+61.27	175.60 L	27.2	MAINTENANCE ROAD PT
22	335+97.01	146.00 L	26.6	MAINTENANCE ROAD
23	335+41.01	25.26 L	32.0	SHELLROCK ROAD PC
24	335+24.84	148.92 L	29.0	SHELLROCK ROAD PT
25	334+97.72	26.10 L	31.7	SHELLROCK ROAD PC
26	335+11.40	67.56 L	30.7	SHELLROCK ROAD PT
27	335+11.03	74.54 L	30.6	SHELLROCK ROAD PC
28	335+19.90	150.59 L	29.0	SHELLROCK ROAD PT
29	335+43.48	259.26 L	28.0	MAINTENANCE ROAD
30	335+37.31	248.80 L	28.0	SHELLROCK ROAD
31	335+30.97	136.90 L	29.0	TRANSFORMER PAD
32	336+14.41	33.00 L	27.0	TOP OF NORTH SEEPAGE CANAL
33	335+98.72	29.84 L	27.0	TOP OF NORTH SEEPAGE CANAL
34	335+52.13	51.42 L	27.0	TOP OF NORTH SEEPAGE CANAL
35	335+61.23	115.56 L	27.0	TOP OF NORTH SEEPAGE CANAL
36	335+77.93	140.73 L	26.9	TOP OF NORTH SEEPAGE CANAL

- NOTES:
1. ALONG THE NORTHERN SEEPAGE CANAL, CONTRACTOR SHALL VERIFY THAT THE EXISTING BERM IS AT OR HIGHER THAN EL 28.0. IF SECTIONS OF THE EXISTING BERM ARE LOWER THAN EL 28.0, IN A SIX INCH WIDE SECTION, CONTRACTOR SHALL PLACE ADDITIONAL SELECT FILL IN THESE SECTIONS TO BRING THE BERM UP TO EL 28.0.
 2. ALONG THE WESTERN SIDE OF THE BOUNDARY MAINTENANCE ROAD, GRADE TO DRAIN TO EXISTING CANAL.



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SAL GRADE ROAD ENTRANCE LAYOUT & GRADING PLAN
SCALE: 1"=30'



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

PROJECT NUMBER 10061267

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

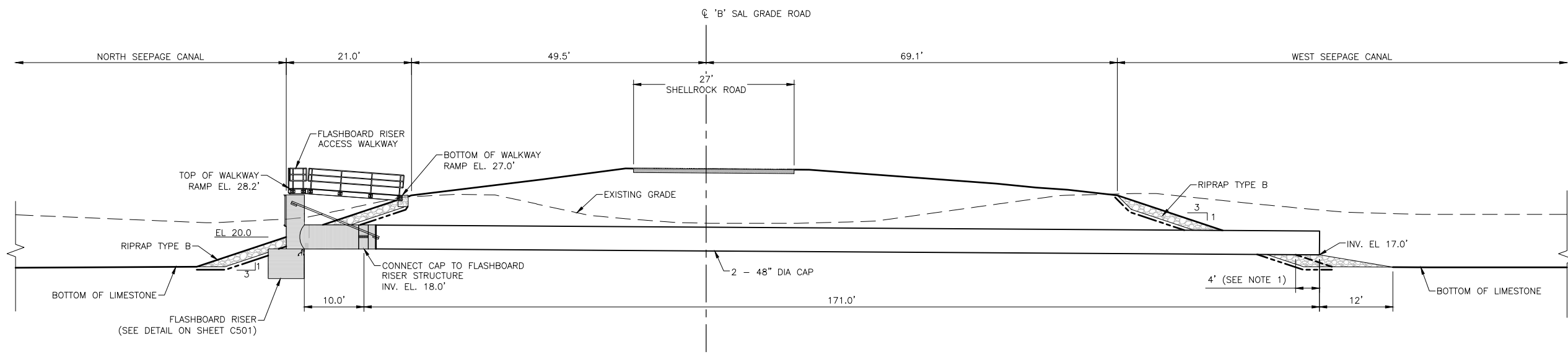
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL SAL GRADE ROAD SITE ENTRANCE LAYOUT AND GRADING PLAN

0 1" 2"
READY TO ADVERTISE

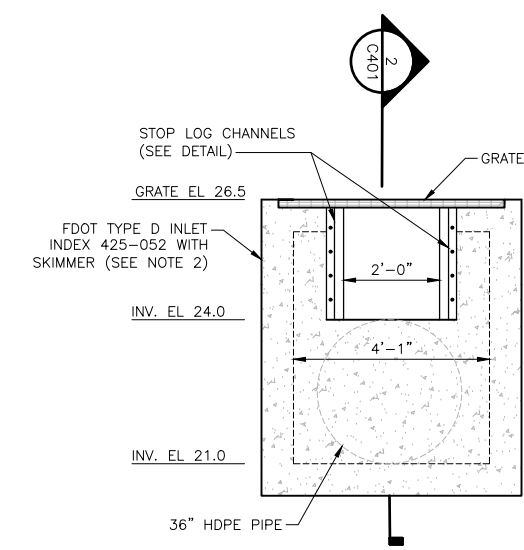
SHEET 37 of 92
SCALE 1" = 30'

DRAWING **C400**

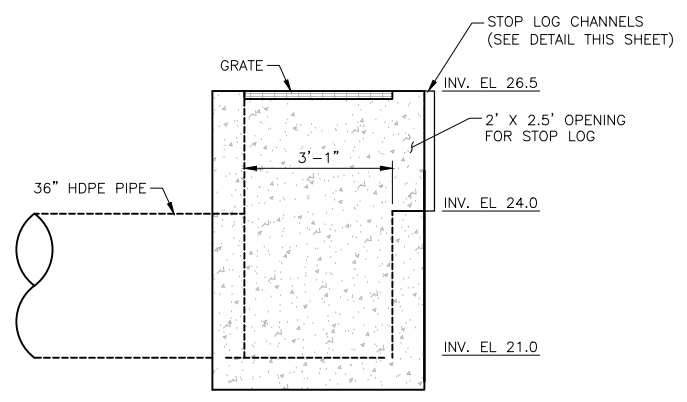


NORTH AND WEST SEEPAGE CANAL SECTION
SCALE: 1"=10'

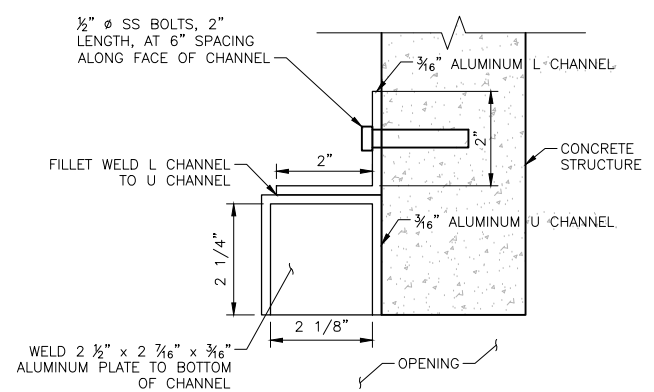
- NOTES:
1. PROVIDE 4' OF ADDITIONAL RIPRAP PROTECTION BENEATH PIPE EXTENSION FROM PROPOSED SLOPE. ADDITIONAL RIPRAP SHALL EXTEND TO THE TOP OF LIMESTONE AT A SLOPE NO STEEPER THAN 2H:1V.
 2. SKIMMER FOR TYPE D INLET SHALL BE 34" IN HEIGHT AND PER FDOT INDEX 425-070.



SAL GRADE ROAD EAST DITCH INTAKE STRUCTURE
NOT TO SCALE



INTAKE STRUCTURE SECTION
NOT TO SCALE



STOP LOG CHANNEL DETAIL
NOT TO SCALE



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

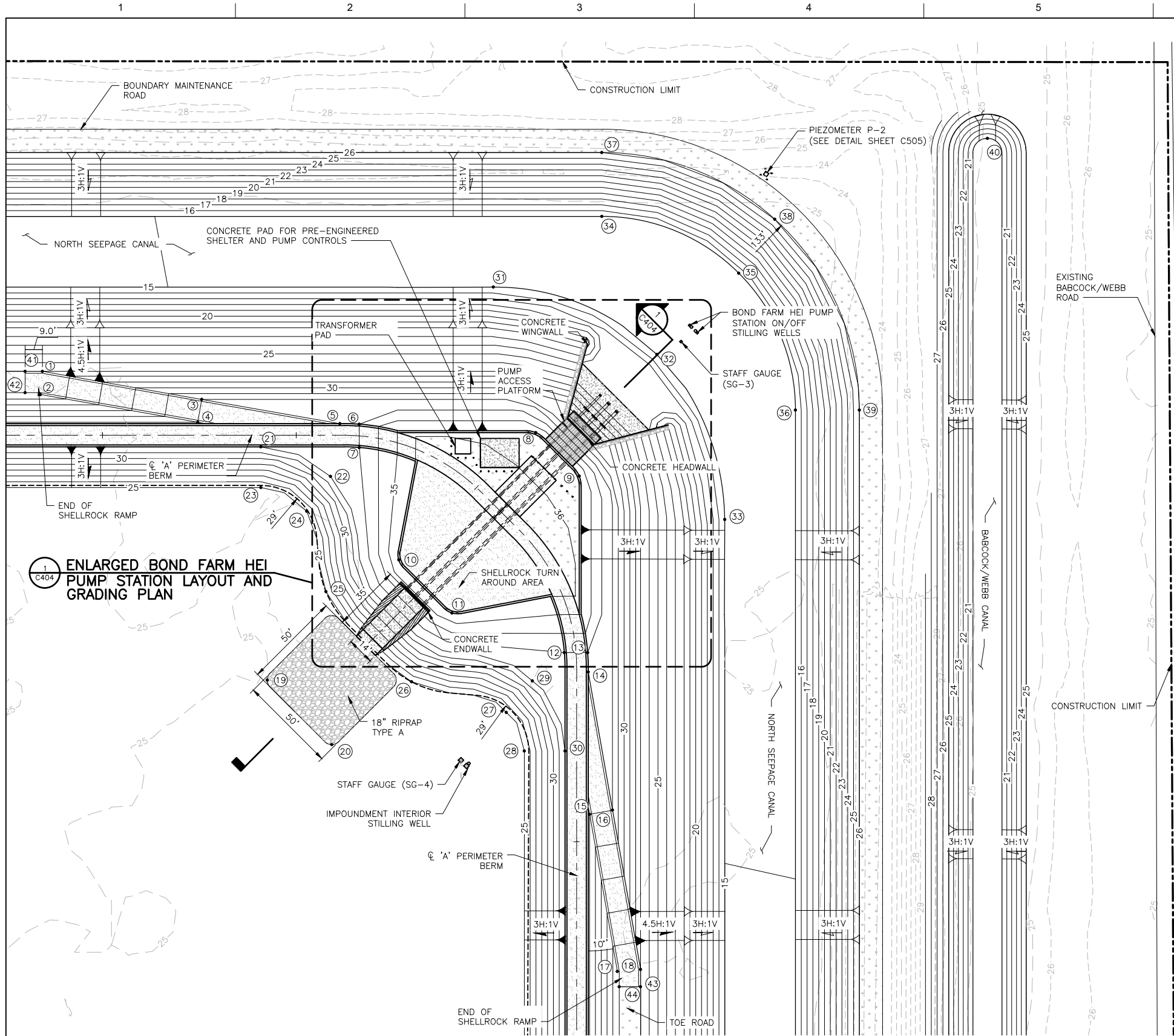
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL
NORTH AND WEST SEEPAGE CANAL SECTION AND SAL GRADE ROAD EAST DITCH INTAKE STRUCTURE

0 1 2
READY TO ADVERTISE

SHEET 38 of 92
SCALE 1" = 10'

DRAWING **C401**



PUMP STATION POINTS				
POINT #	STATION	OFFSET	EL	DESCRIPTION
1	123+68.95	33.00 L	27.00	NORTH RAMP
2	123+67.91	21.00 L	27.24	NORTH RAMP
3	124+51.21	18.54 L	32.00	NORTH RAMP
4	124+49.13	6.72 L	32.00	NORTH RAMP
5	125+22.53	6.00 L	32.24	NORTH RAMP
6	125+32.09	6.00 L	33.00	NORTH RAMP
7	125+33.03	6.00 R	33.00	NORTH RAMP
8	126+02.11	41.64 L	34.71	NE EDGE OF SHELLROCK
9	126+32.80	41.64 L	34.77	NE EDGE OF SHELLROCK
10	125+91.74	54.53 R	35.80	SW EDGE OF SHELLROCK
11	126+43.16	54.53 R	35.82	SW EDGE OF SHELLROCK
12	127+01.88	6.00 R	33.00	SOUTH RAMP
13	127+02.81	6.00 L	33.00	SOUTH RAMP
14	127+12.37	6.00 L	32.24	SOUTH RAMP
15	127+85.86	6.72 L	32.00	SOUTH RAMP
16	127+83.69	18.54 L	32.00	SOUTH RAMP
17	128+67	21.00 L	27.24	SOUTH RAMP
18	128+65.95	33.00 L	27.00	SOUTH RAMP
19	124+85.05	126.43 R	25.00	END OF RIPRAP
20	127+49.86	126.43 R	25.00	END OF RIPRAP
21	124+81.75	6.00 R	32.00	IMPOUNDMENT SLOPE
22	125+17.67	21.21 R	32.00	IMPOUNDMENT SLOPE
23	124+81.75	27.00 R	25.00	IMPOUNDMENT SLOPE
24	125+05.42	39.24 R	25.00	IMPOUNDMENT SLOPE
25	125+15.36	80.74 R	25.00	IMPOUNDMENT SLOPE
26	127+17.44	85.24 R	25.00	IMPOUNDMENT SLOPE
27	127+33.26	36.29 R	25.00	IMPOUNDMENT SLOPE
28	127+53.15	27.00 R	25.00	IMPOUNDMENT SLOPE
29	127+16.98	22.85 R	32.00	IMPOUNDMENT SLOPE
30	127+53.15	6.00 R	32.00	IMPOUNDMENT SLOPE
31	125+65.91	92.66 L	15.00	INTERIOR CANAL BANK
32	126+17.24	114.40 L	15.00	INTERIOR CANAL BANK
33	126+69.23	92.36 L	15.00	INTERIOR CANAL BANK
34	125+80.59	151.11 L	15.00	EXTERIOR CANAL BANK
35	126+17.45	173.94 L	15.00	EXTERIOR CANAL BANK
36	126+54.31	151.11 L	15.00	EXTERIOR CANAL BANK
37	125+74.34	179.65 L	26.00	BOUNDARY MAINTENANCE ROAD
38	126+10.92	206.78 L	26.00	BOUNDARY MAINTENANCE ROAD
39	126+60.57	179.65 L	26.00	BOUNDARY MAINTENANCE ROAD
40	126+38.21	314.90 L	20.00	BABCOCK/WEBB CANAL BANK
41	123+59.99	33.00 L	27.00	NORTH RAMP LANDING
42	123+59.99	22.00 L	27.22	NORTH RAMP LANDING
43	128+74.91	33.00 L	27.00	SOUTH RAMP LANDING
44	128+74.91	22.00 L	27.22	SOUTH RAMP LANDING



NOTES:
1. POINT TABLE ON THIS SHEET APPLIES TO THE POINTS ON THIS DRAWING ONLY.

ENLARGED BOND FARM HEI PUMP STATION LAYOUT AND GRADING PLAN

BOND FARM HEI PUMP STATION LAYOUT AND GRADING PLAN
SCALE: 1" = 30'



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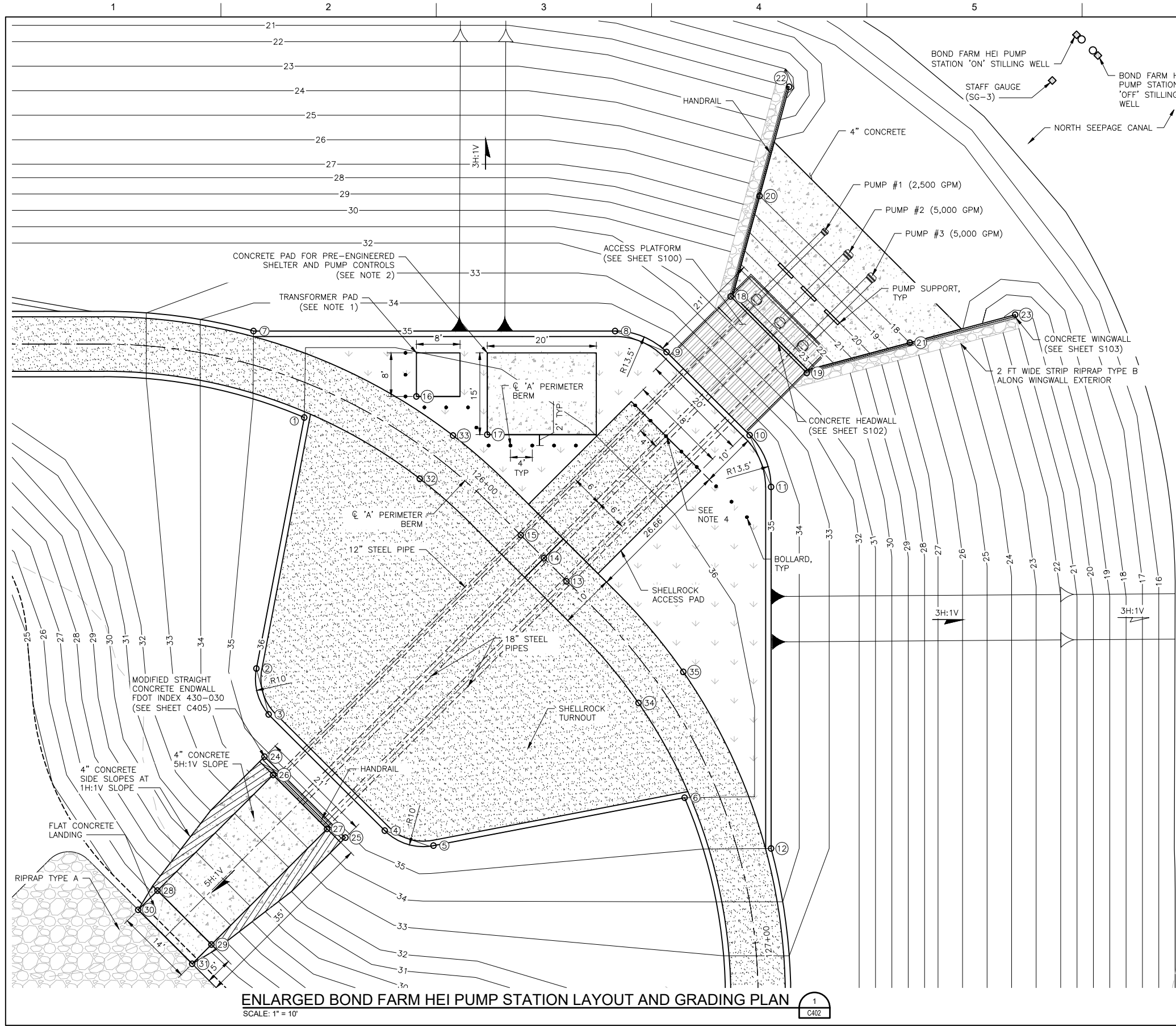
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

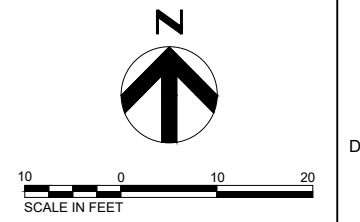
RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL BOND FARM HEI PUMP STATION LAYOUT AND GRADING PLAN
SHEET 39 of 92
SCALE 1" = 30'
DRAWING C402
READY TO ADVERTISE



PUMP STATION POINTS				
POINT #	STATION	OFFSET	EL	DESCRIPTION
1	125+64.94	6.00 R	36.00	EDGE OF TURNOUT
2	125+85.24	50.82 R	36.00	EDGE OF TURNOUT
3	126+00.39	55.96 R	36.00	EDGE OF TURNOUT
4	126+32.88	56.00 R	36.00	EDGE OF TURNOUT
5	126+49.66	50.82 R	36.00	EDGE OF TURNOUT
6	126+69.97	6.00 R	36.00	EDGE OF TURNOUT
7	125+50.96	6.00 L	35.00	EDGE OF SHELLROCK
8	125+98.93	38.84 L	35.00	EDGE OF SHELLROCK
9	126+06.62	42.66 L	35.00	EDGE OF SHELLROCK
10	126+28.17	42.63 L	35.00	EDGE OF SHELLROCK
11	126+35.98	38.84 L	35.00	EDGE OF SHELLROCK
12	126+83.95	6.00 L	35.00	EDGE OF SHELLROCK
13	126+23.38	0.07 R	36.65	ROAD CENTERLINE
14	126+17.45	0.00	36.65	ROAD CENTERLINE
15	126+11.45	0.00	36.65	ROAD CENTERLINE
16	125+81.28	7.02 L	36.87	TRANSFORMER SLAB
17	125+94.83	9.07 L	36.87	CTRL CENTER SLAB
18	126+07.71	58.18 L	35.00	TOP OF HEADWALL
19	126+27.52	58.13 L	35.00	TOP OF HEADWALL
20	126+00.53	75.04 L	18.00	TOE OF SLOPE
21	126+34.65	75.49 L	18.00	TOE OF SLOPE
22	125+95.45	93.56 L	19.80	FINISHED GRADE AT WINGWALL
23	126+39.56	93.33 L	20.33	FINISHED GRADE AT WINGWALL
24	126+06.95	62.00 R	34.50	TOP OF ENDWALL
25	126+27.95	62.00 R	34.50	TOP OF ENDWALL
26	126+10.45	63.25 R	31.00	CONCRETE SLOPE
27	126+24.45	63.25 R	31.00	CONCRETE SLOPE
28	126+10.45	93.25 R	25.00	CONCRETE LANDING
29	126+24.45	93.25 R	25.00	CONCRETE LANDING
30	126+10.45	98.25 R	25.00	CONCRETE LANDING
31	126+24.45	98.25 R	25.00	CONCRETE LANDING
32	125+90.36	5.00 R	36.50	EDGE OF ROAD
33	125+90.36	5.00 L	36.80	EDGE OF ROAD
34	126+49.50	5.00 R	36.50	EDGE OF ROAD
35	126+49.50	5.00 L	36.80	EDGE OF ROAD



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- NOTES:
- CONSTRUCT TRANSFORMER PAD PER DETAIL SHOWN IN THE STRUCTURAL DRAWINGS. TRANSFORMER WILL BE FURNISHED AND INSTALLED BY UTILITY COMPANY. COORDINATE WITH UTILITY COMPANY FOR LOCATION OF CONDUIT SWEEPS THROUGH THE PAD TO ACCOMMODATE INSTALLATION OF THE TRANSFORMER. TOP ELEVATION OF THE PAD SHALL NOT BE LOWER THAN EL 36.2. GRADE AROUND PAD TO ACCOMMODATE THE LEVEL PAD WITH SURROUNDING TOP OF EMBANKMENT GRADING.
 - SHELTER SHALL BE PRE-ENGINEERED OPEN CANOPY STRUCTURE CONFORMING TO SPECIFICATION SECTION 13300. CONCRETE SLAB SHALL BE CONSTRUCTED TO ACCOMMODATE THE SHELTER PER THE MANUFACTURER'S RECOMMENDATION.
 - POINT TABLE ON SHEET APPLIES TO THE POINTS ON THIS DRAWING ONLY.
 - PROVIDE ENGRAVED ALUMINUM SIGN WITH THE FOLLOWING TEXT "CRANES SHALL NOT EXCEED 50 TONS IN THIS SHELLROCK AREA. OUTRIGGERS SHALL EXTEND BEYOND THE SHELLROCK AREA FOR LIFTING." SIGN SHALL BE PERMANENTLY AFFIXED TO A BOLLARD OR VERTICAL POST.
 - FINISHED GRADE AROUND TRANSFORMER AND PUMP CONTROL CONCRETE PADS SHALL BE 2 INCHES BELOW TOP OF PAD ELEVATION AND GRADED 2% AWAY FROM THE PAD FOR 24 INCHES, THEN 2H:1V TO FINISHED GRADE SHOWN ON THIS SHEET.

ENLARGED BOND FARM HEI PUMP STATION LAYOUT AND GRADING PLAN
 SCALE: 1" = 10'

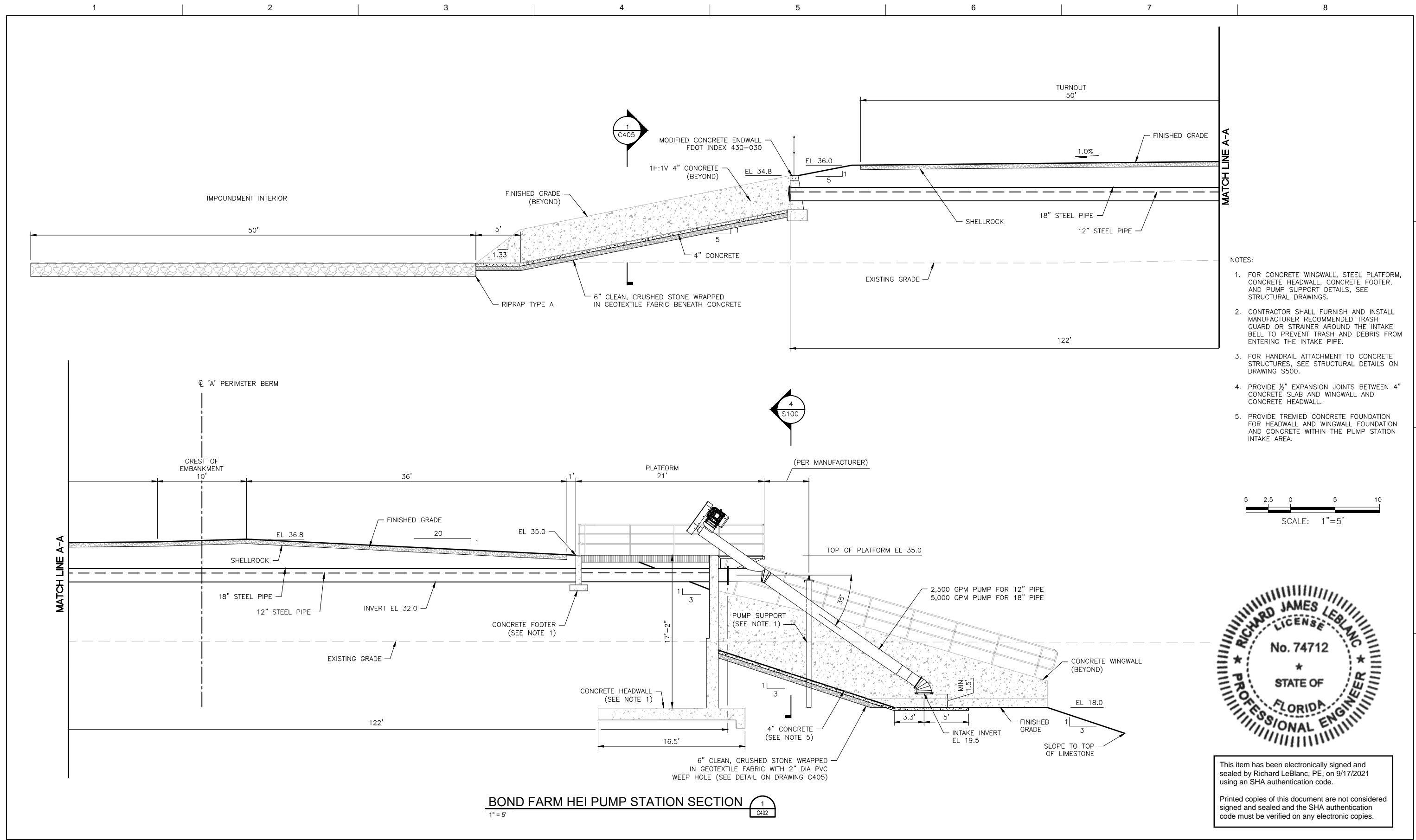


PROJECT MANAGER SUSAN RAY, PE		
ISSUE	DATE	DESCRIPTION
PROJECT NUMBER	10061267	

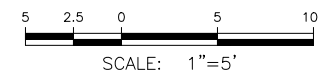
RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**
 FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

**CIVIL
 ENLARGED BOND FARM HEI PUMP STATION
 LAYOUT AND GRADING PLAN**
 SHEET 40 of 92
 SCALE 1" = 10'
 DRAWING C403



- NOTES:
1. FOR CONCRETE WINGWALL, STEEL PLATFORM, CONCRETE HEADWALL, CONCRETE FOOTER, AND PUMP SUPPORT DETAILS, SEE STRUCTURAL DRAWINGS.
 2. CONTRACTOR SHALL FURNISH AND INSTALL MANUFACTURER RECOMMENDED TRASH GUARD OR STRAINER AROUND THE INTAKE BELL TO PREVENT TRASH AND DEBRIS FROM ENTERING THE INTAKE PIPE.
 3. FOR HANDRAIL ATTACHMENT TO CONCRETE STRUCTURES, SEE STRUCTURAL DETAILS ON DRAWING S500.
 4. PROVIDE 1/8" EXPANSION JOINTS BETWEEN 4" CONCRETE SLAB AND WINGWALL AND CONCRETE HEADWALL.
 5. PROVIDE TREMIED CONCRETE FOUNDATION FOR HEADWALL AND WINGWALL FOUNDATION AND CONCRETE WITHIN THE PUMP STATION INTAKE AREA.



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BOND FARM HEI PUMP STATION SECTION
1" = 5'



4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

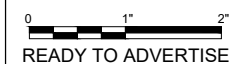
PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION

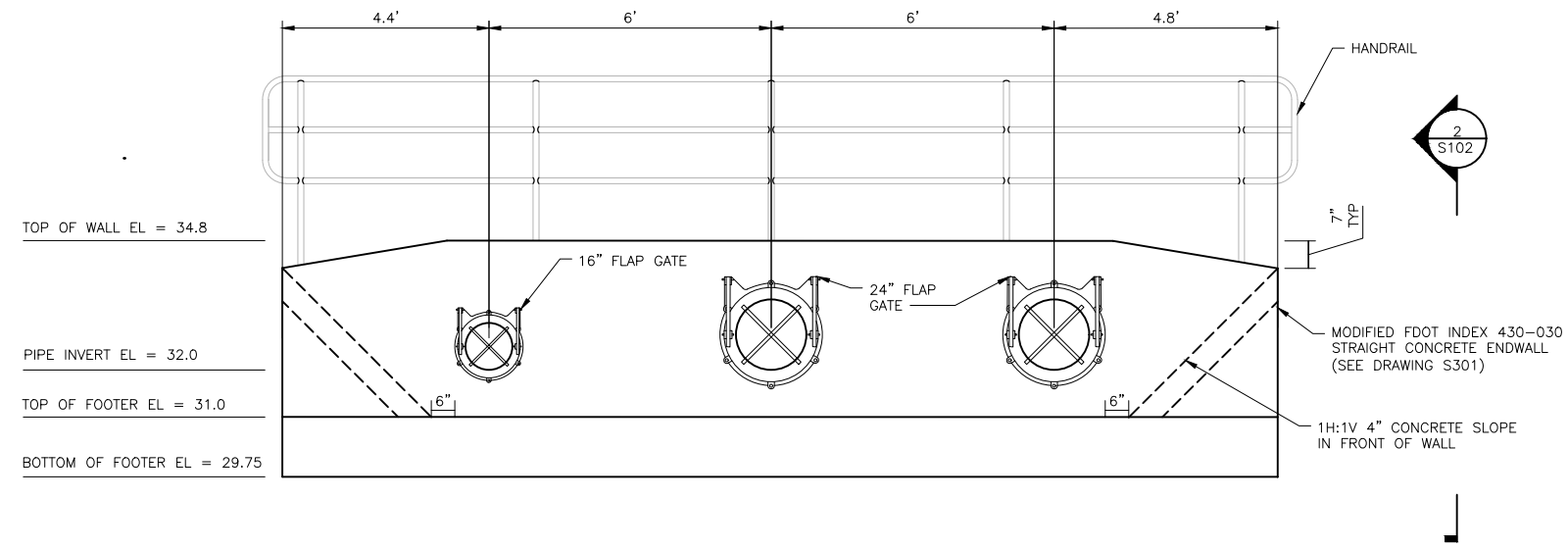
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399



**CIVIL
BOND FARM HEI PUMP STATION
SECTIONS**

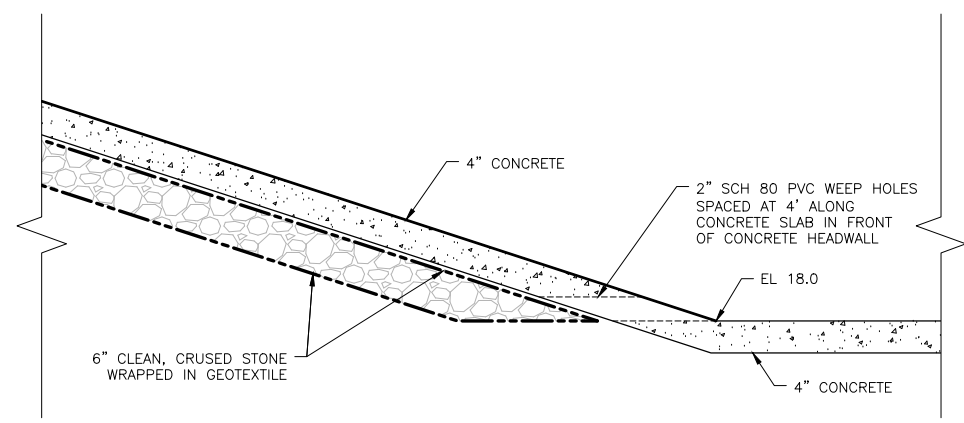
SHEET 41 of 92
SCALE 1" = 5'

DRAWING
C404

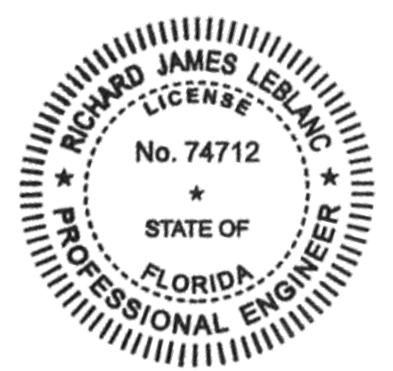


- NOTES:
1. FOR HANDRAIL ATTACHMENT FOR CONCRETE STRUCTURES, SEE STRUCTURAL DETAILS ON DRAWING S500.
 2. PROVIDE TREMIE CONCRETE FOUNDATION FOR HEADWALL AND WINGWALL FOUNDATION

ELEVATION – DISCHARGE HEADWALL
 1
 1" = 2'
 C404



4" CONCRETE SLAB WEEP HOLE DETAIL
 2
 1" = 1'-0"
 C403



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

CIVIL BOND FARM HEI PUMP STATION DISCHARGE HEADWALL ELEVATION

0 1 2
 READY TO ADVERTISE

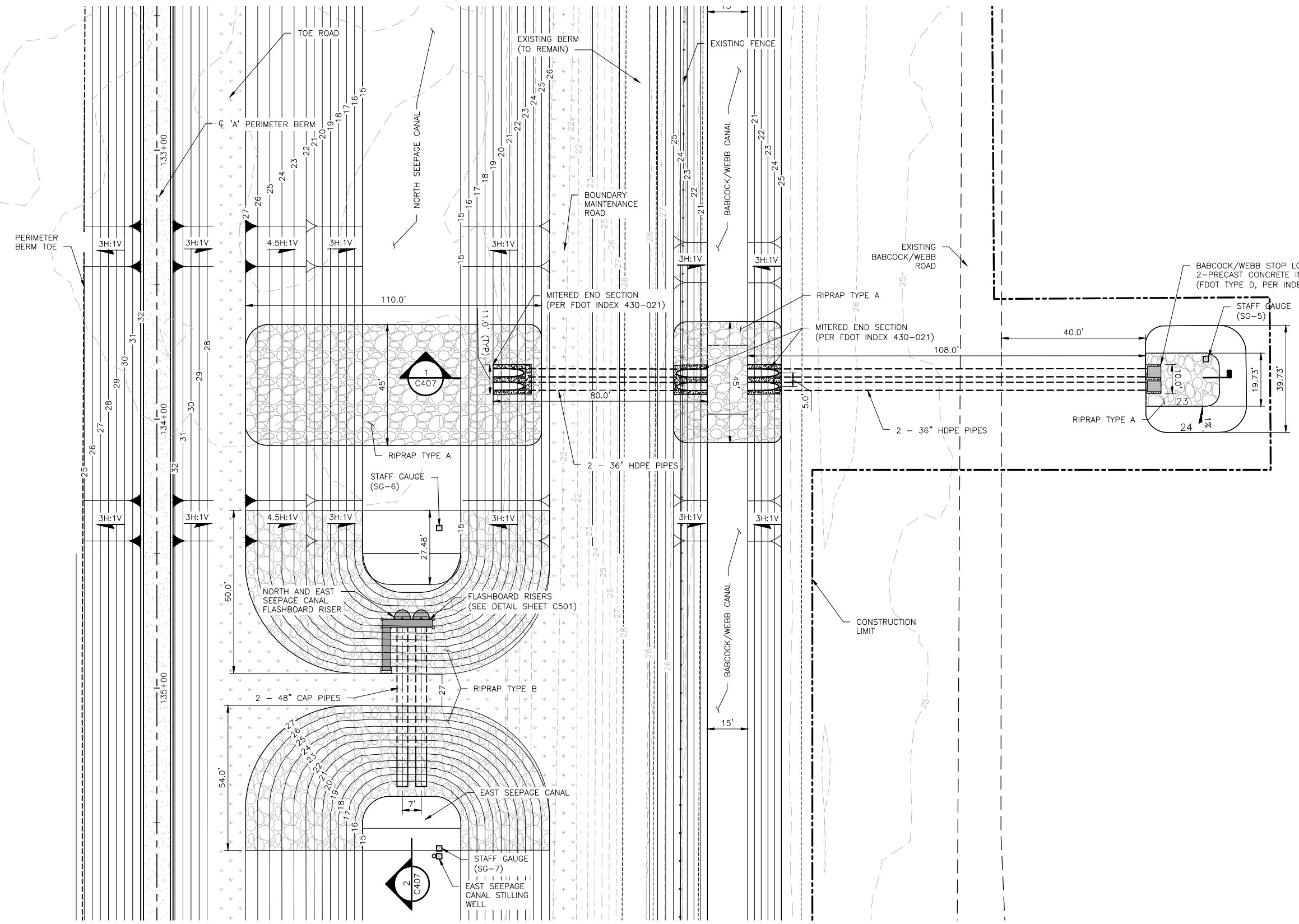
SHEET 42 of 92
 SCALE VARIES

DRAWING **C405**

1 2 3 4 5 6 7 8



SCALE IN FEET
0 20 40



BABCOCK/WEBB INTAKE STRUCTURE AND CULVERT
SCALE: 1"=20'



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FL PE #74712
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TAMPA, FL 33609

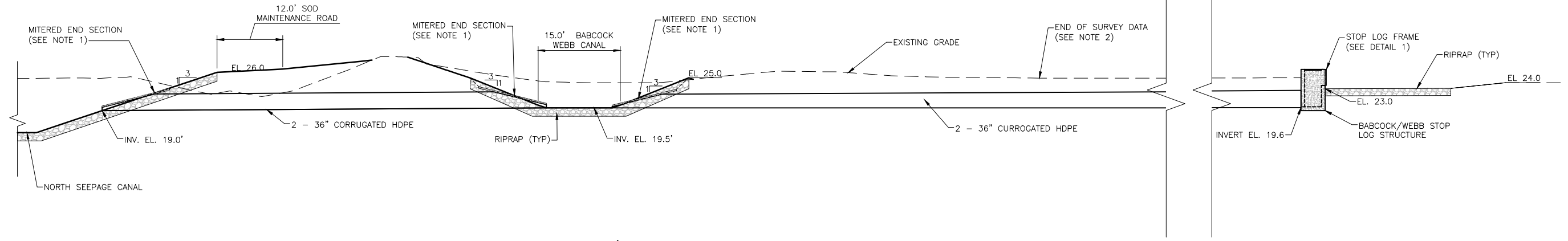
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL
BABCOCK/WEBB INTAKE AND NORTH AND EAST SEEPAGE CANAL LAYOUT AND GRADING PLAN

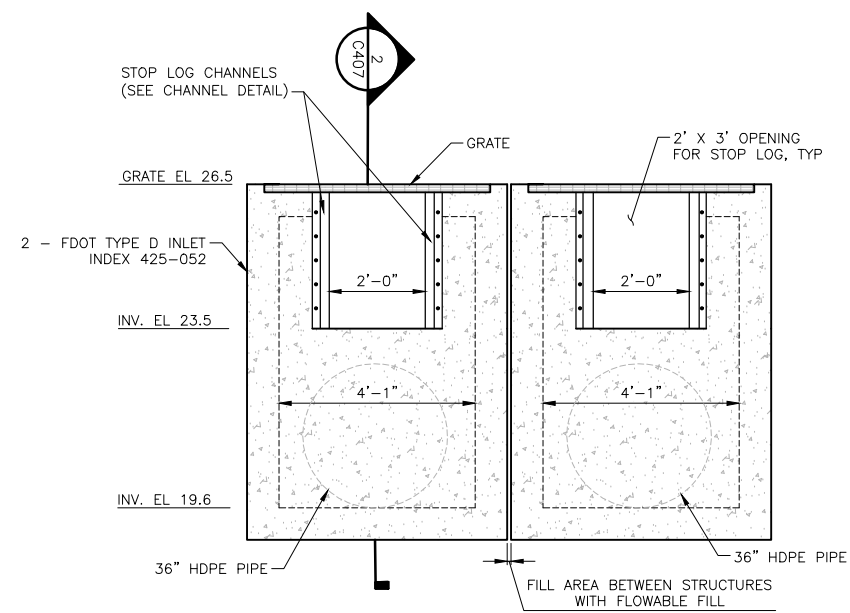
0 1" 2"
READY TO ADVERTISE

SHEET 43 of 92
SCALE 1"=20'

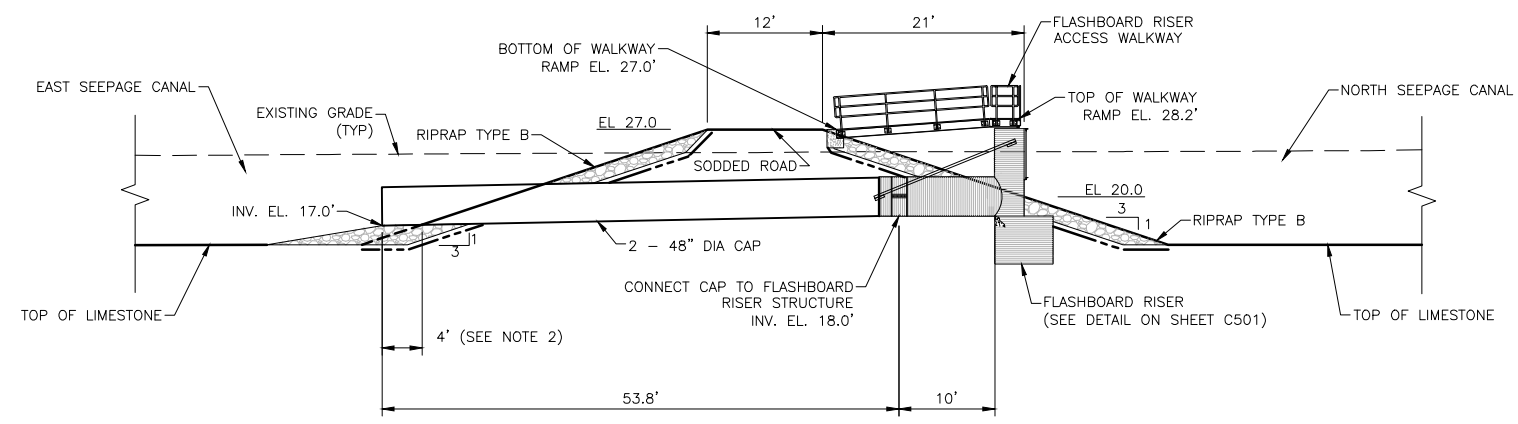
DRAWING
C406



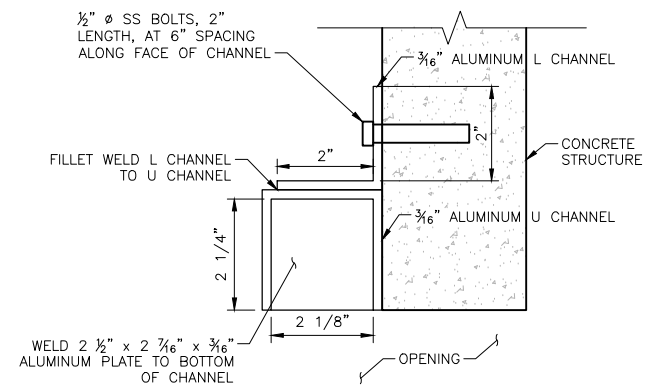
BABCOCK/WEBB INTAKE STRUCTURE SECTION
SCALE: 1"=10'
1
C406



BABCOCK/WEBB STOP LOG STRUCTURE ELEVATION DETAIL
NOT TO SCALE
1
C407



NORTH AND EAST SEEPAGE CANAL FLASHBOARD RISER SECTION
SCALE: 1"=10'
2
C406



STOP LOG CHANNEL DETAIL
NOT TO SCALE
2
C407



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- NOTES:
- MITERED END SECTIONS TO BE PER FDOT INDEX 430-021 AT 4:1 SLOPE.
 - PROVIDE 4' OF ADDITIONAL RIPRAP PROTECTION BENEATH PIPE EXTENSION FROM PROPOSED SLOPE. ADDITIONAL RIPRAP SHALL EXTEND TO THE TOP OF LIMESTONE AT A SLOPE NO STEEPER THAN 2H:1V.

BABCOCK/WEBB STRUCTURE SECTION
NOT TO SCALE
2
C407



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

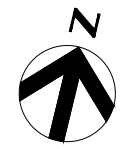
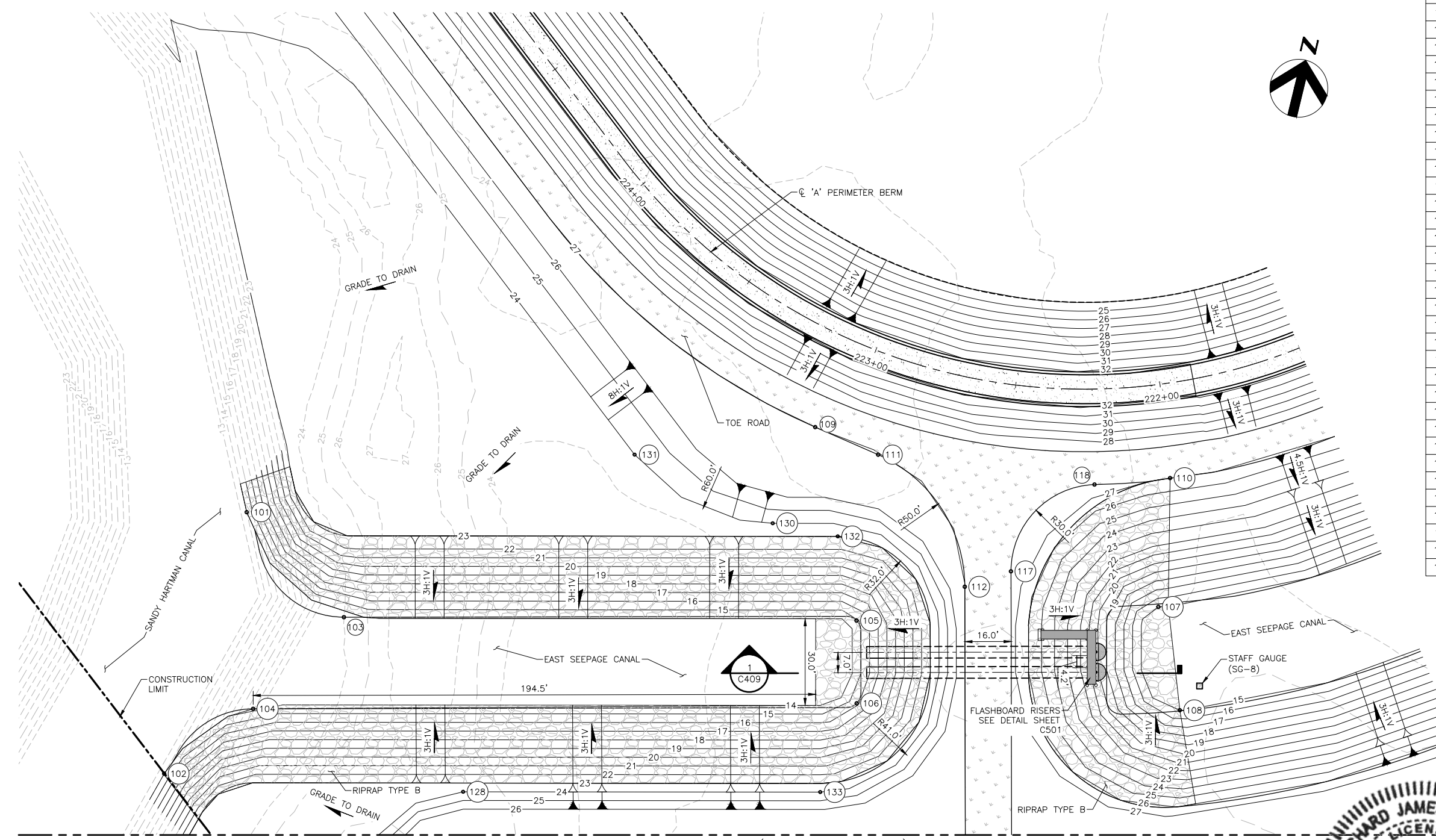
**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
BABCOCK/WEBB INTAKE AND NORTH AND
EAST SEEPAGE CANAL SECTIONS**

0 1 2
READY TO ADVERTISE

SHEET 44 of 92
SCALE 1" = 10'

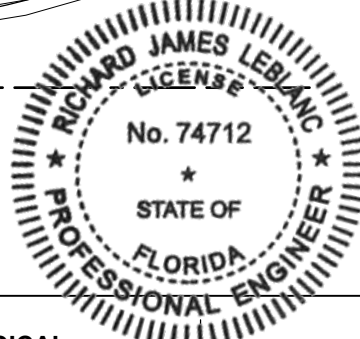
DRAWING
C407



EAST SEEPAGE CANAL LAYOUT TABLE				
NAME	STATION	OFFSET	ELEVATION	DESCRIPTION
101	224+00.81	178.03 LT	14.0	CANAL BOTTOM
102	223+78.60	260.78 LT	14.0	CANAL BOTTOM
103	223+74.63	178.77 LT	13.9	CANAL BOTTOM
104	223+75.42	223.36 LT	14.0	CANAL BOTTOM
105	222+80.98	90.98 LT	14.9	CANAL BOTTOM
106	222+76.08	118.63 LT	15.8	CANAL BOTTOM
107	222+07.63	76.50 LT	15.0	CANAL BOTTOM
108	222+04.99	112.83 LT	15.0	CANAL BOTTOM
109	223+08.53	32.64 LT	27.0	TOE ROAD EDGE
110	222+00.63	32.64 LT	27.0	TOE ROAD EDGE
111	222+88.16	33.85 LT	27.0	TOE ROAD EDGE
112	222+56.74	71.56 LT	27.0	TOE ROAD EDGE
113	222+45.31	228.07 LT	27.0	TOE ROAD EDGE
114	222+52.97	250.13 LT	26.8	TOE ROAD EDGE
115	222+14.91	246.64 LT	27.2	TOE ROAD EDGE
116	222+38.78	196.86 LT	27.2	TOE ROAD EDGE
117	222+45.39	64.28 LT	27.5	TOE ROAD EDGE
118	222+23.15	33.03 LT	27.2	TOE ROAD EDGE
119	222+33.04	289.59 LT	27.3	TOE ROAD EDGE
120	222+24.83	270.00 LT	27.3	TOE ROAD EDGE
121	221+42.09	256.66 LT	27.2	BOUNDARY MAINTENANCE ROAD PC
122	221+64.78	267.48 LT	27.2	BOUNDARY MAINTENANCE ROAD PT
123	221+76.77	284.39 LT	27.4	BOUNDARY MAINTENANCE ROAD PT
124	221+67.69	277.93 LT	27.2	BOUNDARY MAINTENANCE ROAD PC
125	221+27.23	357.03 LT	28.0	BERM EXTENSION TOP PC
126	222+55.62	369.88 LT	28.0	BERM EXTENSION TOP PT
127	223+24.31	256.03 LT	28.0	BERM EXTENSION TOP END
128	223+38.99	201.69 LT	24.0	BERM EXTENSION TOE PT
129	223+35.65	266.31 LT	24.0	BERM EXTENSION TOE PC
130	223+08.63	69.02 LT	24.0	GRADING PC
131	223+48.08	71.71 LT	24.0	GRADING PT
132	222+91.69	65.08 LT	23.0	TOP OF CANAL PT
133	222+78.70	151.53 LT	24.0	TOP OF CANAL PC

NOTES:
 1. POINT TABLE ON SHEET APPLIES TO THE POINTS ON THIS DRAWING AND DRAWING C410.

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MATCH LINE A-A (SEE SHEET C410)
EAST SEEPAGE CANAL DISCHARGE PLAN
 SCALE: 1" = 20'

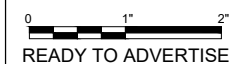


PROJECT MANAGER SUSAN RAY, PE		
ISSUE	DATE	DESCRIPTION
PROJECT NUMBER	10061267	

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

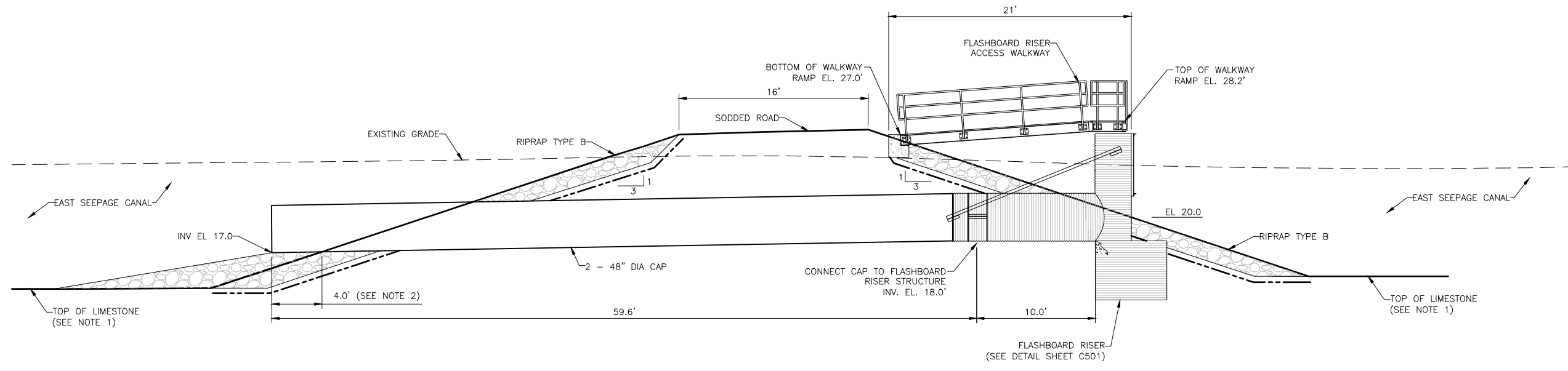
**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**
 FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

**CIVIL
 EAST SEEPAGE CANAL DISCHARGE
 LAYOUT AND GRADING PLAN**



SHEET 45 of 92
 SCALE 1"=20'

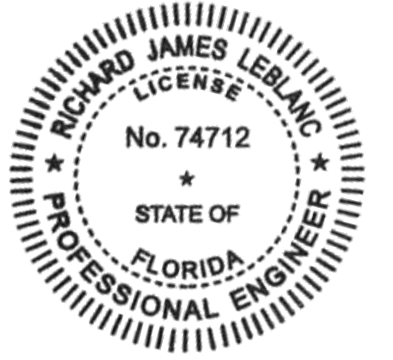
DRAWING
C408



- NOTES:
1. BOTTOM OF CANAL SHALL COINCIDE WITH TOP OF LIMESTONE LAYER. SEE SHEET B100, B200, AND B201 FOR GEOTECHNICAL BORING LOGS AND LOCATIONS.
 2. PROVIDE 4' OF ADDITIONAL RIPRAP PROTECTION BENEATH PIPE EXTENSION FROM PROPOSED SLOPE. ADDITIONAL RIPRAP SHALL EXTEND TO THE TOP OF LIMESTONE AT A SLOPE NO STEEPER THAN 2H:1V.



EAST SEEPAGE CANAL DISCHARGE SECTION
 1" = 5'



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PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
 FL PE #74712
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
 FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

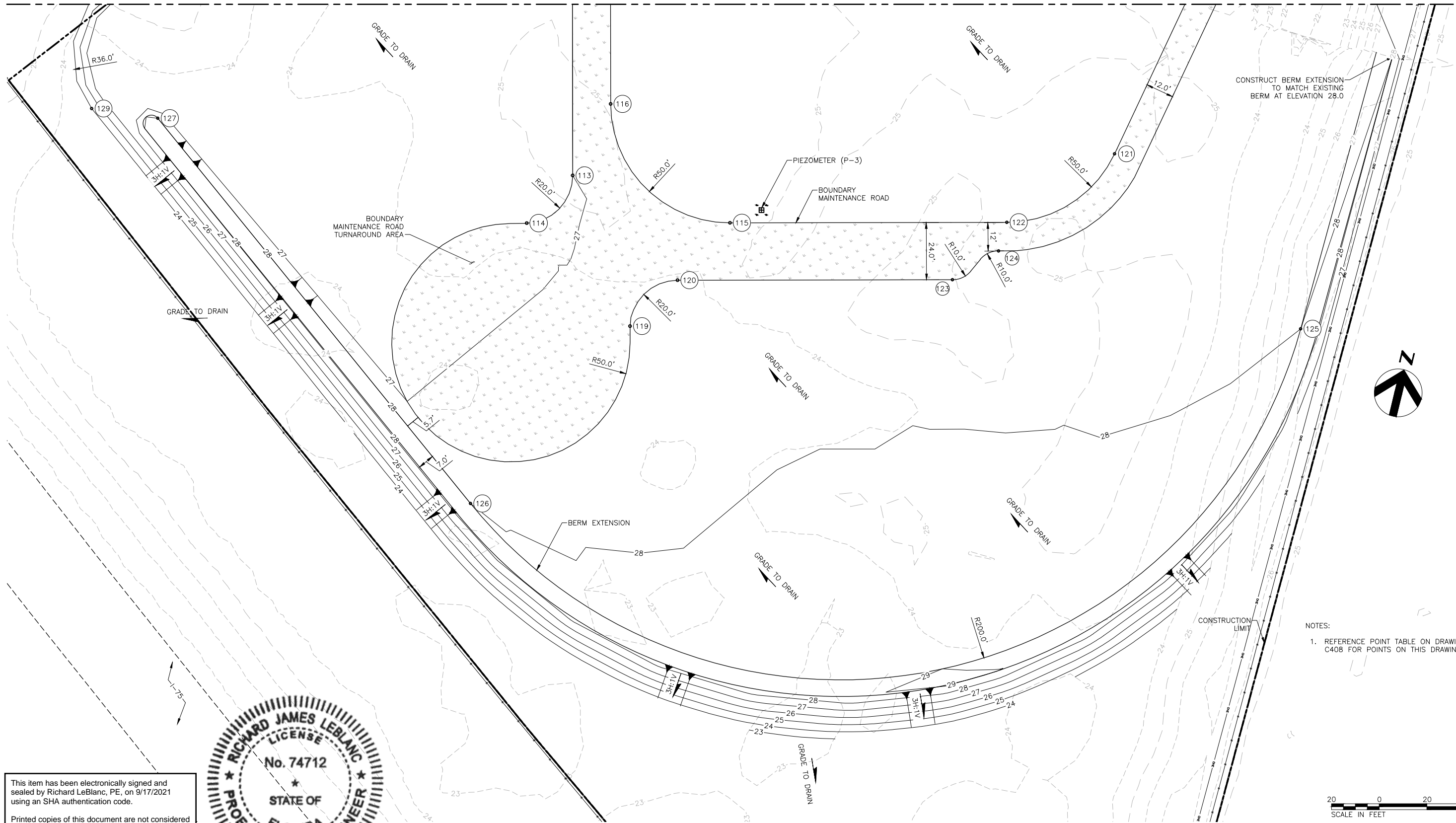
CIVIL EAST SEEPAGE CANAL DISCHARGE SECTIONS

0 1" 2"
 READY TO ADVERTISE

SHEET 46 of 92
 SCALE 1" = 5'

DRAWING
C409

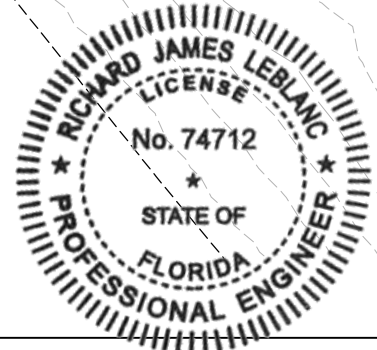
MATCH LINE A-A (SEE SHEET C408)



NOTES:
1. REFERENCE POINT TABLE ON DRAWING C408 FOR POINTS ON THIS DRAWING.

EAST SEEPAGE CANAL DISCHARGE PLAN
SCALE: 1" = 20'

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PROJECT MANAGER	SUSAN RAY, PE
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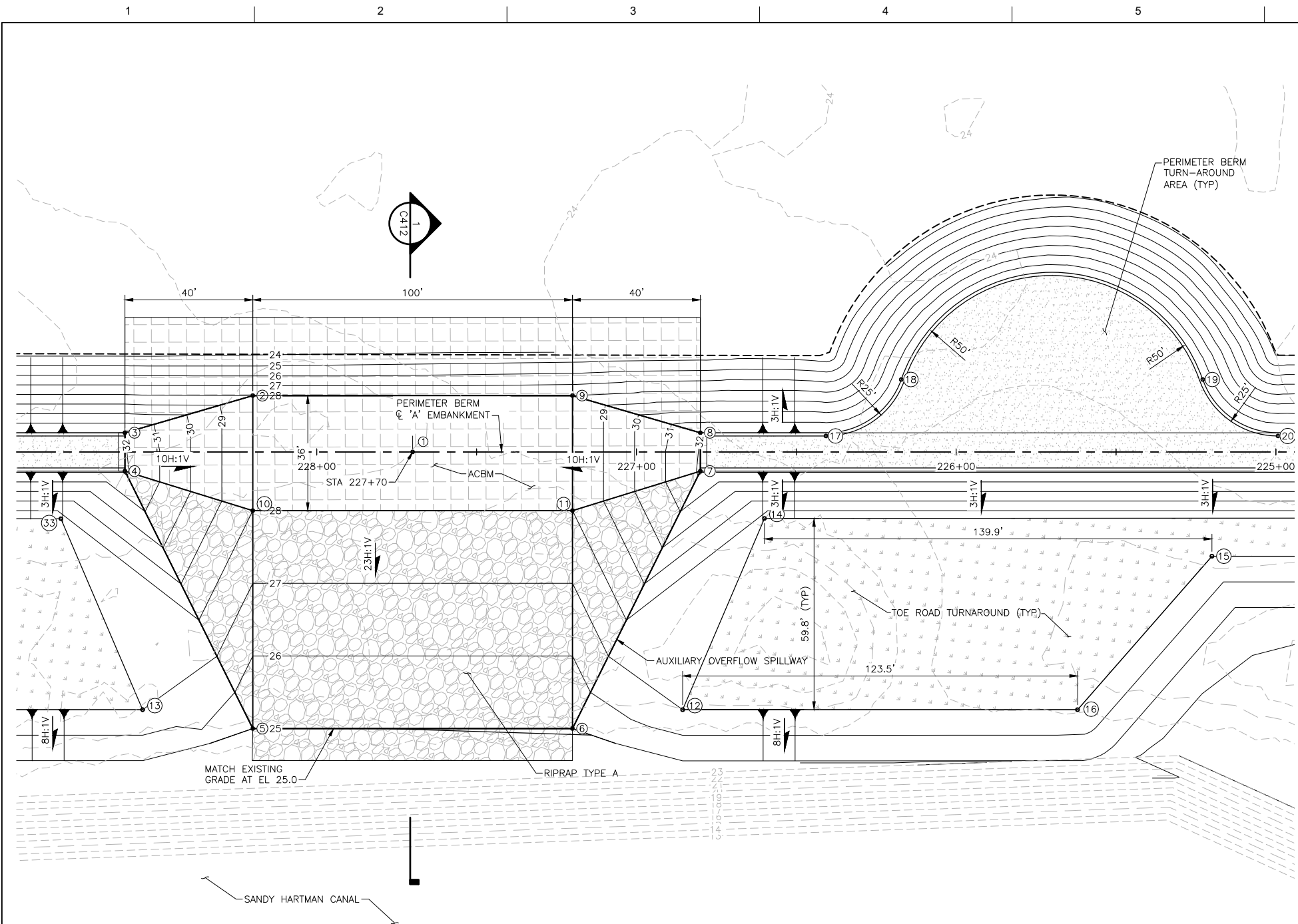
RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL
SOUTHEAST BOUNDARY MAINTENANCE ROAD TURNAROUND LAYOUT AND GRADING PLAN
SHEET 47 of 92
SCALE 1" = 20'
DRAWING C410

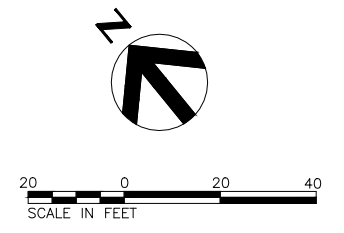
HDR
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

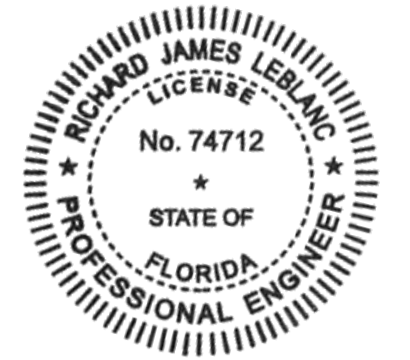


AUXILIARY SPILLWAY LAYOUT TABLE

NAME	STATION	OFFSET	ELEVATION	DESCRIPTION
1	227+70	0.00	28.00	WORKING POINT (WP)
2	228+20	17.64 RT	28.00	SPILLWAY EDGE
3	228+60	6.00 RT	32.00	SPILLWAY TOP OF BANK
4	228+60	6.00 LT	32.12	SPILLWAY TOP OF BANK
5	228+20	86.54 LT	25.00	BOTTOM OF CHUTE
6	227+20	86.54 LT	25.00	BOTTOM OF CHUTE
7	226+80	6.00 LT	32.12	SPILLWAY TOP OF BANK
8	226+80	6.00 RT	32.00	SPILLWAY TOP OF BANK
9	227+20	17.64 RT	28.00	SPILLWAY EDGE
10	228+20	18.36 LT	28.00	SPILLWAY EDGE / TOP OF CHUTE
11	227+20	18.36 LT	28.00	SPILLWAY EDGE / TOP OF CHUTE
12	226+85.53	80.64 LT	27.00	TOE ROAD TURNAROUND CORNER
13	228+54.47	80.64 LT	27.00	TOE ROAD TURNAROUND CORNER
14	226+59.93	20.79 LT	27.24	TOE ROAD EDGE
15	225+20	32.64 LT	27.00	TOE ROAD EDGE
16	225+62	80.64 LT	27.00	TOE ROAD TURNAROUND CORNER
17	226+40.71	5.00 RT	32.00	TURNAROUND TOP OF BANK
18	226+17.14	22.67 RT	32.00	TURNAROUND TOP OF BANK
19	225+22.86	22.67 RT	32.00	TURNAROUND TOP OF BANK
20	224+99.29	5.00 RT	32.00	TURNAROUND TOP OF BANK



AUXILIARY OVERFLOW SPILLWAY PLAN
SCALE: 1" = 20'



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RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

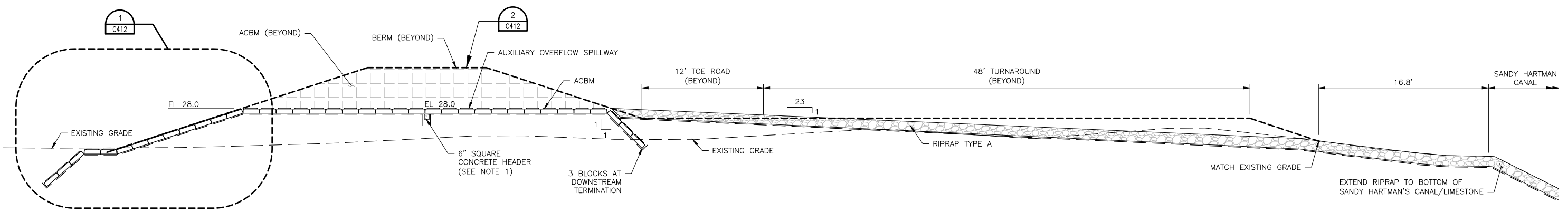
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
AUXILIARY OVERFLOW SPILLWAY
LAYOUT AND GRADING PLAN**

READY TO ADVERTISE

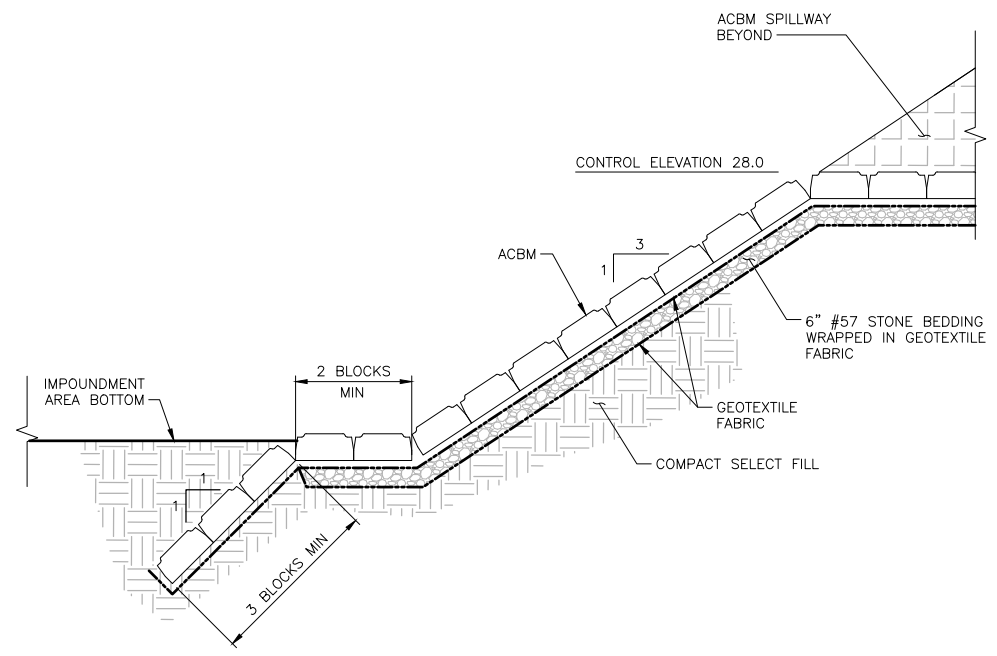
SHEET 48 of 92
SCALE 1" = 20'

DRAWING
C411

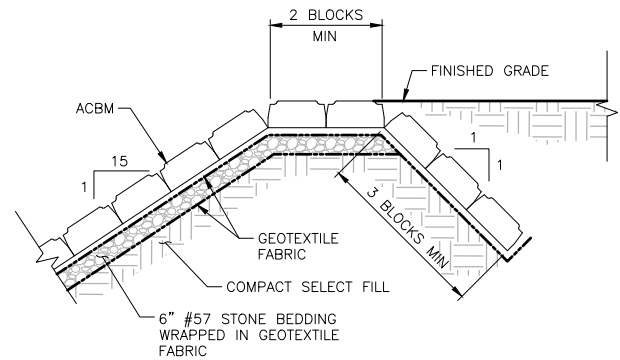


AUXILIARY OVERFLOW SPILLWAY SECTION
SCALE: 1"=5'

- NOTES:
- CONCRETE HEADER SHALL EXTEND ALONG THE BOTTOM OF THE ACBM AT THE PERIMETER BERM CENTERLINE TO PREVENT WATER FLOWING FROM UPSTREAM TO DOWNSTREAM WITHIN THE ACBM BEDDING MATERIAL.



DETAIL 1
NOT TO SCALE



TERMINATION AT TOP OF SLOPE DETAIL 2
NOT TO SCALE



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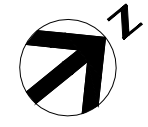
ISSUE	DATE	DESCRIPTION

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RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

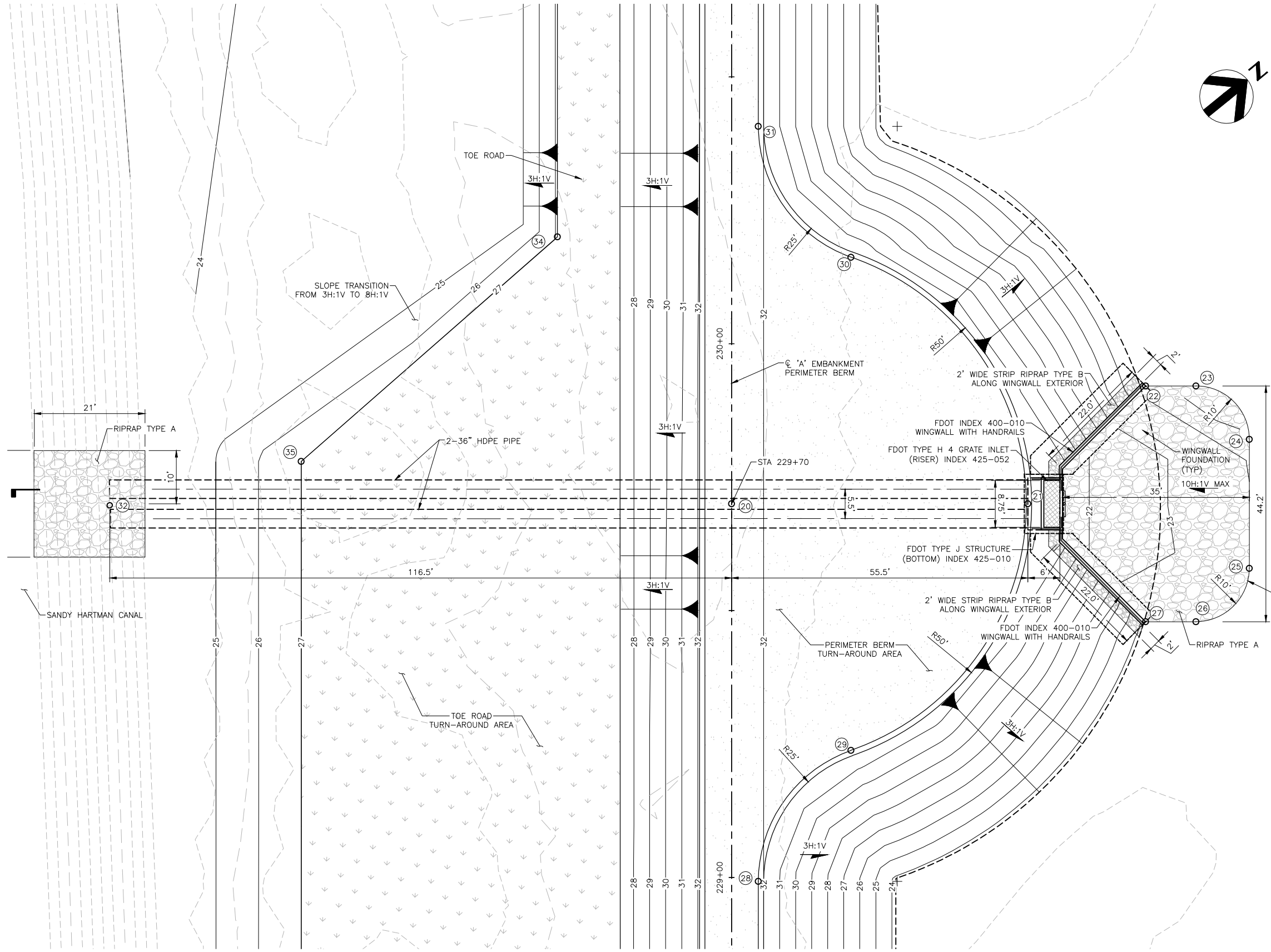
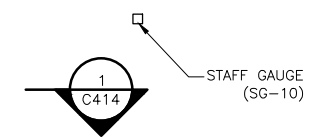
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL AUXILIARY OVERFLOW SPILLWAY SECTIONS
SHEET 49 of 92
SCALE VARIES
DRAWING C412
READY TO ADVERTISE



PRIMARY DISCHARGE LAYOUT TABLE				
NAME	STATION	OFFSET	ELEVATION	DESCRIPTION
20	229+70	0.00	32.06	WORKING POINT (WP)
21	229+70	55.48 RT	21.00	PIPES INLET
22	229+92.09	77.54 RT	24.06	RIPRAP EDGE
23	229+92.09	86.98 RT	24.06	RIPRAP EDGE
24	229+82.09	96.98 RT	24.06	RIPRAP EDGE
25	229+57.91	96.98 RT	24.06	RIPRAP EDGE
26	229+47.91	86.98 RT	24.06	RIPRAP EDGE
27	229+47.91	77.54 RT	24.06	RIPRAP EDGE
28	228+99.29	5.00 RT	32.01	ROAD EDGE
29	229+23.80	22.34 RT	31.90	TURNAROUND EDGE
30	230+16.20	22.34 RT	31.90	TURNAROUND EDGE
31	230+40.71	5.00 RT	32.01	ROAD EDGE
32	229+69.71	116.50 LT	20.00	PIPES OUTLET
33	228+80.03	20.88 LT	27.24	TOE ROAD TURNAROUND CORNER
34	230+20.01	32.64 LT	27.00	TOE ROAD EDGE
35	229+77.97	80.64 LT	27.00	TOE ROAD TURNAROUND CORNER

NOTES:
 1. FOR HANDRAIL ATTACHMENTS ON CONCRETE STRUCTURES SEE STRUCTURAL DETAILS ON DRAWING S500.



PRIMARY DISCHARGE PLAN
 SCALE: 1" = 10'



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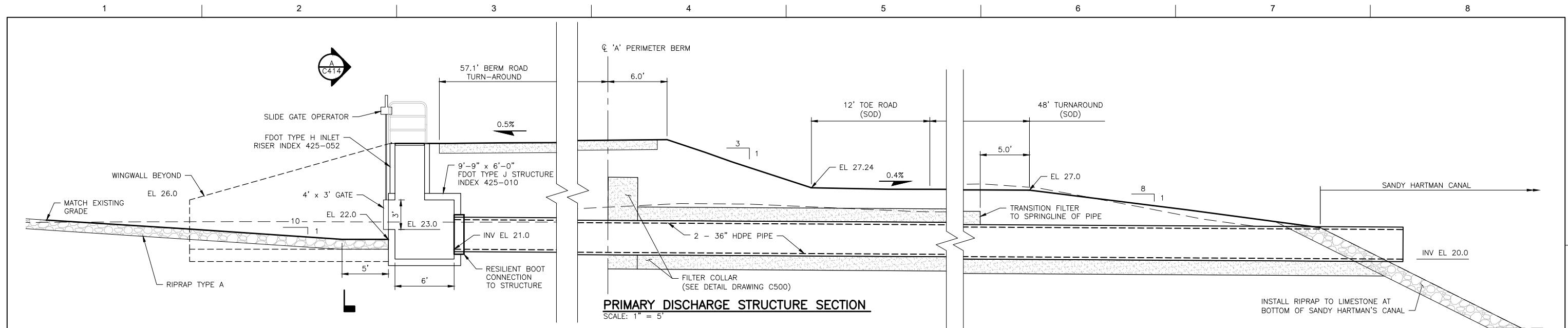
**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**
 FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

**CIVIL
 PRIMARY DISCHARGE STRUCTURE
 LAYOUT AND GRADING PLAN**

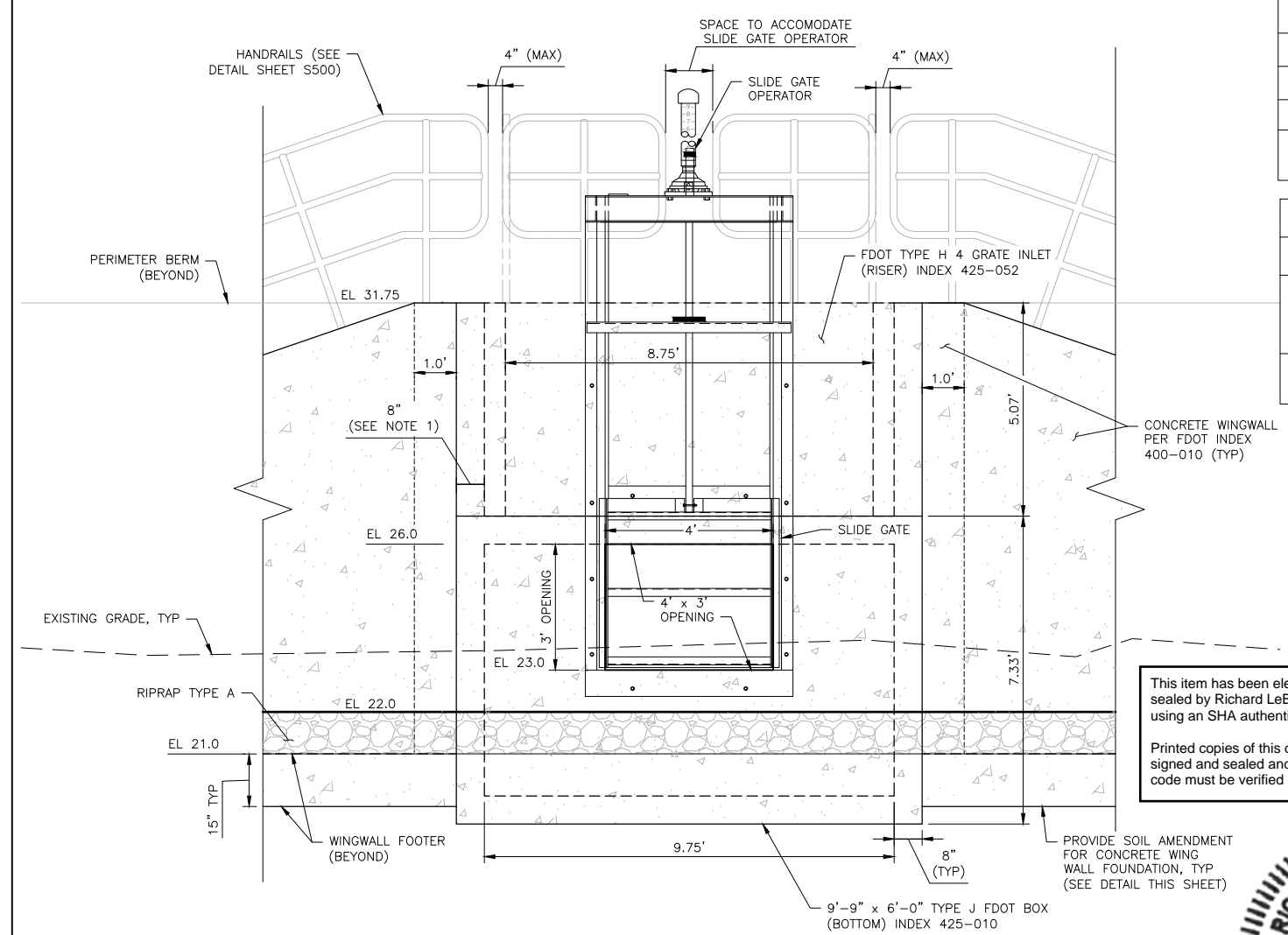
0 1" 2"
 READY TO ADVERTISE

SHEET 50 of 92
 SCALE 1" = 10'

DRAWING
C413



PRIMARY DISCHARGE STRUCTURE SECTION
SCALE: 1" = 5'



PRIMARY DISCHARGE SECTION
SCALE: 1" = 2'

FDOT INDEX 400-010 WINGWALL DIMENSIONS (NO KEY)

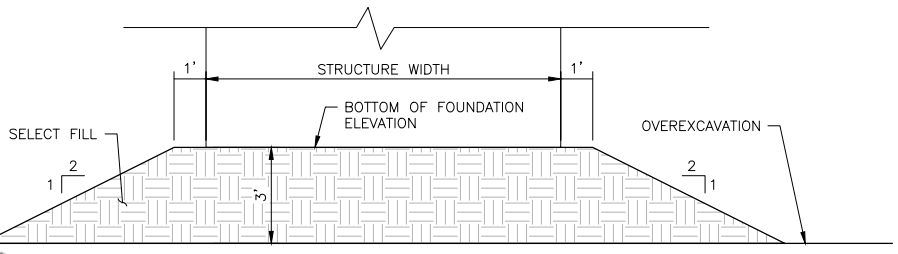
HEIGHT		WALL LENGTH		D	W	L(FOOT)		L(TOE)	SLOPE BACKWALL	D(SOIL)		WALL COVER	FTG COVER (TOP)	FTG COVER (BOTTOM)			
BEGIN	END	FT	IN	IN	IN	FT	IN	FT		IN	FT	IN	IN	IN	IN		
10	9	5	0	22	0	15	10	8	0	2	0	32	1	0	3	4	4.5

FDOT INDEX 400-010 WINGWALL REINFORCING SCHEDULE (NO KEY)

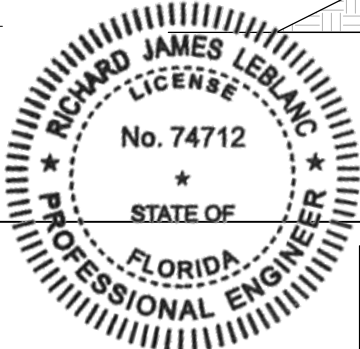
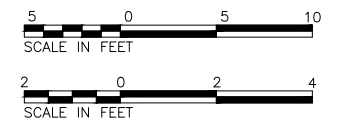
BARS J & K						BARS F & M						BARS G1 & G2			BAR H				
SIZE	SPACING	A		B		SIZE	SPACING	A		B		SIZE	SPACING	LENGTH		SIZE	SPACING	LENGTH	
	IN	FT	IN	FT	IN		IN	FT	IN	FT	IN		IN	FT	IN		IN	FT	IN
4	12	2	6	2	5	4	12	2	6	5	6	4	12	21	6	4	12	7	6

- NOTES:**
- CONSTRUCT CONCRETE WALL MATCHING THE SECTION DIMENSIONS OF THE WINGWALL WITHIN THE 8" GAP BETWEEN THE WINGWALL AND RISER. CONCRETE WALL SHALL BE INTEGRALLY CAST WITH THE WINGWALL AND INCLUDE THE TRANSVERSE REINFORCEMENT FROM THE WINGWALL. VERTICAL #4 REINFORCING BARS SHALL BE PROVIDED WITHIN THE FRONT WALL OF THE TYPE J FDOT BOX ON EITHER SIDE OF THE RISER TO BE CAST INTO THE 8" WIDE CONCRETE WALL. BARS SHALL HAVE A MINIMUM 1'-4" DEVELOPMENT INTO THE TYPE J FDOT BOX AND INTO THE 8" WIDE CONCRETE WALL.
 - FOR HANDRAIL ATTACHMENT TO CONCRETE STRUCTURES, SEE STRUCTURAL DETAILS ON DRAWING S500.

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SOIL AMENDMENT DETAIL
SCALE: 1" = 3'



PROJECT MANAGER SUSAN RAY, PE			PROJECT NUMBER 10061267		
ISSUE	DATE	DESCRIPTION			

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

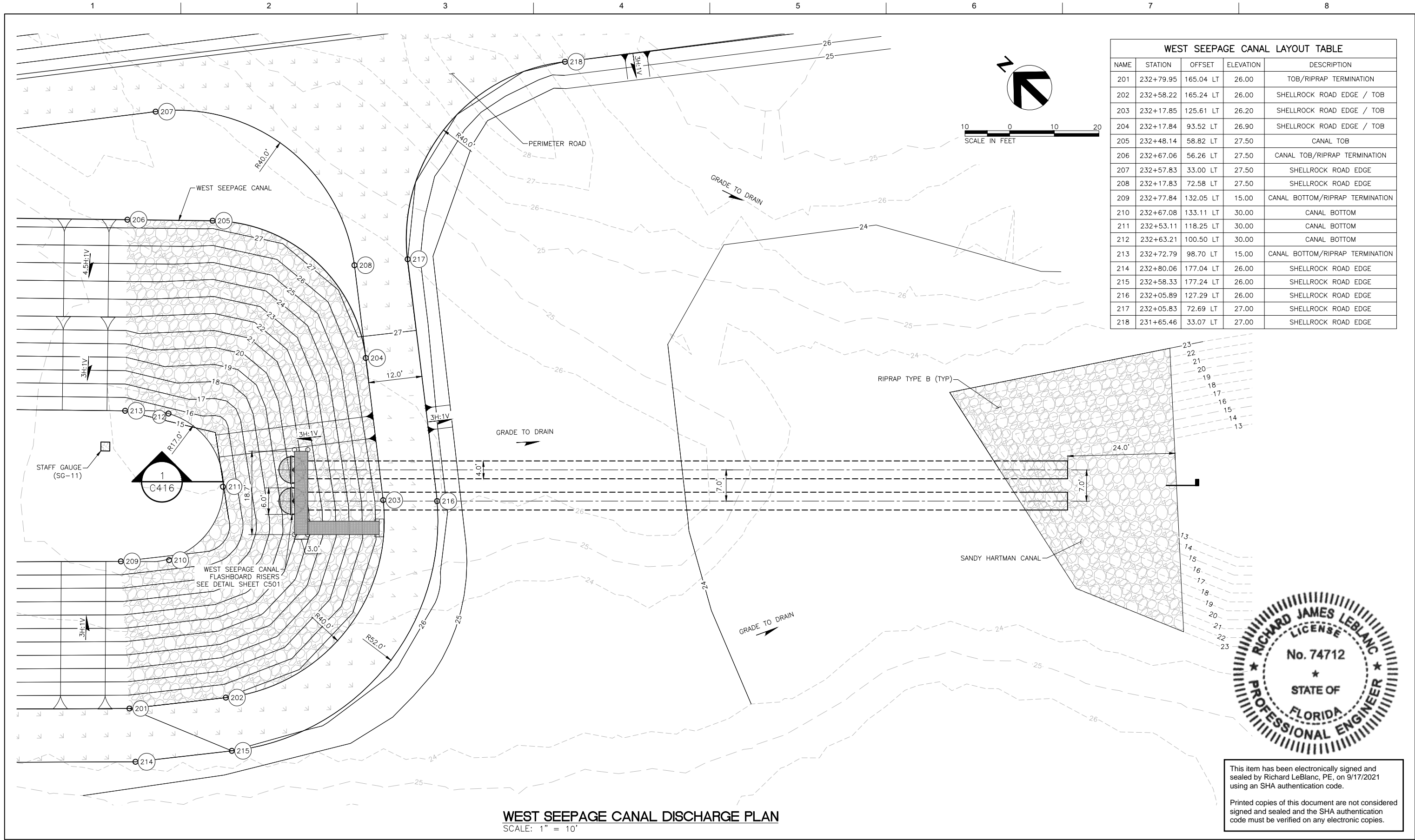
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL PRIMARY DISCHARGE STRUCTURE SECTIONS

0 1 2
READY TO ADVERTISE

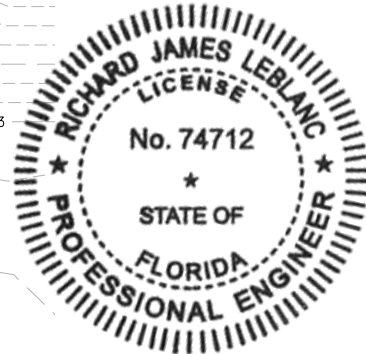
SHEET 51 of 92
SCALE VARIES

DRAWING
C414



WEST SEEPAGE CANAL LAYOUT TABLE					
NAME	STATION	OFFSET	ELEVATION	DESCRIPTION	
201	232+79.95	165.04	LT	26.00	TOB/RIPRAP TERMINATION
202	232+58.22	165.24	LT	26.00	SHELLROCK ROAD EDGE / TOB
203	232+17.85	125.61	LT	26.20	SHELLROCK ROAD EDGE / TOB
204	232+17.84	93.52	LT	26.90	SHELLROCK ROAD EDGE / TOB
205	232+48.14	58.82	LT	27.50	CANAL TOB
206	232+67.06	56.26	LT	27.50	CANAL TOB/RIPRAP TERMINATION
207	232+57.83	33.00	LT	27.50	SHELLROCK ROAD EDGE
208	232+17.83	72.58	LT	27.50	SHELLROCK ROAD EDGE
209	232+77.84	132.05	LT	15.00	CANAL BOTTOM/RIPRAP TERMINATION
210	232+67.08	133.11	LT	30.00	CANAL BOTTOM
211	232+53.11	118.25	LT	30.00	CANAL BOTTOM
212	232+63.21	100.50	LT	30.00	CANAL BOTTOM
213	232+72.79	98.70	LT	15.00	CANAL BOTTOM/RIPRAP TERMINATION
214	232+80.06	177.04	LT	26.00	SHELLROCK ROAD EDGE
215	232+58.33	177.24	LT	26.00	SHELLROCK ROAD EDGE
216	232+05.89	127.29	LT	26.00	SHELLROCK ROAD EDGE
217	232+05.83	72.69	LT	27.00	SHELLROCK ROAD EDGE
218	231+65.46	33.07	LT	27.00	SHELLROCK ROAD EDGE

WEST SEEPAGE CANAL DISCHARGE PLAN
SCALE: 1" = 10'



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4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

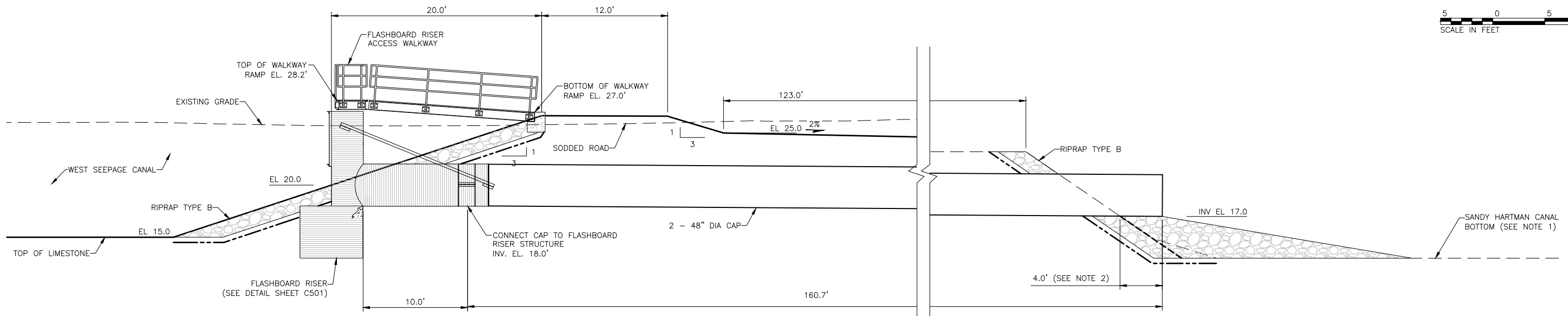
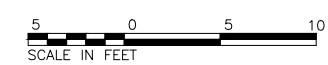
0 1" 2"
READY TO ADVERTISE

**CIVIL
WEST SEEPAGE CANAL DISCHARGE
LAYOUT AND GRADING PLAN**

SHEET 52 of 92
SCALE 1" = 10'

DRAWING
C415

- NOTES:
1. BOTTOM OF CANAL SHALL COINCIDE WITH TOP OF LIMESTONE LAYER. SEE SHEET B100, B200, AND B201 FOR GEOTECHNICAL BORING LOGS AND LOCATIONS.
 2. PROVIDE 4' OF ADDITIONAL RIPRAP PROTECTION BENEATH PIPE EXTENSION FROM PROPOSED SLOPE. ADDITIONAL RIPRAP SHALL EXTEND TO THE TOP OF LIMESTONE AT A SLOPE NO STEEPER THAN 2H:1V.



WEST SEEPAGE CANAL DISCHARGE SECTION
SCALE: 1" = 5'



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE	
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

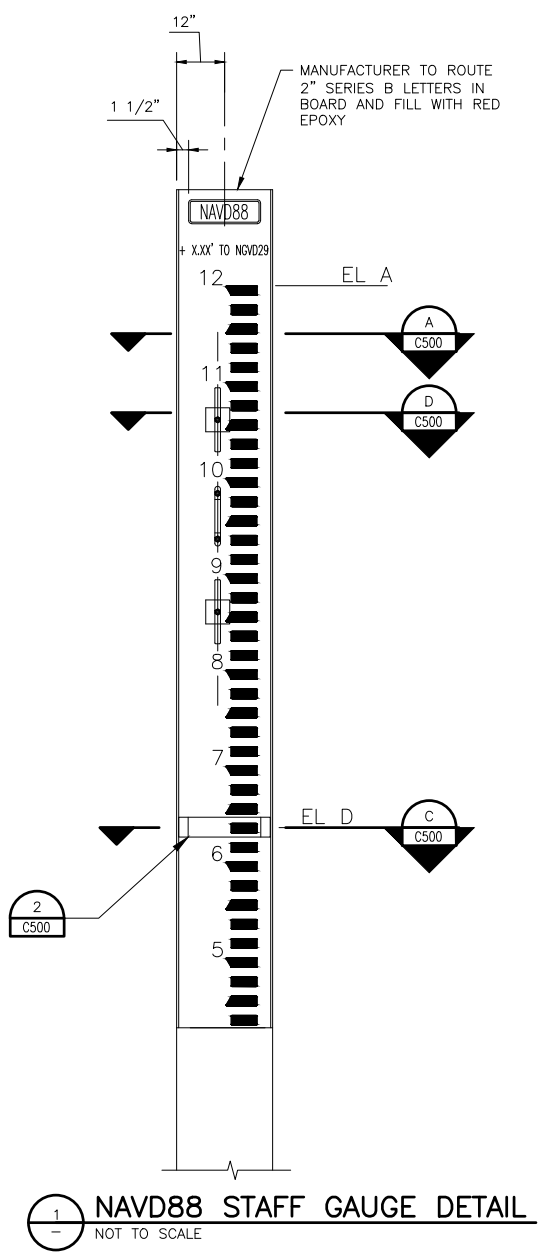
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
WEST SEEPAGE CANAL DISCHARGE
SECTIONS**

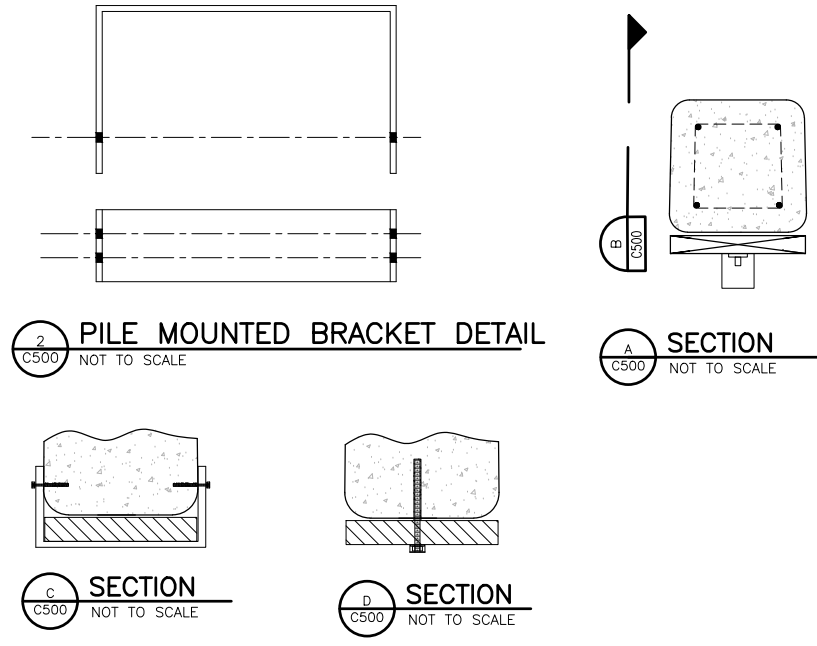
0 1 2
READY TO ADVERTISE

SHEET 53 of 92
SCALE 1" = 5'

DRAWING
C416



1 NAVD88 STAFF GAUGE DETAIL
NOT TO SCALE



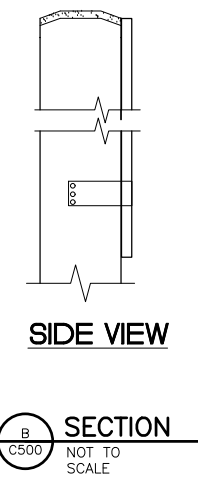
2 PILE MOUNTED BRACKET DETAIL
NOT TO SCALE

A SECTION
C500 NOT TO SCALE

B SECTION
C500 NOT TO SCALE

C SECTION
C500 NOT TO SCALE

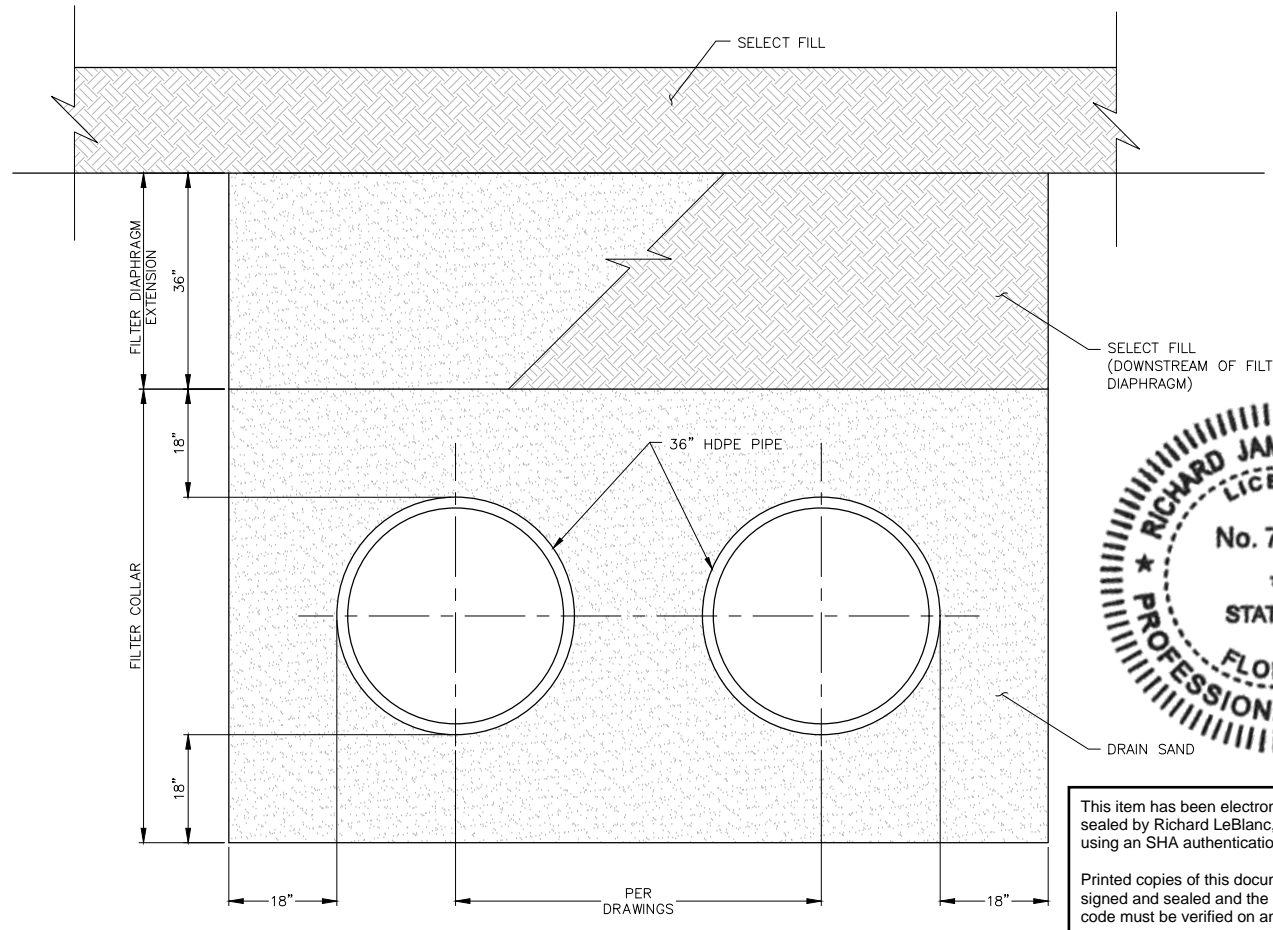
D SECTION
C500 NOT TO SCALE



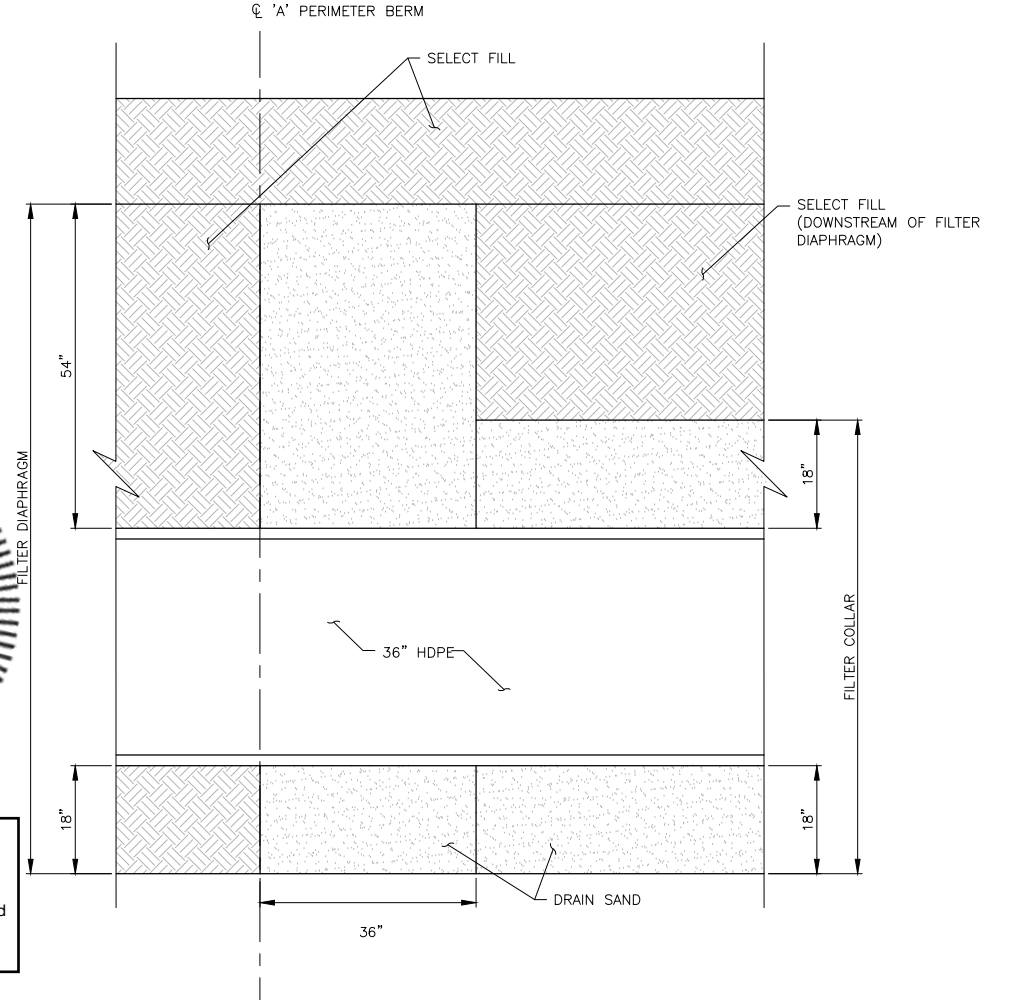
SIDE VIEW

B SECTION
C500 NOT TO SCALE

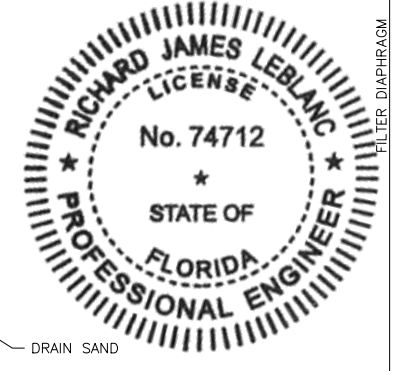
STAFF GAUGE SCHEDULE						
LOCATION	STAFF GAUGE NAME	DRAWING SHEET NO.	TOP OF GAUGE STRIP EL. A (NAVD 88)	CANAL BOTTOM EL. B (NAVD 88)	NORMAL WATER LEVEL EL. C (NAVD 88)	LOW WATER LEVEL EL. D (NAVD 88)
STA 335+50	SG-1	C102	27.0	24.0	25.0	24.0
STA 335+81	SG-2	C102	28.0	15.0	24.0	19.0
STA 126+20	SG-3	C103	28.0	15.0	24.0	19.0
STA 127+60	SG-4	C103	32.0	24.0	28.0	25.0
STA 133+73	SG-5	C103	27.0	24.0	25.0	24.0
STA 134+40	SG-6	C103	28.0	15.0	24.0	19.0
STA 135+62	SG-7	C103	28.0	15.0	24.0	19.0
STA 221+98	SG-8	C107	28.0	15.0	24.0	19.0
STA 226+33	SG-9	C108	32.0	13.0	28.0	25.0
STA 226+89	SG-10	C108	32.0	24.0	28.0	25.0
STA 232+77	SG-11	C108	28.0	15.0	24.0	19.0
STA 334+39	SG-12	C102	28.0	13.0	22.0	15.0



3 PRIMARY DISCHARGE PIPE FILTER DIAPHRAGM AND COLLAR DETAIL
NOT TO SCALE



4 PRIMARY DISCHARGE PIPE FILTER DIAPHRAGM AND COLLAR PROFILE
NOT TO SCALE



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- NOTES:
- THE CONCRETE PILE MOUNTED STAFF GAUGES SHALL BE ADJUSTABLE. REFER TO SPECIFICATION SECTION 02781 FOR STAFF GAUGES ADDITIONAL INFORMATION.
 - HARDWARE:
 - ALL SCREWS, BOLTS, NUTS AND WASHERS SHALL BE TYPE 316 SS UNLESS NOTED OTHERWISE.
 - THE HANDLE SHALL BE A CAST TYPE 316 SS PULL HANDLE W/ FOUR THROUGH HOLES (TWO EACH SIDE), RECTANGULAR GRIP, FOUR M6 SCREWS.
 - FASTEN SS BRACKET TO CONCRETE USING 3/16" DIA SS HEX HEAD CONCRETE SCREWS, 3 1/2" LONG (2 TYP EACH SIDE)
 - PRECAST CONCRETE PILES SHALL CONFORM TO TECHNICAL SPECIFICATION SECTION 02781.
 - DATUM OFFSET SHALL BE INDEPENDENTLY VERIFIED AND CORRECTED BY A PROFESSIONAL SURVEYOR AND MAPPER LICENSED IN THE STATE OF FLORIDA.
 - NO BRACING OR CONNECTION WILL BE MADE TO WALKWAYS OR STRUCTURES UNLESS APPROVED BY THE CONTRACTING OFFICE.
 - LOWEST GAUGE SECTION SHOULD BE AS LOW AS OR LOWER THAN MEAN LOW WATER IF POSSIBLE.
 - A ROUTED GROOVE WILL BE PROVIDED AT EACH HANDLE.
 - SERIES LETTERS BASED ON FEDERAL HIGHWAY ADMINISTRATION STANDARD ALPHABETS FOR TRAFFIC CONTROL DEVICES.



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE

PROJECT NUMBER 10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

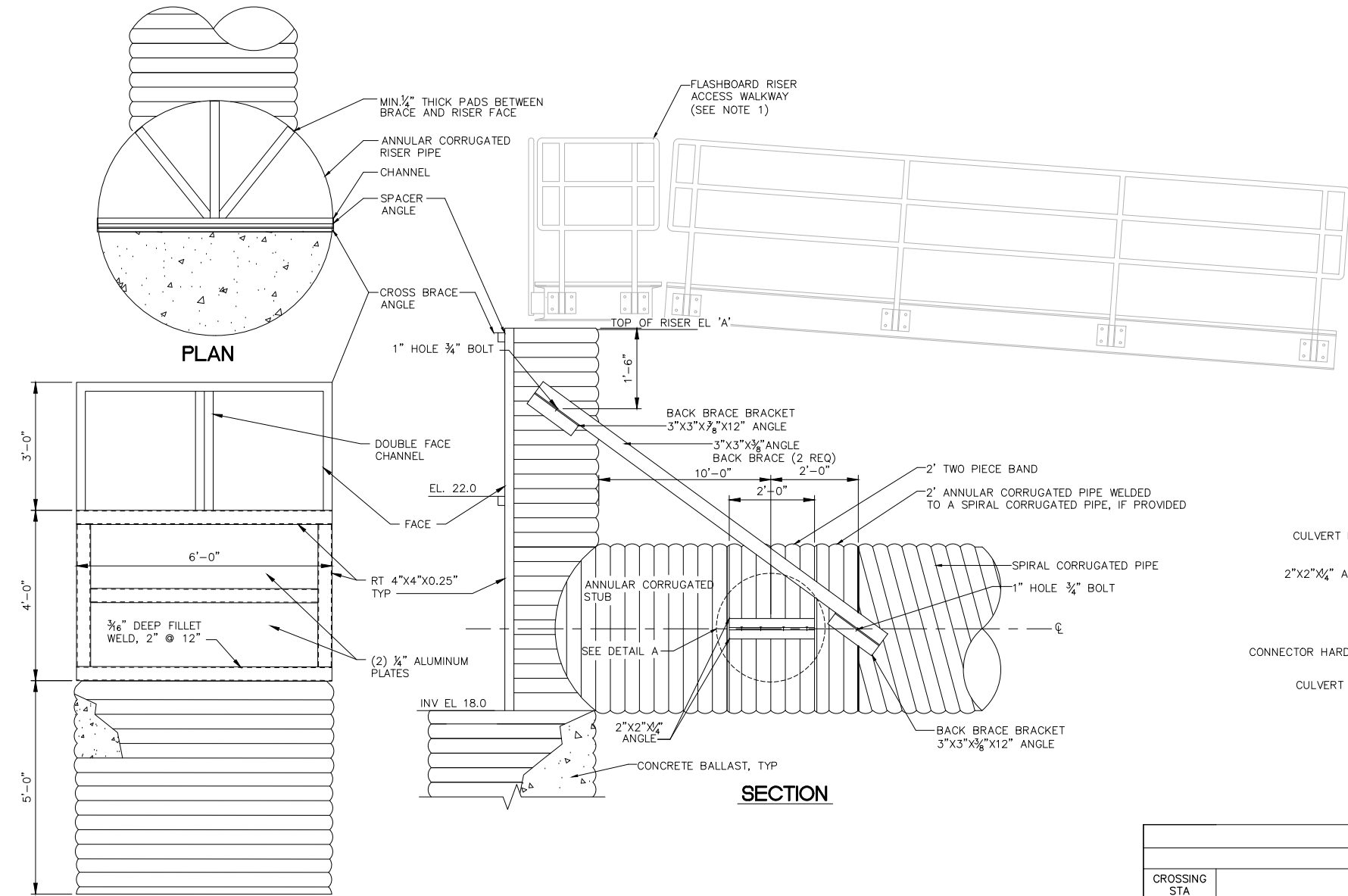
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
STAFF GAUGE AND FILTER DETAILS**

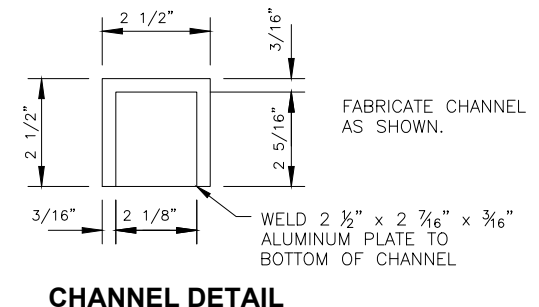
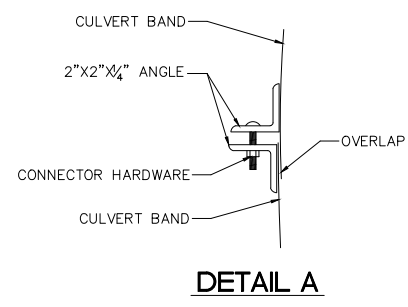
0 1" 2"
READY TO ADVERTISE

SHEET 54 of 92
SCALE NOT TO SCALE

DRAWING
C500



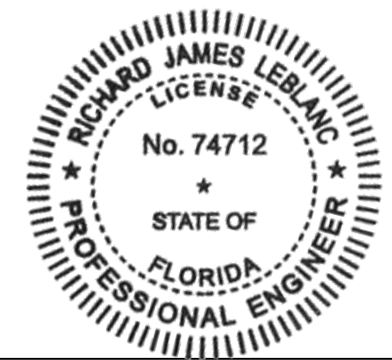
- NOTES:
1. REFER TO DRAWING S300 FOR ACCESS WALKWAY DETAIL.
 2. PROVIDE FLASHBOARDS MANUFACTURED OF TREATED WOOD AT ALL LOCATIONS OUTLINED ON SCHEDULE. FLASHBOARDS SHALL BE INSTALLED WITHIN THE RUNNER FRAME OF THE ALUMINUM FLASHBOARD RISER.
 3. PROVIDE FLASHBOARDS 5-FT IN TOTAL HEIGHT FOR ALL FLASHBOARD RISER SYSTEMS.



1 FLASHBOARD RISER DETAIL
NOT TO SCALE

CROSSING STA	CULVERT		FLASHBOARD		RISER			
	NAME	QTY	SIZE (IN)	INV EL	BOARD WIDTH* (IN)	FACE GA	FRAME WIDTH (IN)	TOP OF RISER EL. 'A'
134+50	NORTH AND EAST SEEPAGE CANAL FLASHBOARD RISER	2	48	18.0	36	12	74	27.0'
222+50	EAST SEEPAGE CANAL FLASHBOARD RISER	2	48	18.0	36	12	74	27.0'
232+50	WEST SEEPAGE CANAL FLASHBOARD RISER	2	48	18.0	36	12	74	27.0'
335+50	NORTH AND WEST SEEPAGE CANAL FLASHBOARD RISER	2	48	18.0	36	12	74	27.0'

* BOARD WIDTH IS NOMINAL. ACTUAL BOARD WIDTH SHALL FIT WITHIN FRAME TO COVER RISER OPENING.



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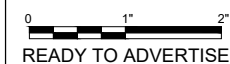


ISSUE	DATE	DESCRIPTION

PROJECT NUMBER 10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

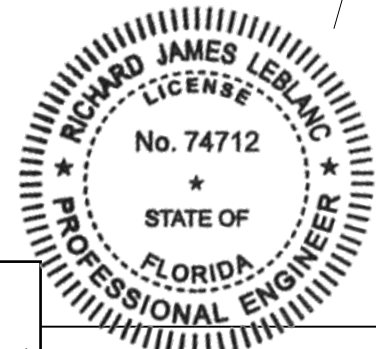
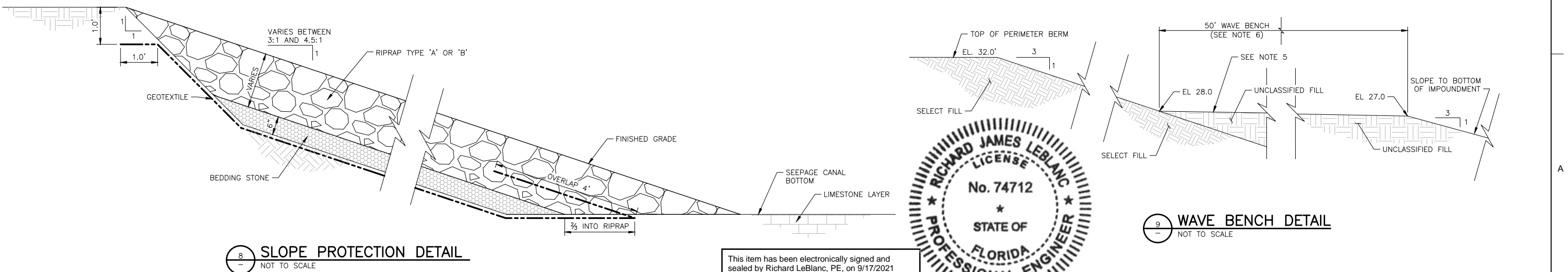
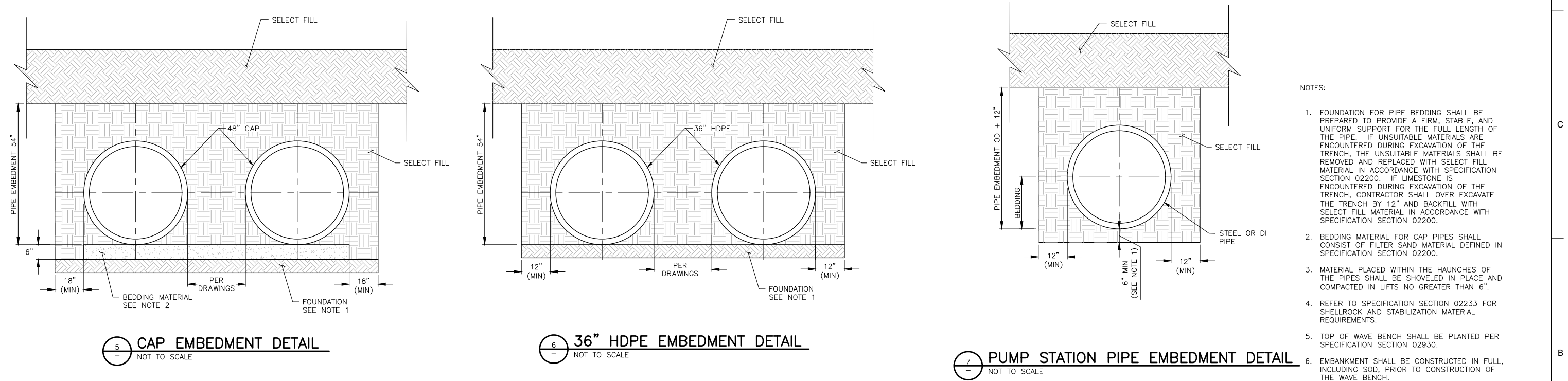
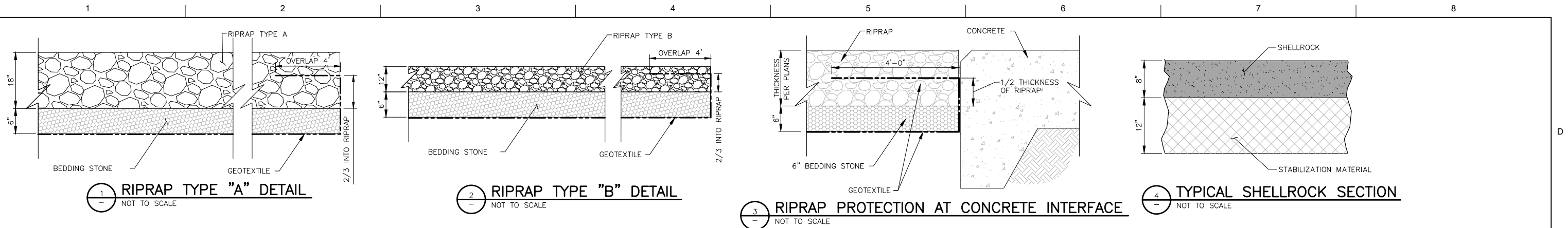
**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399



**CIVIL
FLASHBOARD RISER DETAILS**

SHEET 55 of 92
SCALE NOT TO SCALE

DRAWING
C501



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE

PROJECT NUMBER 10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

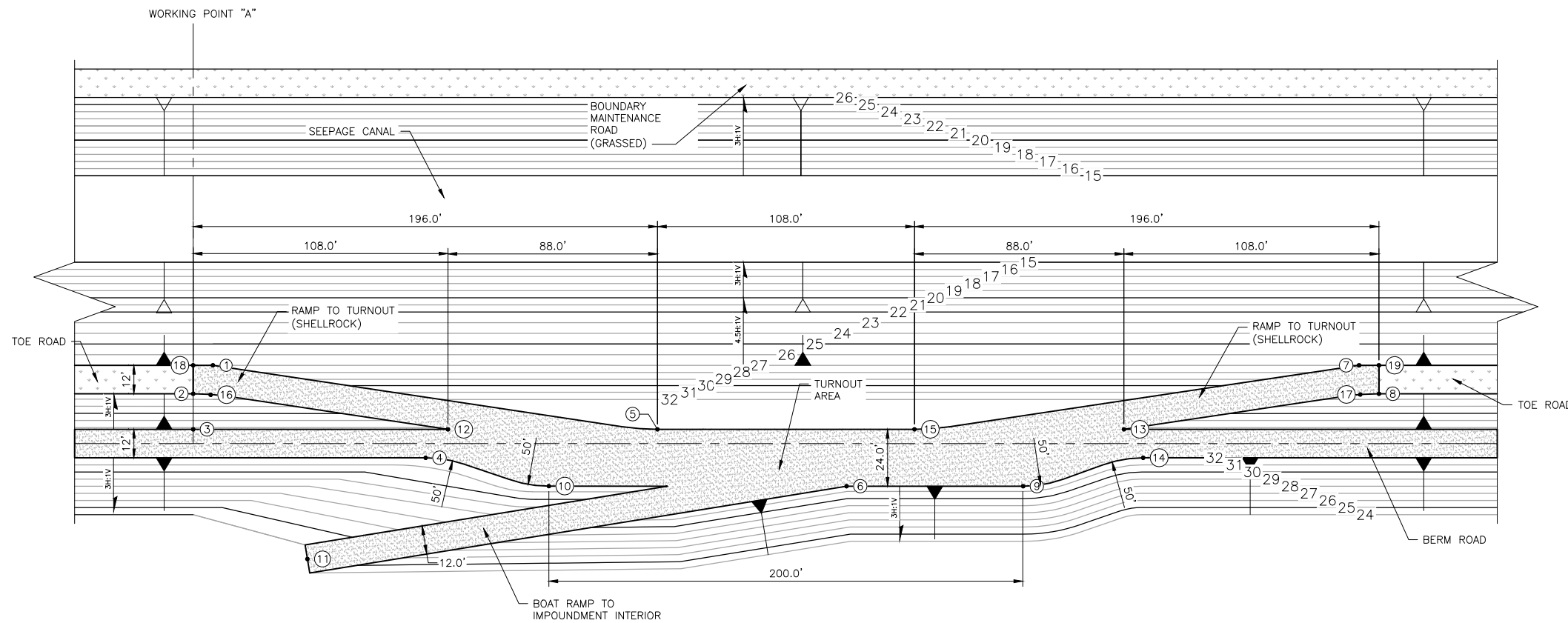
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL RIPRAP, PIPE INSTALLATION, AND WAVE BENCH DETAILS

0 1" 2"
READY TO ADVERTISE

SHEET 56 of 92
SCALE NOT TO SCALE

DRAWING **C502**



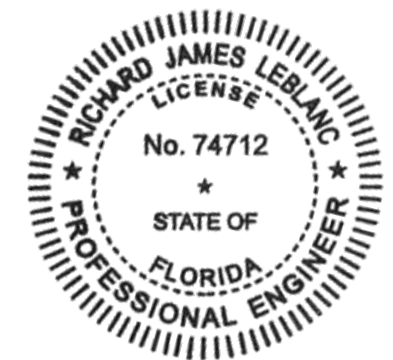
TURNOUT TYPICAL DETAIL

SCALE: 1"=30'

- 1
- C102
- C104
- C105
- C106
- C109
- C111
- C112

WORKING POINT "A"
STATION
107+00
180+50
207+50
261+50
298+50
325+50

POINT TABLE				
POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	8120.66	3372.07	27.00	BEGIN TURNOUT RAMP
2	8108.66	3363.75	27.24	START OF SHELLROCK
3	8093.65	3363.75	32.24	TOP OF BERM ROAD
4	8081.65	3461.78	32.00	BEGIN TURNOUT DEFLECTION
5	8093.65	3559.55	32.24	INTERSECTION OF TURNOUT RAMP
6	8069.67	3639.30	31.74	START OF BOAT RAMP
7	8120.66	3855.42	27.00	BEGIN TURNOUT RAMP
8	8108.66	3863.80	27.24	BEGIN SHELLROCK
9	8069.67	3713.75	31.74	EDGE OF TURNOUT
10	8069.67	3513.75	31.74	EDGE OF TURNOUT
11	8038.96	3411.93	24.00	END OF SHELLROCK
12	8093.65	3471.20	32.24	INTERSECTION OF BERM ROAD AND TURNOUT RAMP
13	8093.65	3756.29	32.24	INTERSECTION OF BERM ROAD AND TURNOUT RAMP
14	8081.65	3764.39	32.00	EDGE OF BERM ROAD
15	8093.65	3667.94	32.24	INTERSECTION OF TURNOUT RAMP
16	8108.26	3371.11	27.56	BEGIN TURNOUT RAMP
17	8108.34	3855.93	27.56	BEGIN TURNOUT RAMP
18	8120.66	3363.75	0.00	START OF SHELLROCK
19	8120.66	3863.80	27.00	BEGIN SHELLROCK



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4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

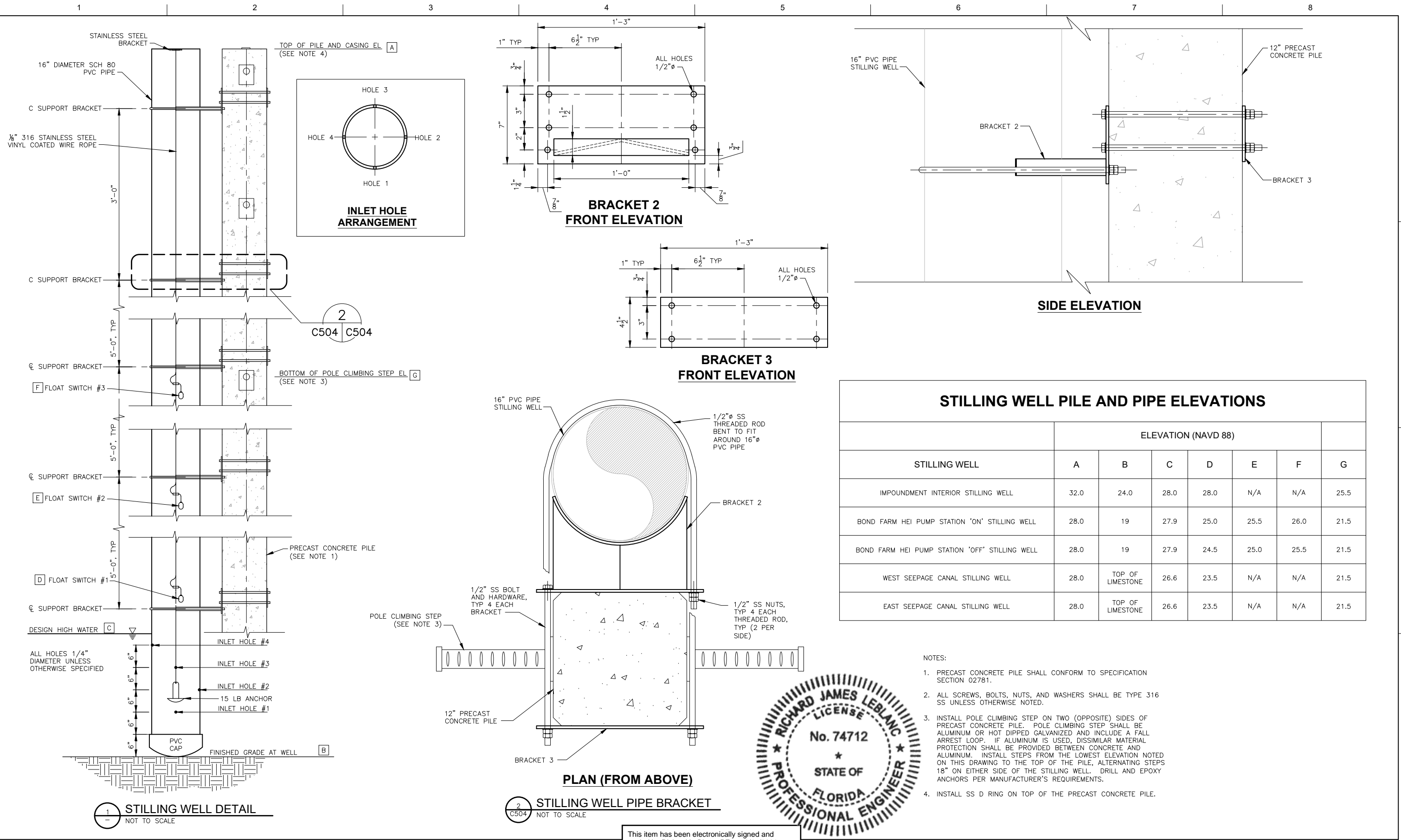
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL TURNOUT DETAILS

0 1 2
READY TO ADVERTISE

SHEET 57 of 92
SCALE 1" = 30'

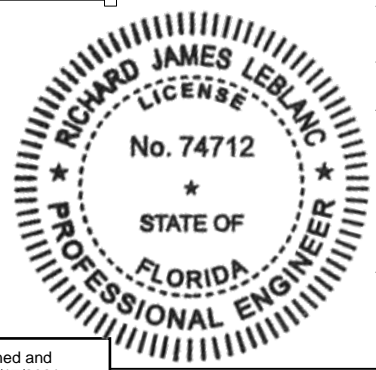
DRAWING
C503



STILLING WELL PILE AND PIPE ELEVATIONS

STILLING WELL	ELEVATION (NAVD 88)						
	A	B	C	D	E	F	G
IMPOUNDMENT INTERIOR STILLING WELL	32.0	24.0	28.0	28.0	N/A	N/A	25.5
BOND FARM HEI PUMP STATION 'ON' STILLING WELL	28.0	19	27.9	25.0	25.5	26.0	21.5
BOND FARM HEI PUMP STATION 'OFF' STILLING WELL	28.0	19	27.9	24.5	25.0	25.5	21.5
WEST SEEPAGE CANAL STILLING WELL	28.0	TOP OF LIMESTONE	26.6	23.5	N/A	N/A	21.5
EAST SEEPAGE CANAL STILLING WELL	28.0	TOP OF LIMESTONE	26.6	23.5	N/A	N/A	21.5

- NOTES:
1. PRECAST CONCRETE PILE SHALL CONFORM TO SPECIFICATION SECTION 02781.
 2. ALL SCREWS, BOLTS, NUTS, AND WASHERS SHALL BE TYPE 316 SS UNLESS OTHERWISE NOTED.
 3. INSTALL POLE CLIMBING STEP ON TWO (OPPOSITE) SIDES OF PRECAST CONCRETE PILE. POLE CLIMBING STEP SHALL BE ALUMINUM OR HOT DIPPED GALVANIZED AND INCLUDE A FALL ARREST LOOP. IF ALUMINUM IS USED, DISSIMILAR MATERIAL PROTECTION SHALL BE PROVIDED BETWEEN CONCRETE AND ALUMINUM. INSTALL STEPS FROM THE LOWEST ELEVATION NOTED ON THIS DRAWING TO THE TOP OF THE PILE, ALTERNATING STEPS 18" ON EITHER SIDE OF THE STILLING WELL. DRILL AND EPOXY ANCHORS PER MANUFACTURER'S REQUIREMENTS.
 4. INSTALL SS D RING ON TOP OF THE PRECAST CONCRETE PILE.



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

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RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

CIVIL GENERAL SITE DETAILS (1 OF 2)

0 1" 2"
READY TO ADVERTISE

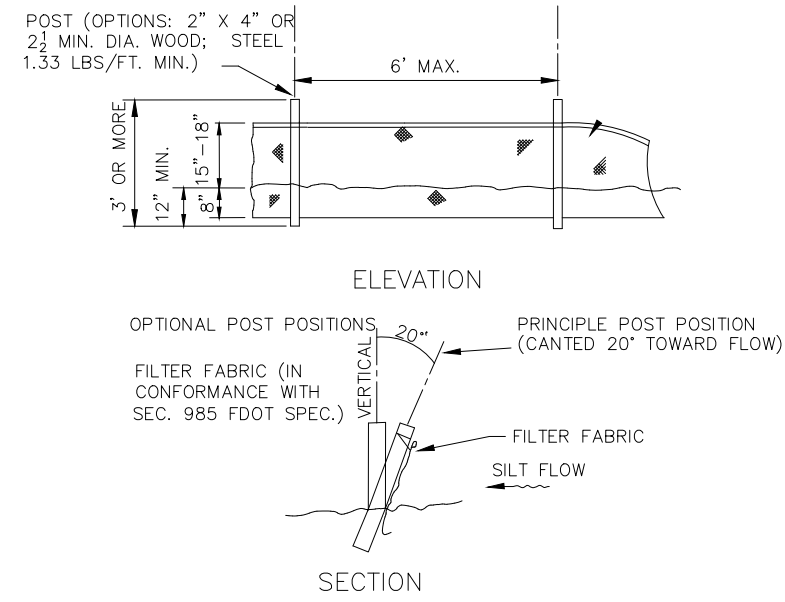
SHEET 58 of 92
SCALE NOT TO SCALE

DRAWING **C504**

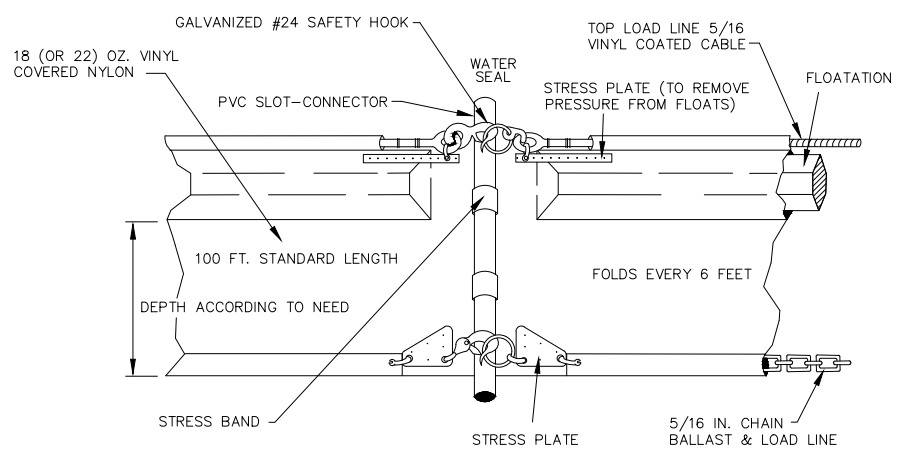
GENERAL EROSION & SEDIMENT CONTROL NOTES

- THE CONTRACTOR SHALL PREPARE AND OBTAIN APPROVAL OF AN EROSION AND SEDIMENT CONTROL PLAN IN ACCORDANCE WITH SPECIFICATION SECTION 02435, AND THESE PLANS.
- ALL PRACTICABLE AND NECESSARY EFFORTS SHALL BE MADE DURING CONSTRUCTION TO CONTROL AND PREVENT EROSION AND TRANSPORT OF SEDIMENT MATERIAL TO DRAINAGE DITCHES AND CANALS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL RESTORATION EFFORTS THAT MAY BE REQUIRED.
- PROVIDE ALL DISTURBED AREAS WITHIN THE LIMITS OF THE WORK WITH TEMPORARY SOIL EROSION CONTROL AND SEDIMENT CONTROL. UTILIZE EARTH DAMS & PONDS, GRADE TO DRAIN SWALES, SETTLING BASINS, SILT FENCES, HAY BALE FILTERS, ETC. SOD SHALL BE PLACED IN AREAS WHICH MAY REQUIRE IMMEDIATE EROSION PROTECTION TO ENSURE WATER QUALITY STANDARDS ARE MAINTAINED. TREAT ALL SOIL SURFACES IN ACCORDANCE WITH THESE PLANS AND SPECIFICATIONS AFTER GRADING.
- ALL SOIL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE AND MAINTAINED THROUGH PROJECT COMPLETION.
- CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND AIR AND WATER POLLUTION WILL BE MINIMIZED. FEDERAL, STATE, AND LOCAL LAWS SHALL BE COMPLIED WITH AT ALL TIMES.
- MINIMIZE THE AMOUNT OF BARE SOIL EXPOSED AT ONE TIME AND INSTALL SOIL EROSION CONTROL FENCES AS SHOWN AND IN SUCH A MANNER AS TO CAPTURE AND FILTER SURFACE WATER DURING CONSTRUCTION.
- REPLACE OR TREAT UNSUITABLE SOILS BEFORE REVEGETATING DISTURBED AREAS. SEE PROJECT SPECIFICATIONS FOR SOIL REQUIREMENTS.
- ALL NEW EROSION AND SILT CONTROL METHODS AND LOCATIONS INDICATED ON THESE DRAWINGS ARE FOR STARTUP AND GENERAL REFERENCE AND SHALL BE ADJUSTED, AS REQUIRED, TO SUIT THE PROCESS OF THE CONSTRUCTION.
- ALL DISTURBED AREAS WITHIN THE LIMITS OF CONSTRUCTION SHALL RECEIVE VEGETATIVE TREATMENT AFTER FINAL GRADING IN ACCORDANCE WITH THESE PLANS AND SPECIFICATIONS. ALL AREAS OF TEMPORARY CONSTRUCTION ARE TO BE SEEDED AND MULCHED IN ACCORDANCE WITH SPECIFICATION SECTION 02486 AND 02920.
- THE INSTALLATION OF TEMPORARY EROSION CONTROL BARRIERS SHALL BE COORDINATED WITH THE CONSTRUCTION OF THE PERMANENT EROSION CONTROL FEATURES TO THE EXTENT NECESSARY TO ASSURE ECONOMICAL, EFFECTIVE AND CONTINUOUS CONTROL OF EROSION AND WATER POLLUTION THROUGHOUT THE CONSTRUCTION PHASE.
- THE TYPE OF EROSION CONTROL BARRIERS USED SHALL BE GOVERNED BY THE NATURE OF THE CONSTRUCTION OPERATION AND SOIL TYPE THAT WILL BE EXPOSED. SILTY AND CLAYEY MATERIAL USUALLY REQUIRES SOLID SEDIMENT BARRIERS TO PREVENT TURBID WATER DISCHARGE, WHILE SANDY MATERIAL MAY NEED ONLY SILT SCREENS OR HAY BALES TO PREVENT EROSION. FLOATING TURBIDITY CURTAINS SHOULD BE USED IN OPEN WATER SITUATIONS. DIVERSION DITCHES OR SWALES MAY BE REQUIRED TO PREVENT TURBID STORMWATER RUNOFF FROM BEING DISCHARGED TO WETLAND OR OTHER WATER BODIES. IT MAY BE NECESSARY TO EMPLOY A COMBINATION OF BARRIERS, DITCHES, AND OTHER EROSION/TURBIDITY CONTROL MEASURES IF CONDITIONS WARRANT.
- WHERE PUMPS ARE TO BE USED TO PUMP TURBID WATERS FROM THE CONSTRUCTION AREA, THE WATER SHALL BE TREATED TO REDUCE TURBIDITY TO STATE

- WATER QUALITY STANDARDS PRIOR TO DISCHARGE INTO CANALS.
- THE CONTRACTOR SHALL PROVIDE ROUTINE MAINTENANCE OF PERMANENT AND TEMPORARY EROSION CONTROL FEATURES UNTIL THE PROJECT IS COMPLETE AND ALL BARE SOIL IS STABILIZED. SILT ACCUMULATIONS GREATER THAN ONE-HALF THE DEPTH OF THE SILTATION CONTROL BARRIER SHALL BE IMMEDIATELY REMOVED AND PLACED IN AREAS APPROVED BY THE DISTRICT. THE CONTRACTOR SHALL REMOVE SILT FROM SITE IF NOT REUSABLE.
 - WATER REMAINING IN THE EXCAVATIONS AFTER CONSTRUCTION MUST BE KEPT CONFINED WITHIN THE EXCAVATIONS PRIOR TO DISCHARGE (IF APPLICABLE) UNTIL THE TURBIDITY LEVEL OF THE WATER RETURNS TO BACKGROUND LEVELS BASED ON VISUAL INSPECTION.
 - THE CONTRACTOR SHALL PROVIDE SILTATION REDUCTION DEVICES FOR THE DISCHARGE FROM THE DEWATERING PROCESS SO THAT DIRECT DISCHARGE DOES NOT OCCUR.
 - DURING THE CONSTRUCTION OF DRAINAGE STRUCTURES, AND OTHER STRUCTURES REQUIRING EXCAVATION, THE CONTRACTOR SHALL PLACE STRAW BALES AROUND SUCH STRUCTURES TO PREVENT EROSION AND THE MIGRATION OF SEDIMENT TO POINTS OUTSIDE THE CONSTRUCTION AREA.
 - PRIOR TO AND DURING CONSTRUCTION, THE CONTRACTOR SHALL PLACE STRAW BALES AT THE UPSTREAM END OF ALL PIPES UNTIL INLETS ARE COMPLETED.
 - THE CONTRACTOR SHALL SEED OR SOD SWALES PER SPECIFICATION SECTION 02930, IMMEDIATELY AFTER CONSTRUCTION IS COMPLETED.
 - THE CONTRACTOR SHALL CHECK ALL EROSION AND SILTATION CONTROL DEVICES AFTER EACH RAINFALL AND REPAIR OR REPLACE THEM AS REQUIRED AT CONTRACTOR'S EXPENSE.
 - DURING THE LAYOUT OF SEDIMENT CONTROLS, FIELD ADJUSTMENTS SHALL BE MADE AS REQUIRED, SUBJECT TO ENGINEER APPROVAL, TO ACCOMMODATE ACTUAL FIELD CONDITIONS.
 - INSTALL SILT FENCE AT THE TOE OF ALL EMBANKMENT SLOPES AND/OR LIMITS OF CONSTRUCTION, WHICH HAVE NOT BEEN STABILIZED WITH PERMANENT VEGETATION.
 - THE CONTRACTOR SHALL PROVIDE DUST CONTROL AND PROTECT ADJACENT ROADS FROM ACCUMULATION OF SOIL.
 - THE CONTRACTOR SHALL COVER THE CONTRACTOR STAGING AREA WITH SHELLROCK AND GRADE TO PROVIDE POSITIVE DRAINAGE.
 - THE REQUIREMENTS LISTED ABOVE SHALL BE CONSIDERED MINIMUM REQUIREMENTS, AND THE CONTRACTOR SHALL USE WHATEVER METHODS HE OR THE DISTRICT DEEMS NECESSARY TO PREVENT EROSION AND SILTATION AS MAY BE REQUIRED FOR THE PROJECT.
 - UNLESS OTHERWISE NOTED IN THESE PLANS AND/OR CONTRACT DOCUMENTS, EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH FDOT STANDARD SPECIFICATIONS.
 - FOR ANY GROUNDWATER DISCHARGED ON OR OFF-SITE DURING CONSTRUCTION, THE CONTRACTOR SHALL OBTAIN AND CONFORM TO THE REQUIREMENTS OF THE NECESSARY PERMIT(S) FROM THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP).



1 SILT FENCE TYPICAL DETAIL NOT TO SCALE



2 TURBIDITY BARRIER DETAIL NOT TO SCALE



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

RICHARD J LEBLANC, PE
FL PE #74712
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

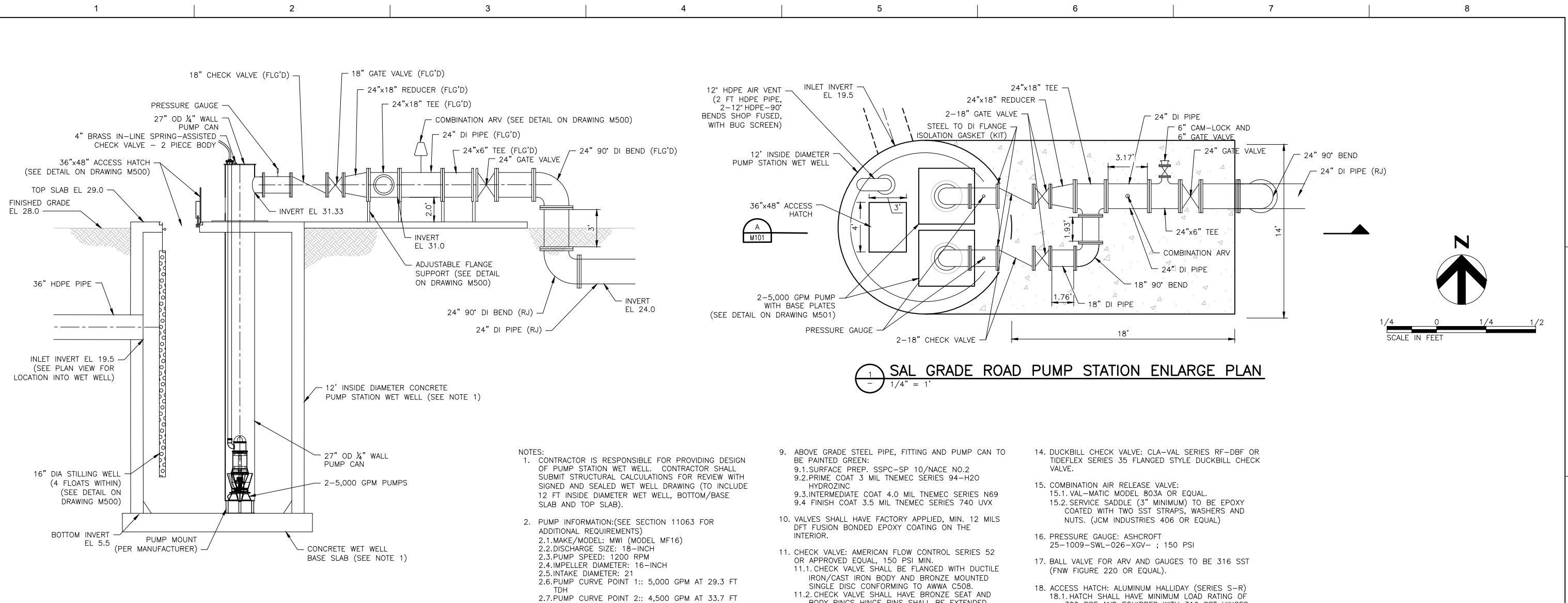
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**CIVIL
EROSION AND SEDIMENT CONTROL
DETAILS**

0 1" 2"
READY TO ADVERTISE

SHEET 60 of 92
SCALE NOT TO SCALE

DRAWING
C506



SAL GRADE ROAD PUMP STATION ELEVATION
 1/4" = 1'

SAL GRADE ROAD PUMP STATION ENLARGE PLAN
 1/4" = 1'

- NOTES:**
- CONTRACTOR IS RESPONSIBLE FOR PROVIDING DESIGN OF PUMP STATION WET WELL. CONTRACTOR SHALL SUBMIT STRUCTURAL CALCULATIONS FOR REVIEW WITH SIGNED AND SEALED WET WELL DRAWING (TO INCLUDE 12 FT INSIDE DIAMETER WET WELL, BOTTOM/BASE SLAB AND TOP SLAB).
 - PUMP INFORMATION:(SEE SECTION 11063 FOR ADDITIONAL REQUIREMENTS)
 - MAKE/MODEL: MWI (MODEL MF16)
 - DISCHARGE SIZE: 18-INCH
 - PUMP SPEED: 1200 RPM
 - IMPELLER DIAMETER: 16-INCH
 - INTAKE DIAMETER: 21
 - PUMP CURVE POINT 1:: 5,000 GPM AT 29.3 FT TDH
 - PUMP CURVE POINT 2:: 4,500 GPM AT 33.7 FT TDH
 - PUMP CAN STEEL
 - THICKNESS:: 1/4-INCH
 - OUTSIDE DIAMETER: 27-INCH
 - MOTOR
 - POWER: 50HP, 460 VOLTS, 3 PHASE, 60A
 - NEMA DESIGN : B
 - NEMA CODE: G
 - RATING: CONTINUOUS
 - INSULATION CLASS: F
 - FRAME: 365
 - FULL LOAD EFFICIENCY: 90.5%
 - FULL LOAD POWER FACTOR: 86.5%
 - STARTING: FULL VOLTAGE
 - WET WELL OPERATING LEVELS:
 - HIGH LEVEL ALARM ELEV.: 23.6 FT
 - PUMP ON ELEV.: 22.6
 - ALL OFF ELEV.: 11.5 FT
 - LOW LEVEL ALARM ELEV.: 10.5 FT
 - WET WELL INTERIOR TO BE COATED WITH SAUREEISEN 210T OR 210GL.
 - TEST PUMPS PER SECTION 11063.
 - TESTING OF PIPING (PRESSURE TEST) TO BE PER SECTION 15106).
 - ABOVE GRADE DUCTILE IRON VALVES AND APPURTENANCES TO BE PAINTED GREEN:
 - SURFACE PREP: NAPF 500-03-05
 - PRIME COAT 4 MIL TNE MEC SERIES N69
 - INTERMEDIATE COAT 4.0 MIL TNE MEC SERIES N69
 - FINISH COAT 3.5 MIL TNE MEC SERIES 740 UVX
 - ABOVE GRADE STEEL PIPE, FITTING AND PUMP CAN TO BE PAINTED GREEN:
 - SURFACE PREP: SSPC-SP 10/NACE NO.2
 - PRIME COAT 3 MIL TNE MEC SERIES 94-H2O HYDROZINC
 - INTERMEDIATE COAT 4.0 MIL TNE MEC SERIES N69
 - FINISH COAT 3.5 MIL TNE MEC SERIES 740 UVX
 - VALVES SHALL HAVE FACTORY APPLIED, MIN. 12 MILS DFT FUSION BONDED EPOXY COATING ON THE INTERIOR.
 - CHECK VALVE: AMERICAN FLOW CONTROL SERIES 52 OR APPROVED EQUAL, 150 PSI MIN.
 - CHECK VALVE SHALL BE FLANGED WITH DUCTILE IRON/CAST IRON BODY AND BRONZE MOUNTED SINGLE DISC CONFORMING TO AWWA C508.
 - CHECK VALVE SHALL HAVE BRONZE SEAT AND BODY RINGS HINGE PINS SHALL BE EXTENDED BRONZE OR 316 SST.
 - GASKETS: SBR OR EPDM.
 - GATE VALVE: AMERICAN FLOW CONTROL SERIES 2500 FLXFL (OS&Y)
 - GATE VALVE SHALL BE RESILIENT SEATED VALVES CONFORMING TO AWWA C515, BODY AND BONNET SHALL BE DUCTILE IRON, 316 SST STEMS, STEM NUT SHALL BE BRONZE/COPPER, WEDGE SHALL BE DUCTILE IRON FULLY ENCAPSULATED IN EPDM RUBBER WITH THE LETTERS "EPDM" EMBOSSED OR FORMED INTO THE WEDGE.
 - VALVE SHALL HAVE FLANGED ENDS WITH OUTSIDE STEM & YOKE (OS&Y) AND BE EQUIPPED WITH MANUFACTURER- STANDARD HEAVY DUTY GEAR TYPE ACTUATORS WITH HANDWHEEL.
 - GASKETS: SBR OR EPDM.
 - DI PIPE AND FITTINGS TO BE CLASS 250 AMERICAN DUCTILE IRON PIPE COMPANY, ANSI/AWWA A21.50/C150.
 - ABOVE GRADE: FLANGED TO MATCH PUMP DISCHARGE HOLE SPACING, ANSI/AWWA A21.15/C115.
 - CEMENT LINING PER ANSI/AWWA A21.4/C104, ASTM A746.
 - BELOW GROUND PIPING TO HAVE ASPHALTIC COATING WITH GREEN STRIPE AND "STORMWATER" PRINTED EVERY 10 FEET.
 - BELOW GROUND PIPING TO BE POLYWRAPPED IN GREEN POLYETHYLENE (PER AWWA C104/ANSI A21.5)
 - FITTINGS PER ANSI/AWWA A21.53/C104, ASTM A746.
 - GASKETS: SBR OR EPDM.
 - DUCKBILL CHECK VALVE: CLA-VAL SERIES RF-DBF OR TIDEFLEX SERIES 35 FLANGED STYLE DUCKBILL CHECK VALVE.
 - COMBINATION AIR RELEASE VALVE:
 - VAL-MATIC MODEL 803A OR EQUAL.
 - SERVICE SADDLE (3" MINIMUM) TO BE EPOXY COATED WITH TWO SST STRAPS, WASHERS AND NUTS. (JCM INDUSTRIES 406 OR EQUAL)
 - PRESSURE GAUGE: ASHCROFT 25-1009-SWL-026-XGV- ; 150 PSI
 - BALL VALVE FOR ARV AND GAUGES TO BE 316 SST (FNW FIGURE 220 OR EQUAL).
 - HATCH: ALUMINUM HALLIDAY (SERIES S-R)
 - HATCH SHALL HAVE MINIMUM LOAD RATING OF 300 PSF AND EQUIPPED WITH 316 SST HINGES, HASP, AND A DEVICE TO LOCK THE DOORS IN AN OPEN POSITION WHEN THE LID IS RAISED. HATCH SHALL HAVE 2 COATS OF BITUMASTIC EPOXY, 16 MILS DFT.
 - WET WELL LEVEL FLOATS: MDI PRODUCTS OR CONNERY MANUFACTURING FLOAT SWITCH.
 - WET WELL TO BE PRECAST, MANUFACTURED BY OLD CASTLE OR APPROVED EQUAL.
 - ALL EXTERNAL BOLTS, NUTS, AND WASHERS SHALL BE 316 SST.
 - PIPE SUPPORTS TO BE PER DETAIL 1, DRAWING M500.
 - AREA WITHIN FENCE LINE TO BE RESTORED WITH 4-INCHES OF NO. 57 STONE.
 - 4" BRASS IN-LINE SPRING-ASSISTED CHECK VALVE TO BE 2 PIECE BODY, MANUFACTURER TO BE DURACHOICE (ISO 9001) OR EUQAL, WORKING PRESSURE 200 PSI (WOG), NPT THREADED ENDS ANSI B1.20.1), BODY-BRASS, CAP-BRASS, STEM-PLASTICS.
 - SUBMITTALS FOR PIPE AND MATERIALS SHALL BE PROVIDED IN ACCORDANCE WITH SPECIFICATIONS 01300 AND 15106.



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

HEATHER MANGANIELLO, PE
 FL PE #68385
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

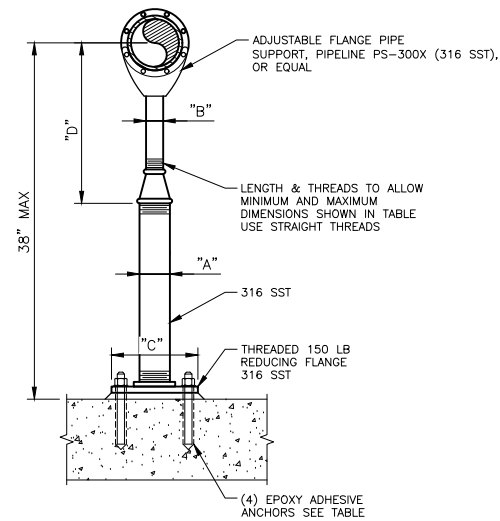
**MECHANICAL
 SAL GRADE ROAD PUMP STATION
 ENLARGED PLAN AND SECTIONS**

0 1" 2"
 READY TO ADVERTISE

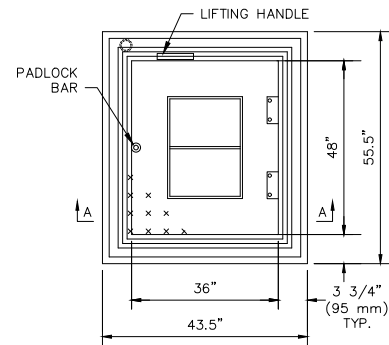
SHEET 62 of 92
 SCALE 1/4" = 1'

DRAWING
M101

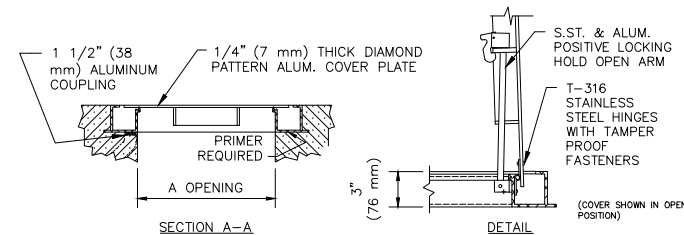
FLOOR PIPE SUPPORT SCHEDULE							
DIMENSIONS IN INCHES							
PIPE SIZE	"A"	"B"	"C"	"D"		ANCHORS	
				MINIMUM	MAXIMUM	DIA	EMBED
18	4	3	11	19 1/2	24	3/4	6 5/8
24	6	4	13 1/2	20 1/2	28 1/2	3/4	6 5/8



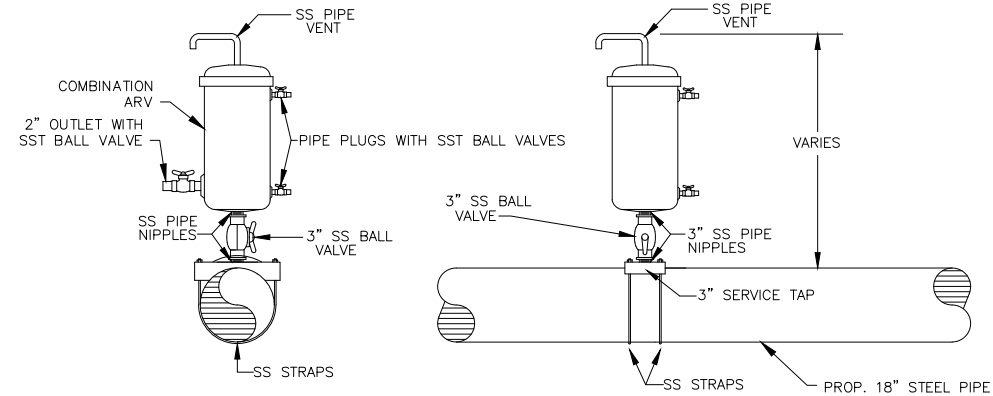
1 ADJUSTABLE FLANGE PIPE SUPPORT DETAIL
M101 NOT TO SCALE



STANDARD SIZES					
QTY.	MANUFACTURER	MODEL NO.	OPENING A INCHES (mm)	OPENING B INCHES (mm)	UNIT WT. LBS. (kg.)
1	HALLIDAY PRODUCTS	WIR3648	36 (914)	48 (1219)	97 (44)

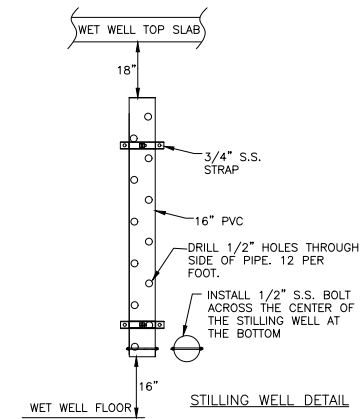


2 HATCH DETAIL
M101 NOT TO SCALE

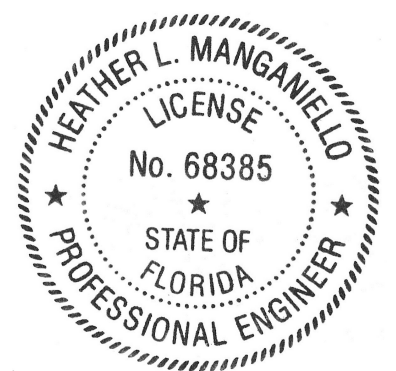


- NOTES:
- SERVICE TAP SADDLE (3" MIN.) TO BE EPOXY COATED WITH TWO SS STRAPS, WASHERS & NUTS.
 - AIR, VACUUM OR COMBINATION RELEASE VALVES TO BE VAL-MATIC MODEL 803A OR EQUIVALENT.

3 AIR RELEASE VALVE DETAIL
M101 NOT TO SCALE



4 STILLING WELL DETAIL
M101 NOT TO SCALE



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PROJECT MANAGER SUSAN RAY, PE

HEATHER MANGANIELLO, PE
FL PE #68385
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

PROJECT NUMBER 10061267

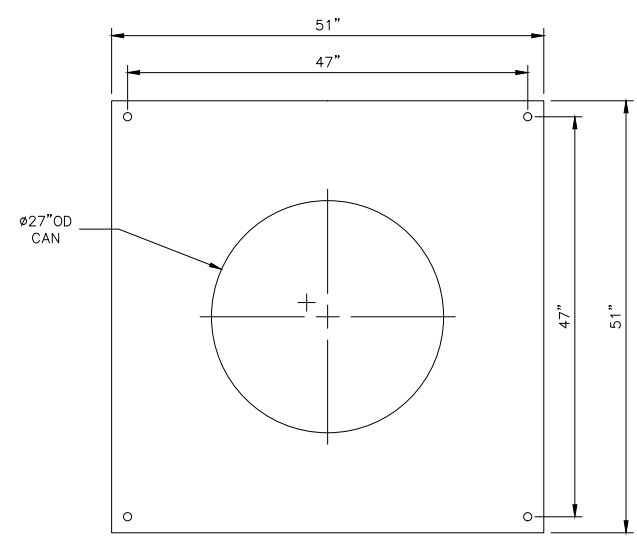
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

MECHANICAL SAL GRADE ROAD PUMP STATION MECHANICAL DETAILS (1 OF 2)

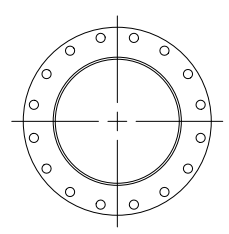
0 1 2
READY TO ADVERTISE

SHEET 63 of 92
SCALE NOT TO SCALE
DRAWING M500



1" THICK BASE PLATE

(16) $\phi 1\frac{1}{4}$ " EQ. SP. HOLES ON A $\phi 22.75$ " BCD
 (2) HOLES STRADDLE VERTICAL CENTERLINE



DISCHARGE FLANGE

NOTES:
 1. $\phi 18$ X ANSI 150# DISCHARGE FLANGE

1 SUBMERSIBLE PUMP DETAILS
 M101 NOT TO SCALE



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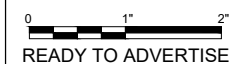
PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

HEATHER MANGANIELLO, PE
 FL PE #68385
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

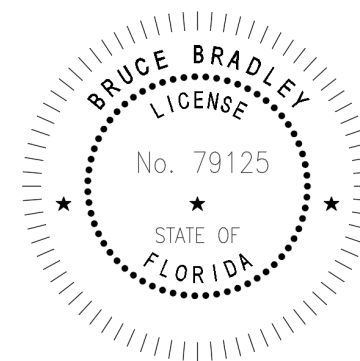
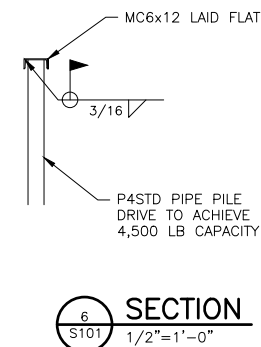
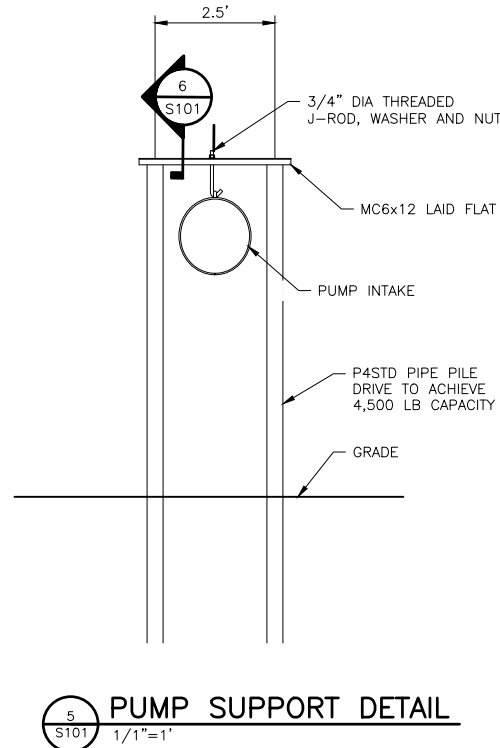
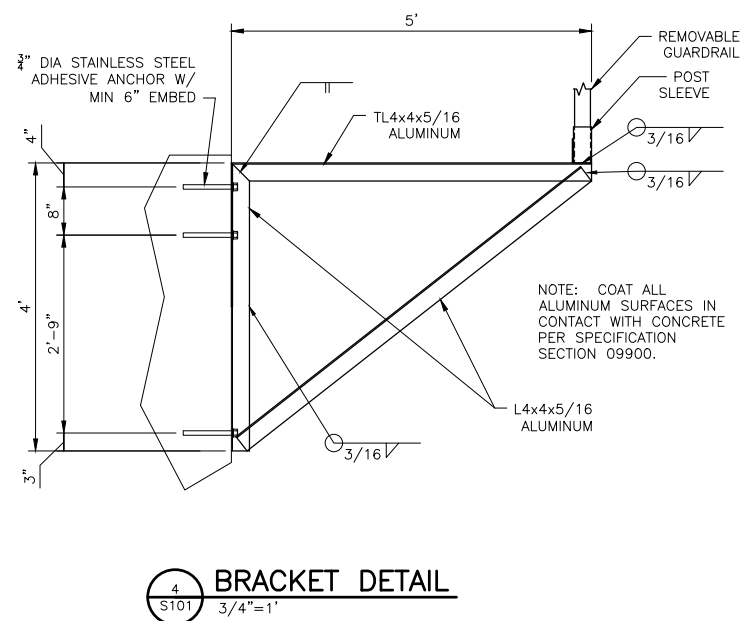
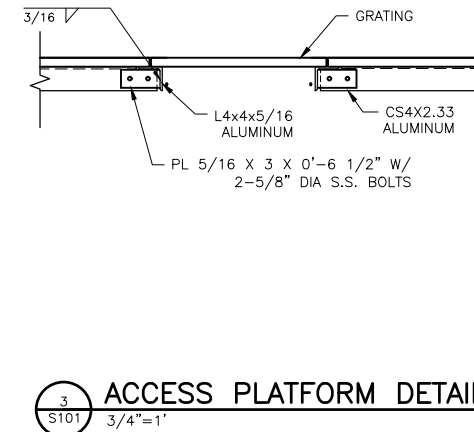
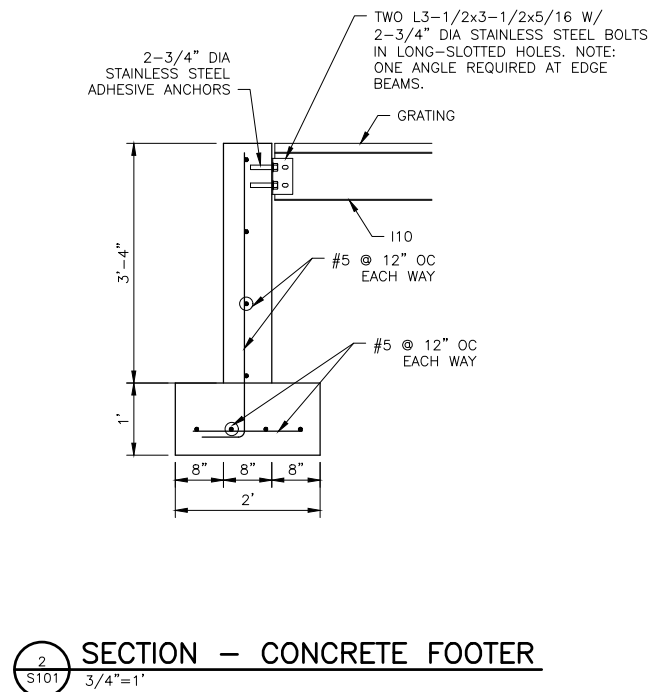
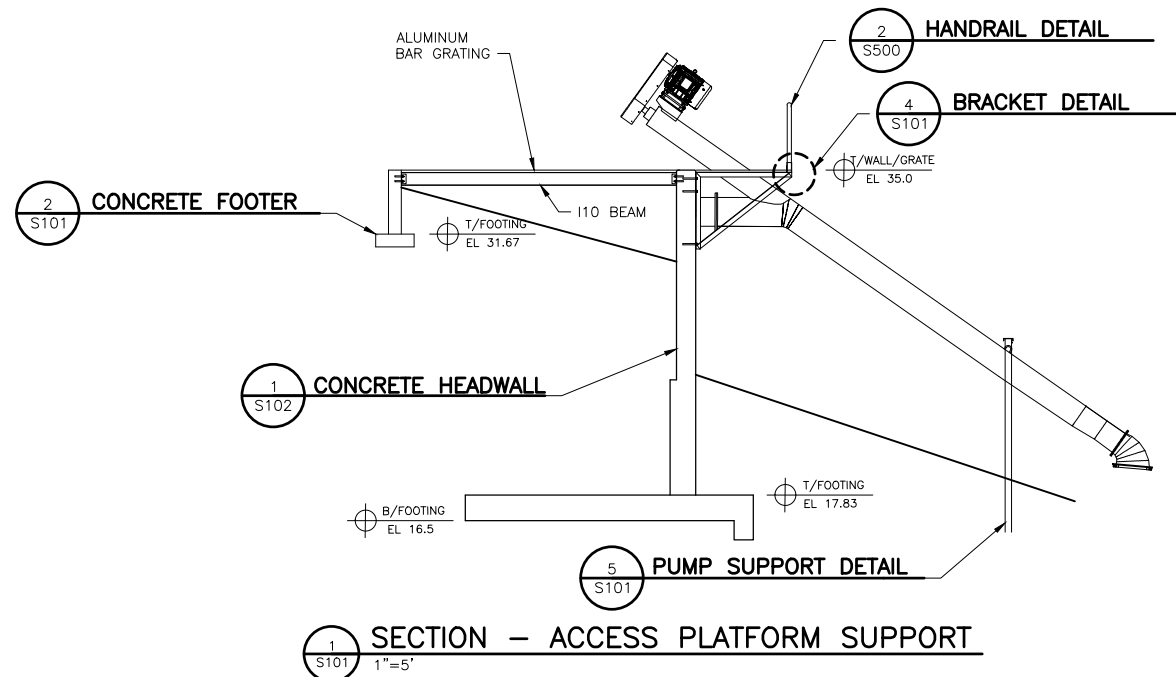
**MECHANICAL
 SAL GRADE ROAD PUMP STATION
 MECHANICAL DETAILS (2 OF 2)**



SHEET 64 of 92
 SCALE NOT TO SCALE

DRAWING
M501

READY TO ADVERTISE



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4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

BRUCE BRADLEY, PE
FL PE #79125
2601 CATTLEMEN RD, STE 400
SARASOTA, FL 34232

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

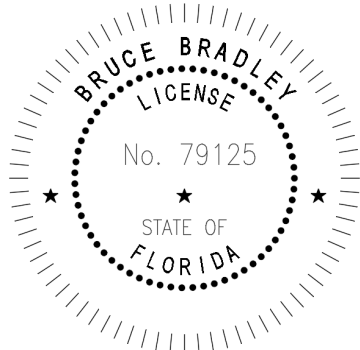
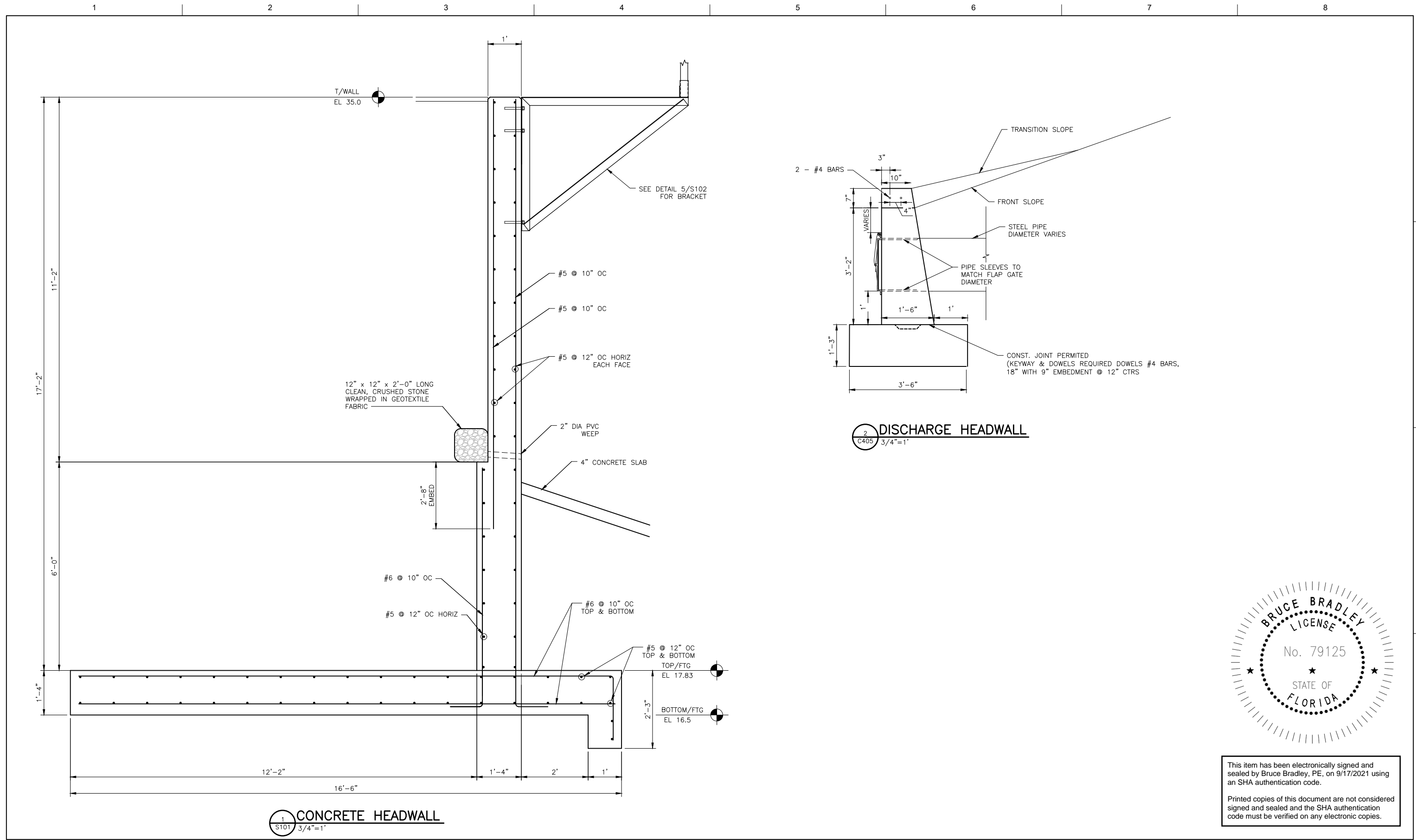
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

STRUCTURAL BOND FARM HEI PUMP STATION PLATFORM CONNECTION DETAILS

0 1" 2"
READY TO ADVERTISE

SHEET 67 of 92
SCALE VARIES

DRAWING
S101



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TAMPA, FL 33609
CA 4213

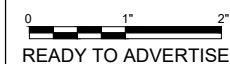
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE	
PROJECT NUMBER	10061267

BRUCE BRADLEY, PE
FL PE #79125
2601 CATTLEMEN RD, STE 400
SARASOTA, FL 34232

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

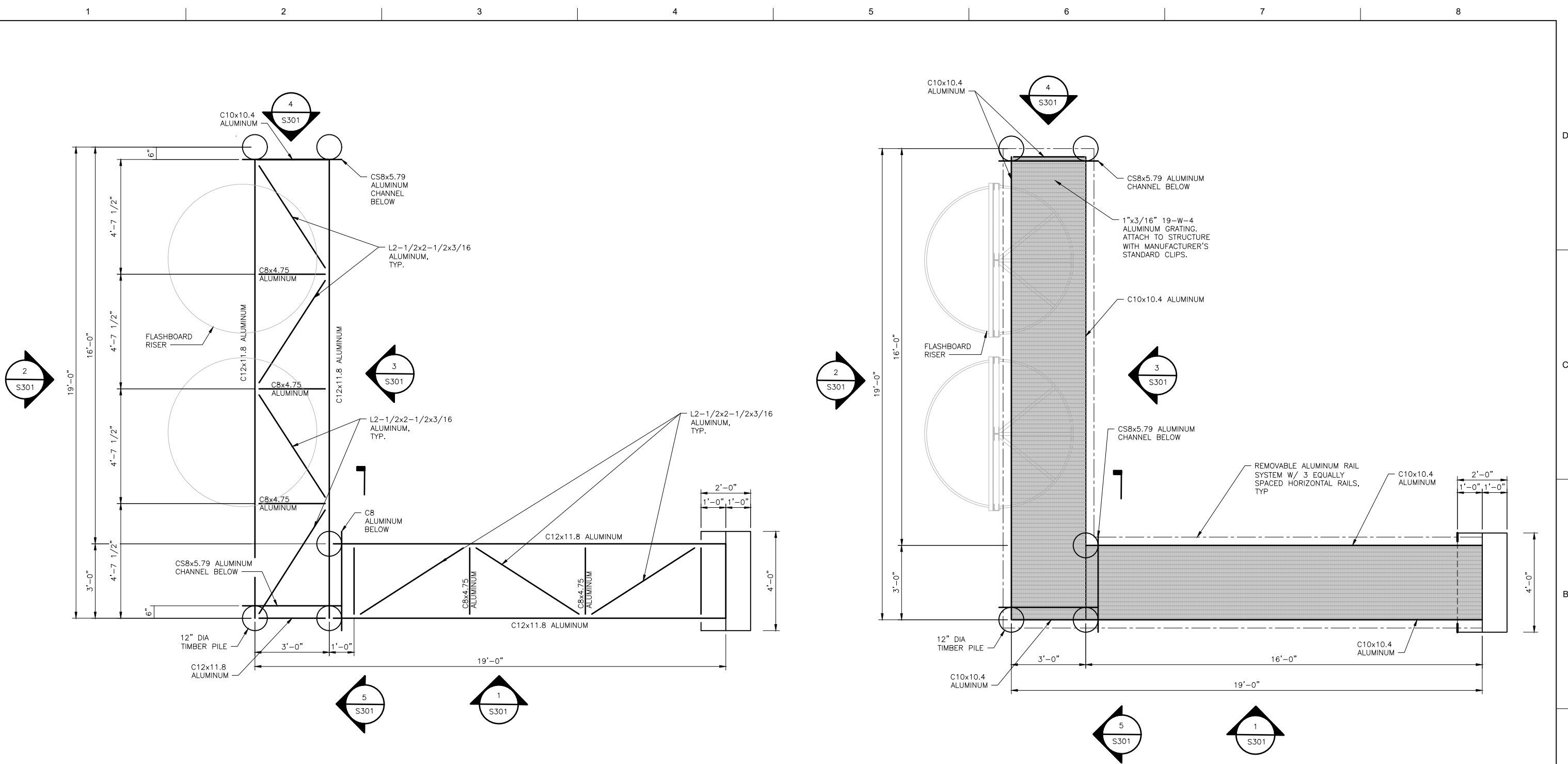


READY TO ADVERTISE

STRUCTURAL BOND FARM HEI PUMP STATION WALL DETAILS (1 OF 2)

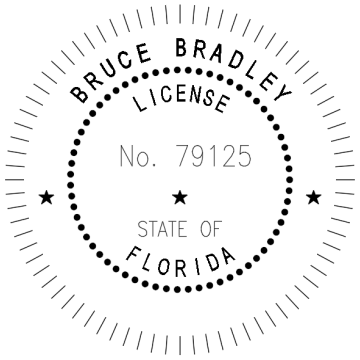
SHEET 68 of 92
SCALE 3/4" = 1'-0"

DRAWING
S102



1
S300
FRAMING PLAN
1/2"=1'-0"

2
S300
GRATE AND RAIL PLAN
1/2"=1'-0"



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PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

BRUCE BRADLEY, PE
FL PE #79125
2601 CATTLEMEN RD, STE 400
SARASOTA, FL 34232

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

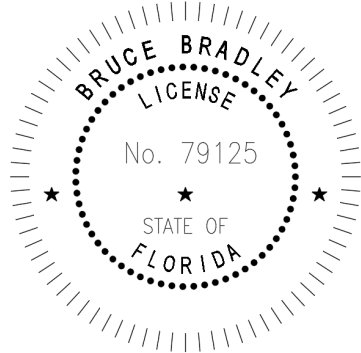
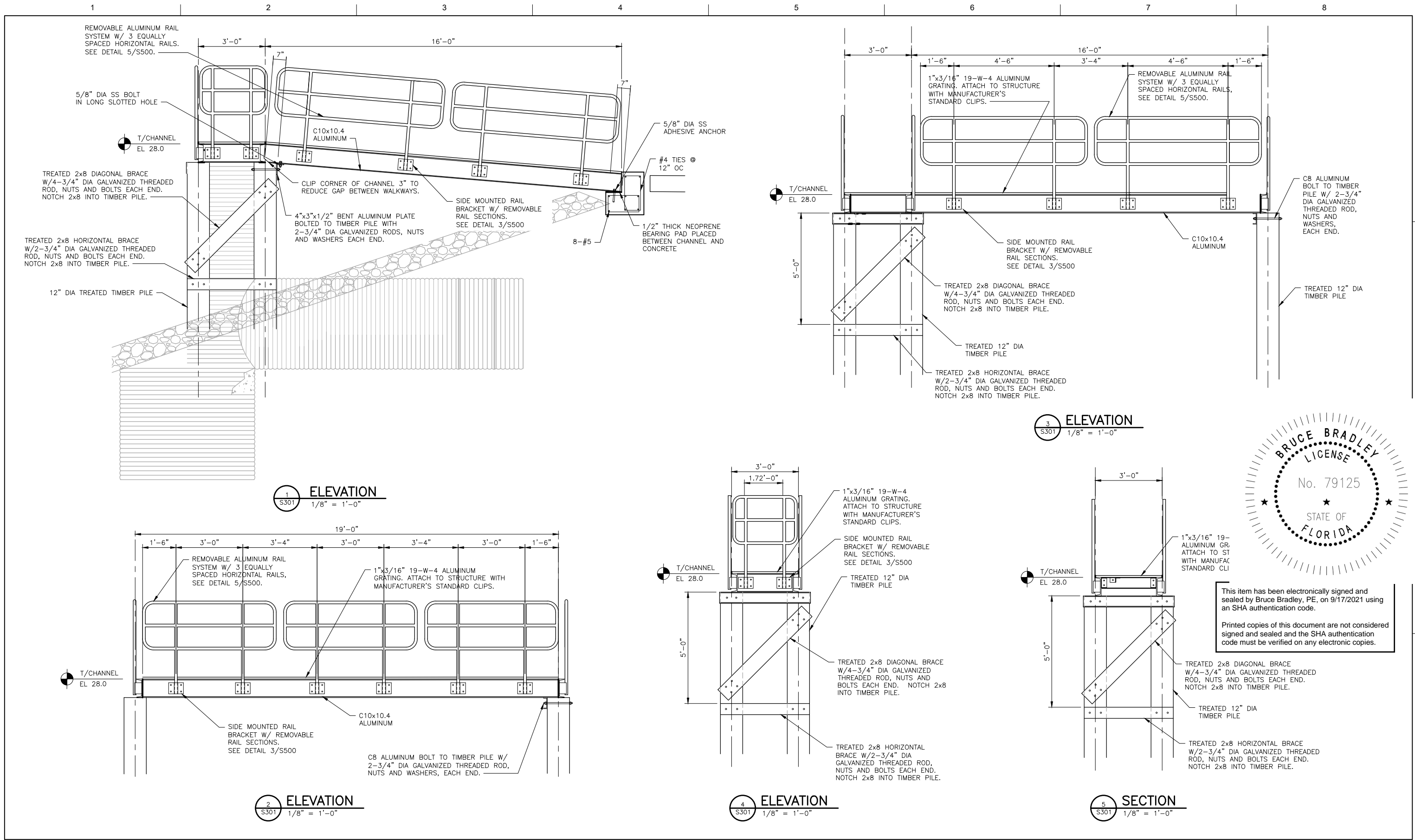
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**STRUCTURAL
FLASHBOARD RISER WALKWAY**

0 1 2
READY TO ADVERTISE

SHEET 70 of 92
SCALE 1/2" = 1'-0"

DRAWING
S300



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4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609
 CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

BRUCE BRADLEY, PE
 FL PE #79125
 2601 CATTLEMEN RD, STE 400
 SARASOTA, FL 34232

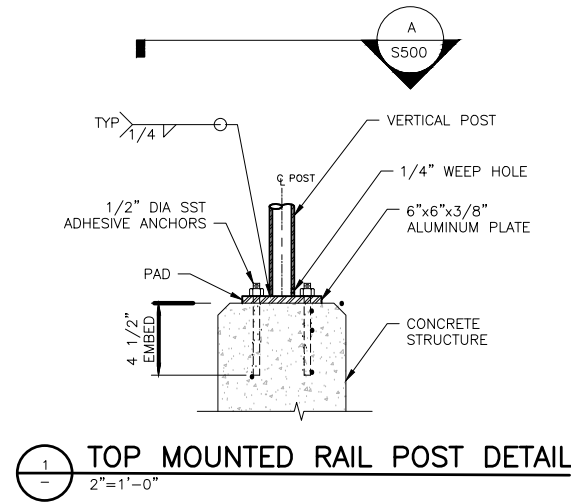
**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**
 FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

**STRUCTURAL
 FLASHBOARD RISER
 WALKWAY ELEVATIONS**

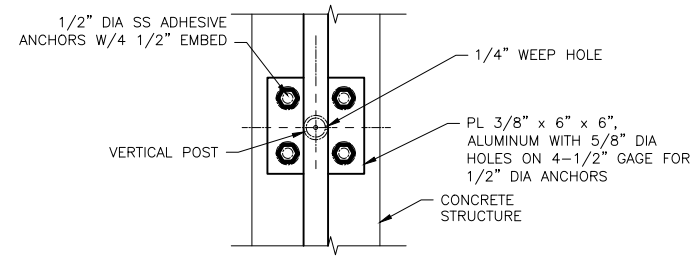
0 1" 2"
 READY TO ADVERTISE

SHEET 71 of 92
 SCALE 1/8" = 1'-0"

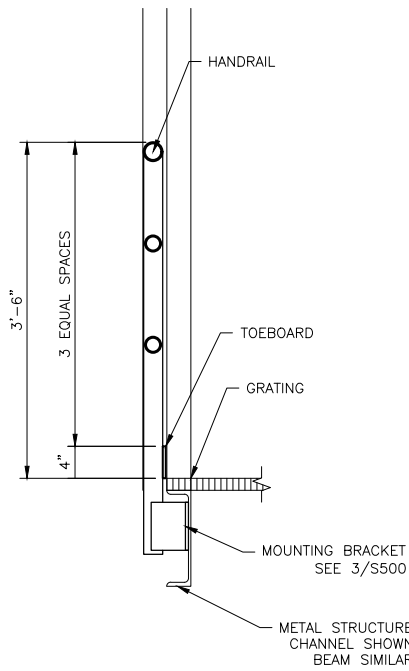
DRAWING
S301



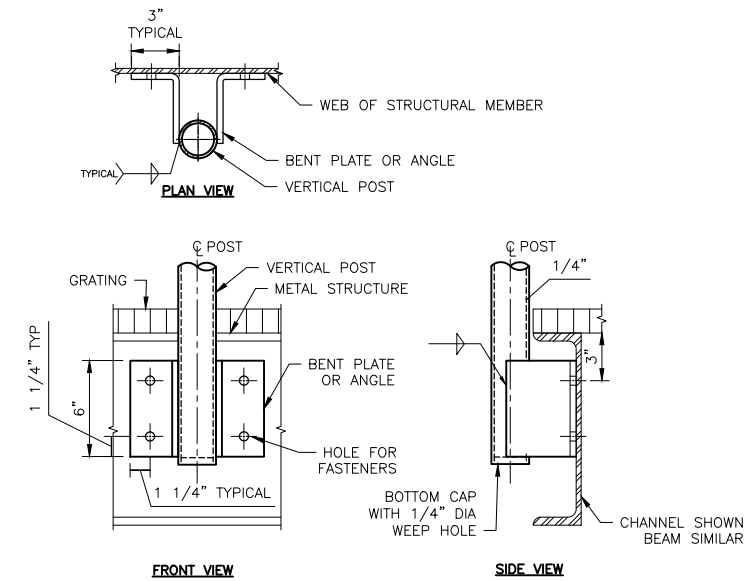
1 TOP MOUNTED RAIL POST DETAIL
2"=1'-0"



A TOP MOUNTED RAIL POST - PLAN VIEW
S500 2"=1'-0"

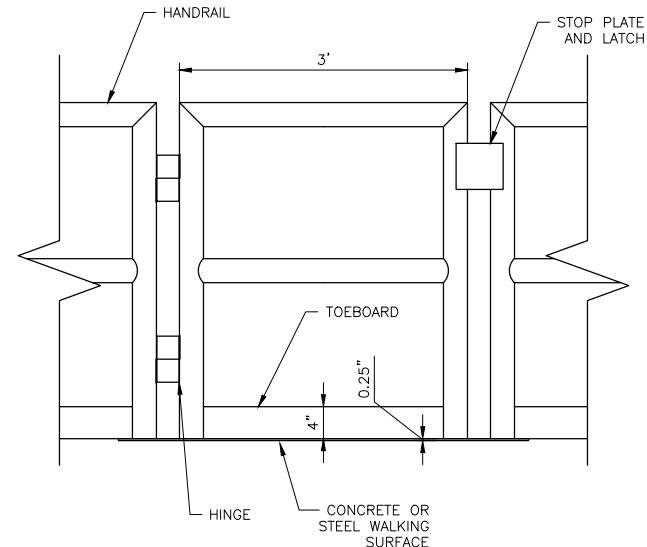


2 SIDE MOUNTED RAIL POST DETAIL
1"=1'-0"

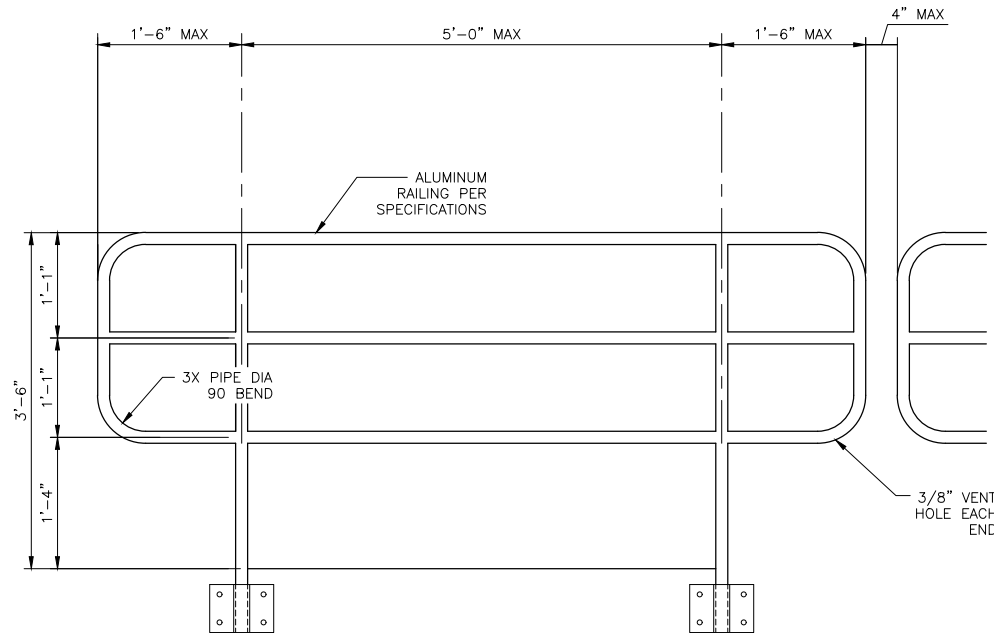


3 SIDE MOUNTED RAIL POST BRACKET DETAIL
2"=1'-0"

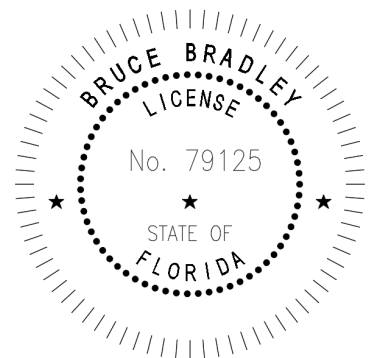
NOTE:
1. TOEBOARD NOT SHOWN.



4 GATE DETAIL
1"=1'-0"



5 REMOVABLE RAIL DETAIL
1"=1'-0"



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4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

BRUCE BRADLEY, PE
FL PE #79125
2601 CATTLEMEN RD, STE 400
SARASOTA, FL 34232

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**STRUCTURAL
TYPICAL RAIL DETAILS**

0 1 2
READY TO ADVERTISE

SHEET 72 of 92
SCALE NOT TO SCALE

DRAWING
S500

	LOW - VOLTAGE CIRCUIT BREAKER (CB). RATINGS AND NO. OF POLES AS SHOWN. WHEN SPECIFIC TYPE IS REQUIRED, X INDICATES TYPE. TYPES: MCCB - MOLDED CASE ICCB - INSULATED CASE LVP - LOW - VOLTAGE POWER MCP - MOTOR CIRCUIT PROTECTOR (RATING PER CONNECTED LOAD)
	SEPARATELY MOUNTED CIRCUIT BREAKER; SEE ELECTRICAL ONE - LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION
	GROUND FAULT PROTECTION
	MEDIUM - VOLTAGE CIRCUIT BREAKER
	FUSE, SIZE, AND NUMBER OF FUSES AS NOTED
	FUSED CUTOUT, CURRENT RATING, FUSE SIZE, AND NUMBER OF POLES AS NOTED
	FUSIBLE SWITCH, CURRENT RATING, FUSE SIZE, AND QUANTITY AS NOTED
	NON-FUSED SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED
	DISCONNECT OR DRAWOUT CONNECTION
	MAGNETIC MOTOR STARTER AND SEPARATELY MOUNTED COMBINATION MAGNETIC MOTOR STARTER
	MOTOR CONTROLLER AND SEPARATELY MOUNTED MOTOR CONTROLLER WITH SHORT CIRCUIT PROTECTION AND DISCONNECT
MOTOR STARTER AND CONTROLLER SUBSCRIPTS:	
A	MAGNETIC STARTER NEMA SIZE
B	STARTER TYPE NONE - FULL VOLTAGE NON-REVERSING (FVNR) FVR - FULL VOLTAGE REVERSING 2S - TWO SPEED RVAT - REDUCED VOLTAGE AUTO TRANSFORMER
C	CONTROL DIAGRAM OR CONTROLS SCHEDULE NUMBER (IF REQUIRED)
D	CONTROLLER TYPE VFD - VARIABLE FREQUENCY DRIVE SS - SOLID STATE
	SEPARATELY MOUNTED COMBINATION MOTOR STARTER OR CONTROLLER; SEE ELECTRICAL ONE - LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION
	THERMAL OVERLOAD ELEMENT
	THERMAL OVERLOAD RELAY CONTACT
	DISCONNECT OR SAFETY SWITCH, 30A, 3P, NON-FUSED UNLESS OTHERWISE NOTED
	MOTOR WITH DESIGN HORSEPOWER (WHEN INDICATED)
	GENERATOR
	TRANSFER SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED ATS - AUTOMATIC MTS - MANUAL
	TRANSFORMER
	3-PHASE, 3-WIRE DELTA CONNECTION
	3-PHASE, 4-WIRE GROUNDED WYE CONNECTION
	SWITCHBOARD OR PANELBOARD; NAME, VOLTAGE, PHASE, NUMBER OF WIRES WHEN INDICATED

	NON-MOTOR LOAD WITH DESIGN KVA, KW, OR AMP
	CONTROL POWER TRANSFORMER (CPT)
	VOLTAGE TRANSFORMER (VT OR PT)
	CURRENT TRANSFORMER (CT)
	UTILITY WATT-HOUR METER PER UTILITY REQUIREMENTS
	DIGITAL METERING PACKAGE
	RUN TIME METER
	GROUND
	LIGHTNING ARRESTER
	LOW VOLTAGE SURGE PROTECTIVE DEVICE
	ELECTRICAL CONNECTION
	NO ELECTRICAL CONNECTION
	SOLENOID VALVE
	CONTROL/RELAY COIL; X INDICATES TYPE, Y INDICATES LOOP NO. WHEN USED TYPES: CR - CONTROL RELAY DP - DEFINITE PURPOSE RELAY LC - LIGHTING CONTACTOR M - MOTOR STARTER PC - PHOTO CELL TC - TIME CLOCK TR - TIMING RELAY
	NORMALLY OPEN CONTACT (N.O.)
	NORMALLY CLOSED CONTACT (N.C.)
	NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS ENERGIZED
	NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS ENERGIZED
	NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS DE-ENERGIZED
	NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS DE-ENERGIZED
	NORMALLY OPEN TEMPERATURE SWITCH; CLOSE ON RISING TEMPERATURE
	NORMALLY CLOSED TEMPERATURE SWITCH; OPEN ON RISING TEMPERATURE
	NORMALLY OPEN FLOW SWITCH; CLOSE ON INCREASING FLOW
	NORMALLY CLOSED FLOW SWITCH; OPEN ON INCREASING FLOW
	TRANSIENT VOLTAGE SURGE SUPPRESSOR
	NORMALLY OPEN LEVEL SWITCH; CLOSE ON RISING LEVEL
	NORMALLY CLOSED LEVEL SWITCH; OPEN ON RISING LEVEL

	NORMALLY OPEN PRESSURE SWITCH, CLOSE ON INCREASING PRESSURE
	NORMALLY CLOSED PRESSURE SWITCH, OPEN ON INCREASING PRESSURE
	NORMALLY OPEN LIMIT SWITCH, CLOSE ON REACHING LIMIT
	NORMALLY CLOSED LIMIT SWITCH, OPEN ON REACHING LIMIT
	FIELD WIRING EXTERNAL TO CONTROL PANEL
	INTERLOCK; X INDICATES TYPE TYPES: E - ELECTRICAL M - MECHANICAL K - KEY
	3 POSITION SELECTOR SWITCH, MAINTAINED CONTACTS; UNLESS OTHERWISE NOTED, 2-POSITION SIMILAR
	NORMALLY OPEN PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED
	NORMALLY CLOSED PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED
	INDICATING LIGHT, X INDICATES LENS COLOR
	PUSH TO TEST INDICATING LIGHT, X INDICATES LENS COLOR LENS COLORS: R - RED Y - YELLOW G - GREEN W - WHITE B - BLUE A - AMBER
	TRANSFORMER
	SELECTOR SWITCH
	PUSHBUTTON
	INSTRUMENTATION/CONTROL DEVICE
	CONTROL PANEL INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT
	CONTROL PANEL WITH DISCONNECT SWITCH INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT
	JUNCTION OR PULL BOX
	PANELBOARD (250V TO 600V)
	PANELBOARD (LESS THAN 250V)
	ELECTRICAL EQUIPMENT ENCLOSURE: SWITCHBOARD, MOTOR CONTROL CENTER, CONTROL PANEL, OR OTHER EQUIPMENT AS INDICATED
	PHOTOCELL
	CEILING/PENDANT-MOUNTED LUMINAIRE - HID, COMPACT FLUORESCENT, OR INCANDESCENT
	WALL-MOUNTED LUMINAIRE - HID, COMPACT FLUORESCENT, OR INCANDESCENT
	CEILING/PENDANT-MOUNTED FLUORESCENT FIXTURE
	WALL-MOUNTED FLUORESCENT FIXTURE
	CEILING/PENDANT-MOUNTED FLUORESCENT FIXTURE NORMAL/EMERGENCY
	WALL-MOUNTED FLUORESCENT FIXTURE NORMAL/EMERGENCY
	EMERGENCY LIGHT FIXTURE, 2 ATTACHED HEADS AS SHOWN
	EMERGENCY LIGHT, REMOTE MOUNTED HEAD
	DOUBLE-FACED CEILING OR WALL MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS AS INDICATED ON PLANS
	SINGLE-FACED CEILING OR WALL MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS

	AREA OR ROADWAY LIGHT - POLE-MOUNTED
	LIGHTING FIXTURE SUBSCRIPTS: X - INDICATES FIXTURE TYPE PER LIGHTING FIXTURE SCHEDULE Y - INDICATES CIRCUIT NUMBER FROM PANELBOARD Z - INDICATES CONTROLLING SWITCH (IF REQUIRED)
	TOGGLE SWITCH SUBSCRIPTS: X - INDICATES TYPE NONE - SINGLE POLE 3 - THREE-WAY 4 - FOUR-WAY HP - TOGGLE SWITCH, HORSEPOWER RATED K - KEY SWITCH TE - MANUAL MOTOR STARTER WITH THERMAL ELEMENT P - PILOT LIGHT L - LIGHTED HANDLE Y - INDICATES CONTROLLING SWITCH (IF REQUIRED)
	SPECIAL-PURPOSE RECEPTACLE AS DEFINED ON PLANS
	PLUG-IN RECEPTACLE STRIP, QUANTITY AND SPACING OF RECEPTACLES AS NOTED OR SPECIFIED
	TELECOMMUNICATIONS OUTLET JUNCTION BOX
	QUAD-DUPLEX RECEPTACLE, TWO NEMA 5-20R UNDER COMMON COVER PLATE
	DUPLEX RECEPTACLE, NEMA 5-20R
	SIMPLEX RECEPTACLE, NEMA 5-20R SUBSCRIPTS: X - INDICATES TYPE GFCI - GROUND FAULT CIRCUIT INTERRUPTER Y - INDICATES CIRCUIT NUMBER FROM PANELBOARD
	CONDUIT TURNING UP
	CONDUIT TURNING DOWN
	HOME RUN TO PANEL, 2 #12, 1 #12G IN 3/4" UNLESS OTHERWISE NOTED
	CIRCUIT RUN BETWEEN DEVICES EXPOSED IN NON-ARCHITECTURALLY FINISHED AREAS; CONCEALED IN ARCHITECTURALLY FINISHED AREAS. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.
	CONDUIT RUN BETWEEN DEVICES CONCEALED IN NON-ARCHITECTURALLY FINISHED AREAS UNDERGROUND OR UNDER FLOOR SLAB. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.
	CIRCUIT HASH MARKS (WHEN INDICATED): LONG, SHORT, SINGLE DOT, AND DOUBLE DOT REPRESENT PHASE, NEUTRAL, EQUIPMENT GROUND, AND ISOLATED EQUIPMENT GROUND, RESPECTIVELY. #12 IN 3/4" CONDUIT UNLESS OTHERWISE INDICATED.
	CIRCUIT CONTINUATION
	CONDUIT STUBBED OUT AND CAPPED
	CONDUIT TAG OR CIRCUIT NUMBER - WIRE AND CONDUIT SIZE AS SPECIFIED IN CIRCUIT SCHEDULE ON THE SHEETS
	GROUND CABLE
	GROUND ROD
	EXISTING OVERHEAD ELECTRIC LINE
	PROPOSED UNDERGROUND PRIMARY ELECTRIC LINE
	EXISTING GUY WIRE
	FEEDER CONDUIT, CONDUCTORS, SUPPORTS AND ALL ASSOCIATED MATERIALS TO BE DEMOLISHED AND DISPOSED OF BY CONTRACTOR.
	PANEL, CONTROL PANEL, OR EQUIPMENT INCLUDING ALL ASSOCIATED MATERIALS TO BE DEMOLISHED AND DISPOSED OF BY THE CONTRACTOR

ELECTRICAL ABBREVIATIONS

A	AMP
AF	AMP FRAME, AMP FUSE
AIC	AMPS INTERRUPTING CAPACITY
ALUM	ALUMINUM
AWG	AMERICAN WIRE GAUGE
ATS	AUTOMATIC TRANSFER SWITCH
BKR	BREAKER
C	CABLE/CONDUIT
CAB	CABINET
CPT	CONTROL POTENTIAL TRANSFORMER
CT	CURRENT TRANSFORMER
DB	DUCT BANK, DECIBEL
DMP	DIGITAL METERING PACKAGE
E	EAST, ELECTRICAL DWG DISCIPLINE
ENCL	ENCLOSURE
EQUIP	EQUIPMENT
EXST	EXISTING
FCLs	FAULT CIRCUIT INDICATORS
FVNR	FULL VOLTAGE NON-REVERSIBLE
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
GEN	GENERATOR
J/B	JUNCTION BOX
KVA	KILO VOLT-AMPERES
LTG	LIGHTNING
LTNG	LIGHTNING
LP	LIGHTING PANEL
MCC	MOTOR CONTROL CENTER
MH	MOUNTING HEIGHT, MAN HOLE
MP	METERING PUMP
MV	MEDIUM VOLTAGE
N	NORTH, NEUTRAL
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
P	POWER
PF	POWER FACTOR
PH	PHASE
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
R/R	RATE OF RISE
R	RACEWAY
RGS	RIGID GALVANIZED STEEL
RGS-PVC	PVC COATED RGS
RPM	RESERVOIR PUMP MOTOR, REVOLUTIONS PER MINUTE
RVSS	REDUCED VOLTAGE SOFT START
S	SIGNAL
SP	SPARE
SPD	SURGE PROTECTION DEVICE
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
UG	UNDERGROUND
V	VOLT
VA	VOLT-AMPERE
VAR	VOLT-AMPERE REACTIVE
VFD	VARIABLE FREQUENCY DRIVE
W	WATT, WIRE, WEST
WP	WEATHER PROOF
XMFR	TRANSFORMER

- ### ELECTRICAL NOTES
- CONTRACTOR TO LOCATE AND STAKE ALL UNDERGROUND UTILITIES TO AVOID INTERRUPTIONS AND DAMAGES TO OTHER UTILITIES. HAND EXCAVATE AT LOCATIONS WHERE UTILITIES ARE LESS THAN THREE (3) FEET BELOW GRADE.
 - THE CONTRACTOR IS SOLELY RESPONSIBLE TO FIELD VERIFY ALL EQUIPMENT, LOCATIONS, MEASUREMENTS, AND CONDITIONS PRIOR TO BID SUBMITTAL AND INCLUDE ALL MATERIALS, LABOR, AND EQUIPMENT REQUIRED TO INSTALL AS CONVEYED IN THE PLANS AND SPECIFICATIONS.
 - THIS IS A STANDARD ELECTRICAL SYMBOLOGY SHEET. ALL SYMBOLS MAY NOT BE USED ON THIS PROJECT.
 - SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.
 - REFER TO ONE LINE DIAGRAMS, CONTROL SCHEMATICS, P&ID, DETAILS AND OTHER DISCIPLINE SHEETS AND SPECIFICATIONS FOR OTHER INFORMATION AND REQUIREMENTS. COORDINATE INSTALLATION THOROUGHLY WITH ALL OTHER DISCIPLINES/TRADES.
 - A LICENSED ELECTRICIAN MUST PERFORM THE ELECTRICAL INSTALLATION IN COMPLIANCE WITH THE NEC, STATE AND FEDERAL REGULATIONS AND CONTRACT DOCUMENTS. A LOCKOUT/TAGOUT PROGRAM MUST BE IMPLEMENTED AT ALL TIMES FOR THE DURATION OF THE PROJECT.



PROJECT MANAGER SUSAN RAY, PE		
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ISSUE	DATE	DESCRIPTION
PROJECT NUMBER		10061267

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

STATE OF FLORIDA
PROFESSIONAL ENGINEER
No 58896

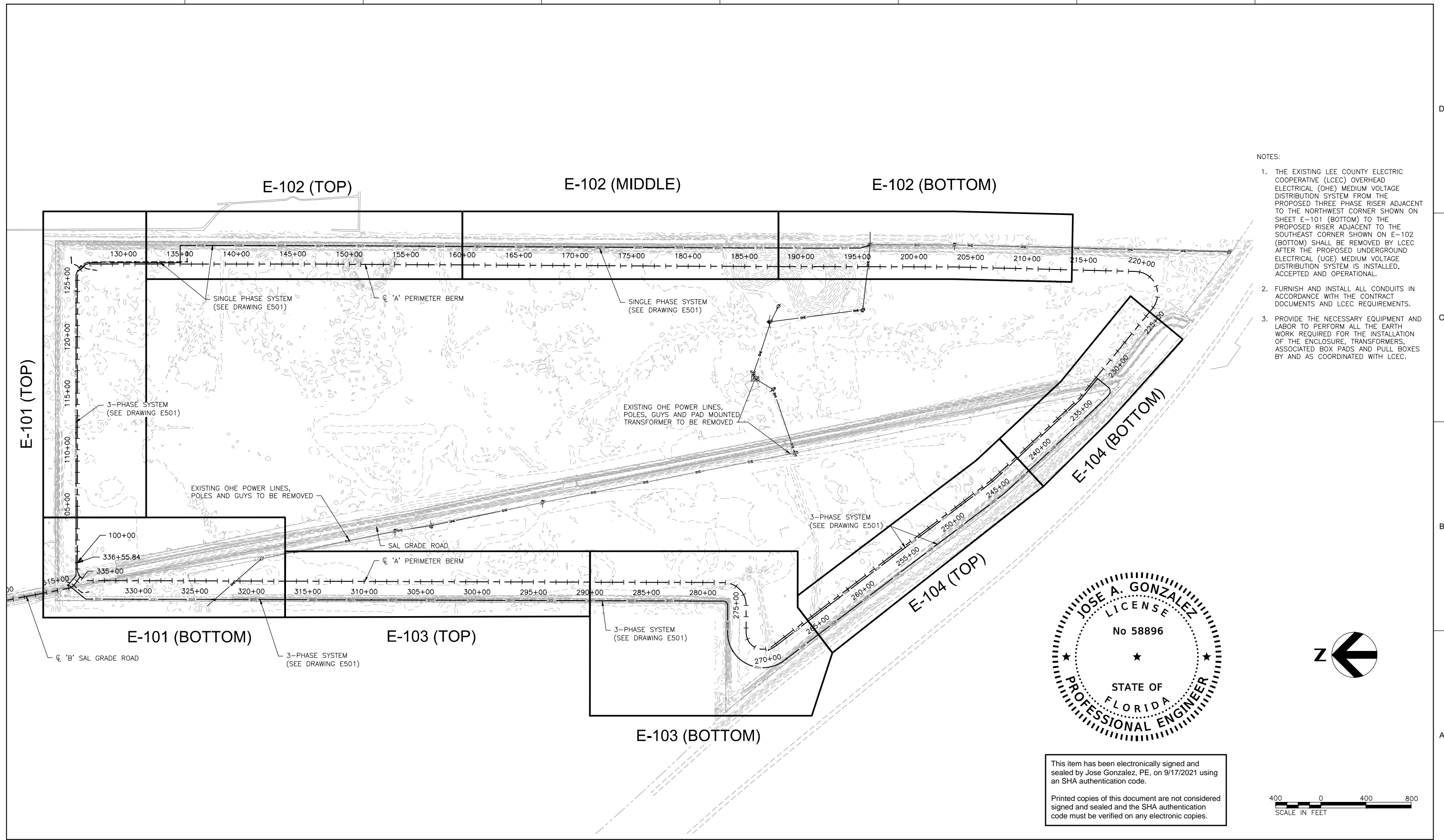
**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

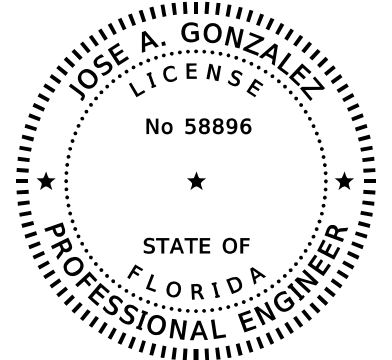
**ELECTRICAL
ABBREVIATIONS, SYMBOLS,
AND NOTES**

SHEET 73 of 92
SCALE NOT TO SCALE
DRAWING E001

READY TO ADVERTISE



- NOTES:
1. THE EXISTING LEE COUNTY ELECTRIC COOPERATIVE (LCEC) OVERHEAD ELECTRICAL (OHE) MEDIUM VOLTAGE DISTRIBUTION SYSTEM FROM THE PROPOSED THREE PHASE RISER ADJACENT TO THE NORTHWEST CORNER SHOWN ON SHEET E-101 (BOTTOM) TO THE PROPOSED RISER ADJACENT TO THE SOUTHEAST CORNER SHOWN ON E-102 (BOTTOM) SHALL BE REMOVED BY LCEC AFTER THE PROPOSED UNDERGROUND ELECTRICAL (UGE) MEDIUM VOLTAGE DISTRIBUTION SYSTEM IS INSTALLED, ACCEPTED AND OPERATIONAL.
 2. FURNISH AND INSTALL ALL CONDUITS IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND LCEC REQUIREMENTS.
 3. PROVIDE THE NECESSARY EQUIPMENT AND LABOR TO PERFORM ALL THE EARTH WORK REQUIRED FOR THE INSTALLATION OF THE ENCLOSURE, TRANSFORMERS, ASSOCIATED BOX PADS AND PULL BOXES BY AND AS COORDINATED WITH LCEC.



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

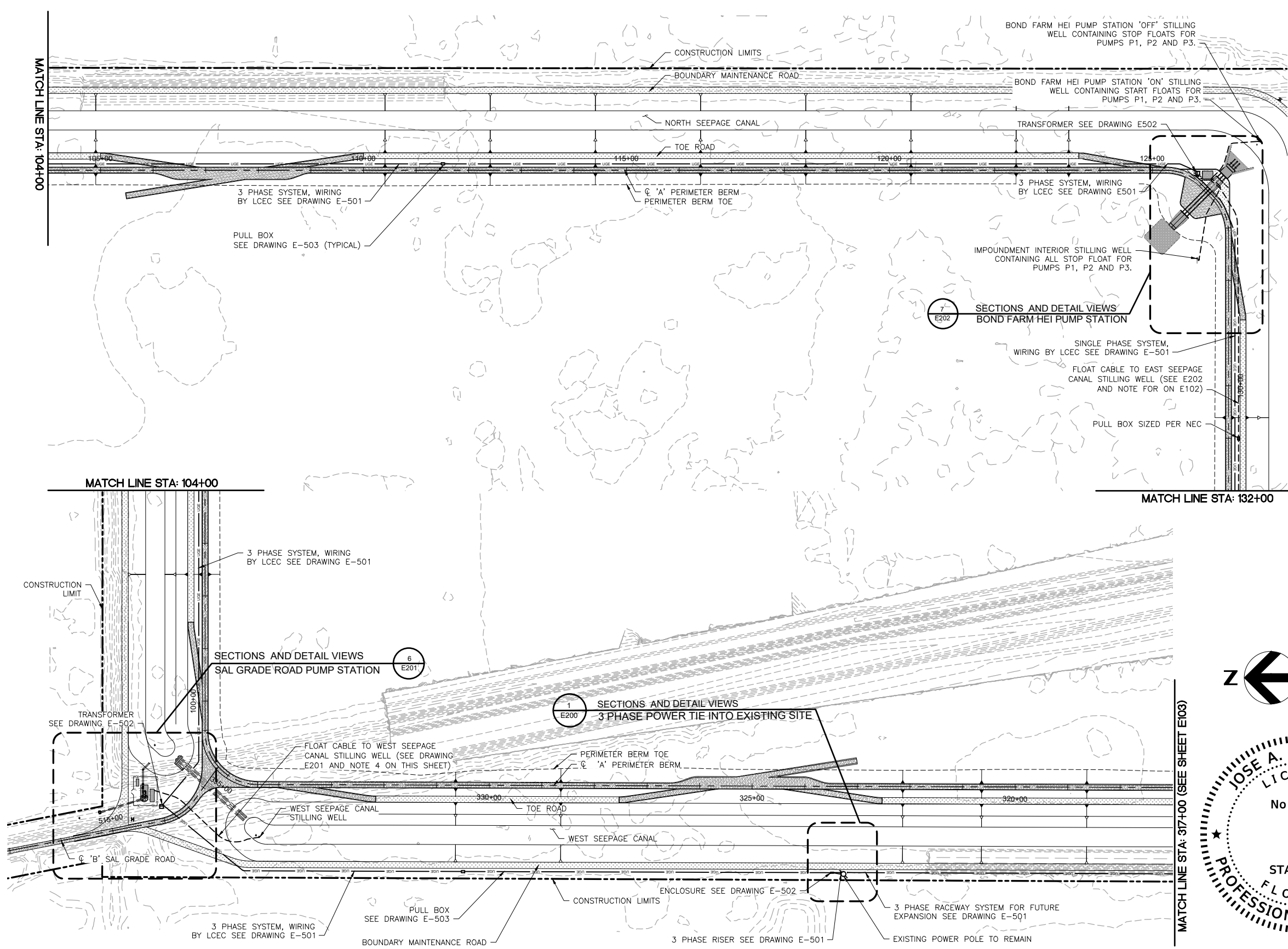
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**ELECTRICAL
OVERALL ELECTRICAL SITE PLAN
AND KEY MAP**

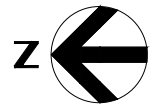
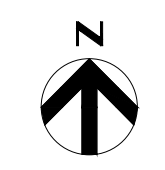
0 1" 2"
READY TO ADVERTISE

SHEET 74 of 92
SCALE 1"=400'

DRAWING
E100

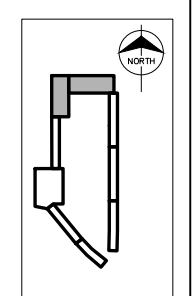
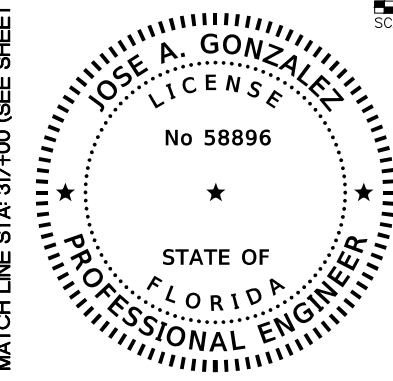


- NOTES:
- SEE DRAWING E501 FOR POWER SYSTEM TYPICAL SECTION DETAIL.
 - 3 PHASE SYSTEM CONSIST OF THREE (3) 2" PVC SCHEDULE 40 CONDUITS AND THE SINGLE PHASE SYSTEM CONSIST OF ONE (1) CONDUIT 2" PVC SCHEDULE 40. ALL MEDIUM VOLTAGE DISTRIBUTION SYSTEM WIRING WILL BE DESIGNED, FURNISHED AND INSTALLED BY LEE COUNTY ELECTRIC COOPERATIVE (LCEC).
 - AT ALL LCEC PULL BOX LOCATIONS THE CONTRACTOR SHALL INSTALL CONDUIT IN FULL LENGTH AND LCEC WILL CUT CONDUITS, INSTALL PULL BOXES, AND TERMINATE CONDUITS TO PULL BOXES.
 - PROVIDE NEMA 4X JUNCTION BOX SIZED PER NEC ON TOP OF CONCRETE PILE FOR WEST SEEPAGE CANAL STILLING WELL TO SPLICE FLOAT CABLE, FLOAT ELEVATION IS 23.5. PROVIDE A STOOW #12/3 CORD SUITABLE TO BE SUBMERGED IN A 1" CONDUIT DIRECT BURIED 18" BELOW FINAL GRADE FROM SAL GRADE PUMP STATION CONTROL PANEL TO STILLING WELL. CONDUIT SHALL BE INSTALLED 2' PASS THE SEEPAGE CANAL BANK AND FOR THE REMAINING OF THE RUN THE STOOW CORD SHALL LAY AT BOTTOM OF CANAL, ROUTED UP THE CONCRETE PILE AND BE TERMINATED TO THE JUNCTION BOX WITH A STRAIN RELIEF FITTING. PULL BOXES SHALL BE TRAFFIC RATED TO H-20 LOADING.



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TAMPA, FL 33609
CA 4213

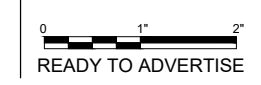
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
ELECTRICAL ENGINEER	JORGE PLASENCIA, P.E.
PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

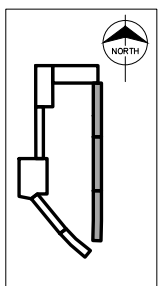
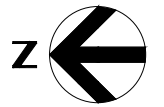
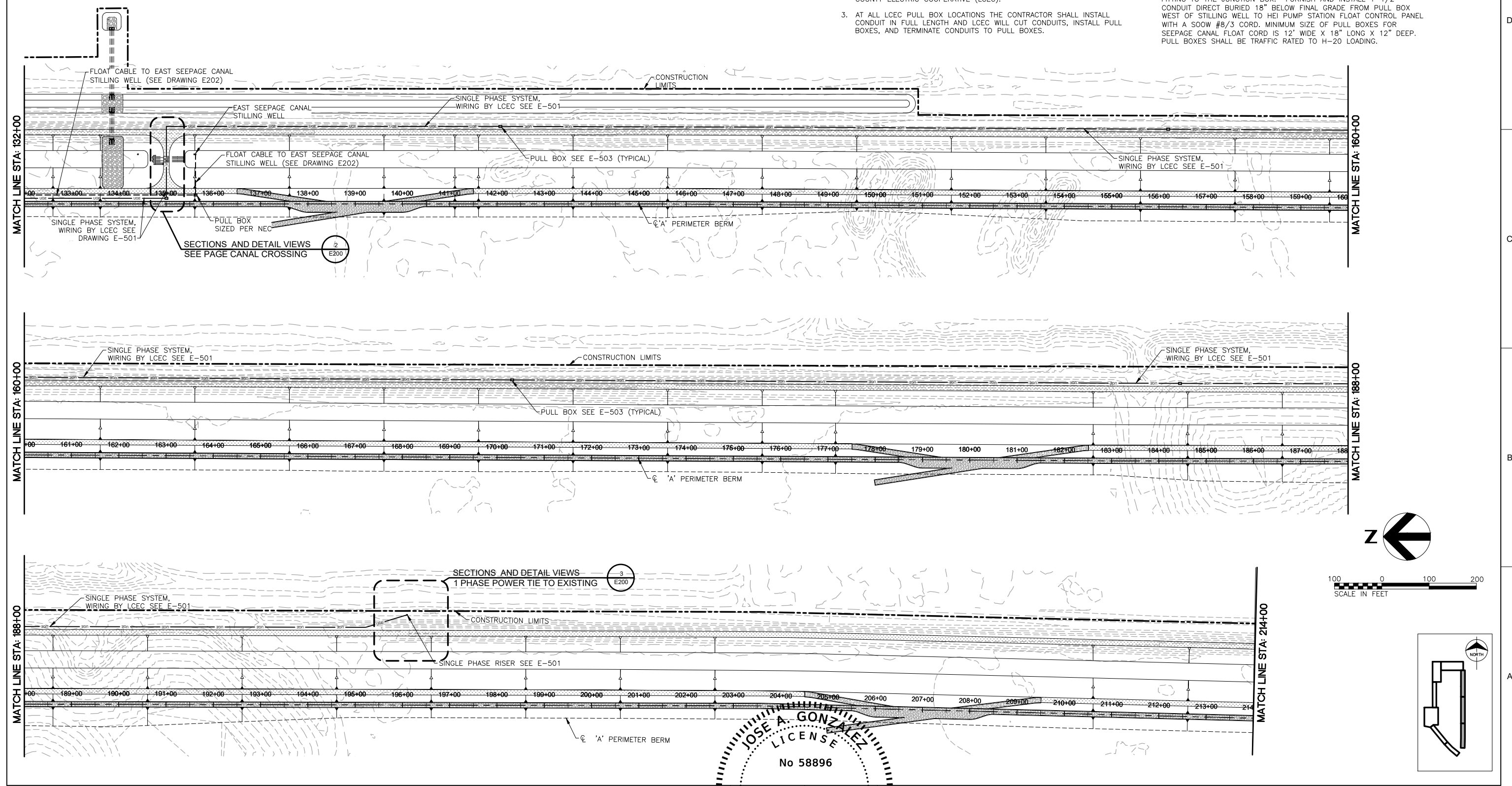


**ELECTRICAL
SITE PLAN (1 OF 4)**

SHEET 75 of 92
SCALE 1"=100'

DRAWING
E101

- NOTES:
1. SEE DRAWING E-501 FOR POWER SYSTEM TYPICAL SECTION DETAIL.
 2. 3 PHASE SYSTEM CONSIST OF THREE (3) 2" PVC SCHEDULE 40 CONDUITS AND THE SINGLE PHASE SYSTEM CONSIST OF ONE (1) CONDUIT 2" PVC SCHEDULE 40. ALL MEDIUM VOLTAGE DISTRIBUTION SYSTEM WIRING WILL BE DESIGNED, FURNISHED AND INSTALLED BY LEE COUNTY ELECTRIC COOPERATIVE (LCEC).
 3. AT ALL LCEC PULL BOX LOCATIONS THE CONTRACTOR SHALL INSTALL CONDUIT IN FULL LENGTH AND LCEC WILL CUT CONDUITS, INSTALL PULL BOXES, AND TERMINATE CONDUITS TO PULL BOXES.
 4. PROVIDE NEMA 4X JUNCTION BOX SIZED PER NEC ON TOP CONCRETE PILE FOR STILLING WELL TO SPLICE FLOAT CABLE, FLOAT ELEVATION IS 23.5. PROVIDE A STOOV #12/3 CORD SUITABLE TO BE SUBMERGED FROM PULL BOX WEST OF STILLING WELL IN A 1" CONDUIT DIRECT BURIED 18" BELOW FINAL GRADE. CONDUIT SHALL BE INSTALLED 2' PASS THE SEEPAGE CANAL BANK AND FOR THE REMAING OF THE RUN THE STOOV CORD SHALL LAY AT BOTTOM OF CANAL. BE ROUTED UP THE CONCRETE PILE AND BE TERMINATED WITH A STRAIN RELIEF FITTING TO THE JUNCTION BOX. FURNISH AND INSTALL 1-1/2" CONDUIT DIRECT BURIED 18" BELOW FINAL GRADE FROM PULL BOX WEST OF STILLING WELL TO HEI PUMP STATION FLOAT CONTROL PANEL WITH A SOOV #8/3 CORD. MINIMUM SIZE OF PULL BOXES FOR SEEPAGE CANAL FLOAT CORD IS 12" WIDE X 18" LONG X 12" DEEP. PULL BOXES SHALL BE TRAFFIC RATED TO H-20 LOADING.



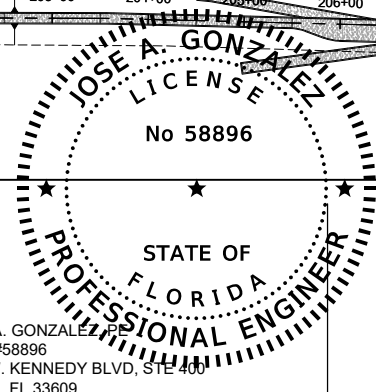
HR
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609
 CA 4213

ISSUE	DATE	DESCRIPTION	PROJECT NUMBER
			10061267

PROJECT MANAGER SUSAN RAY, PE

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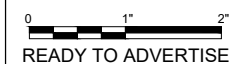
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JOSE A. GONZALEZ, PE
 FL PE #58896
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

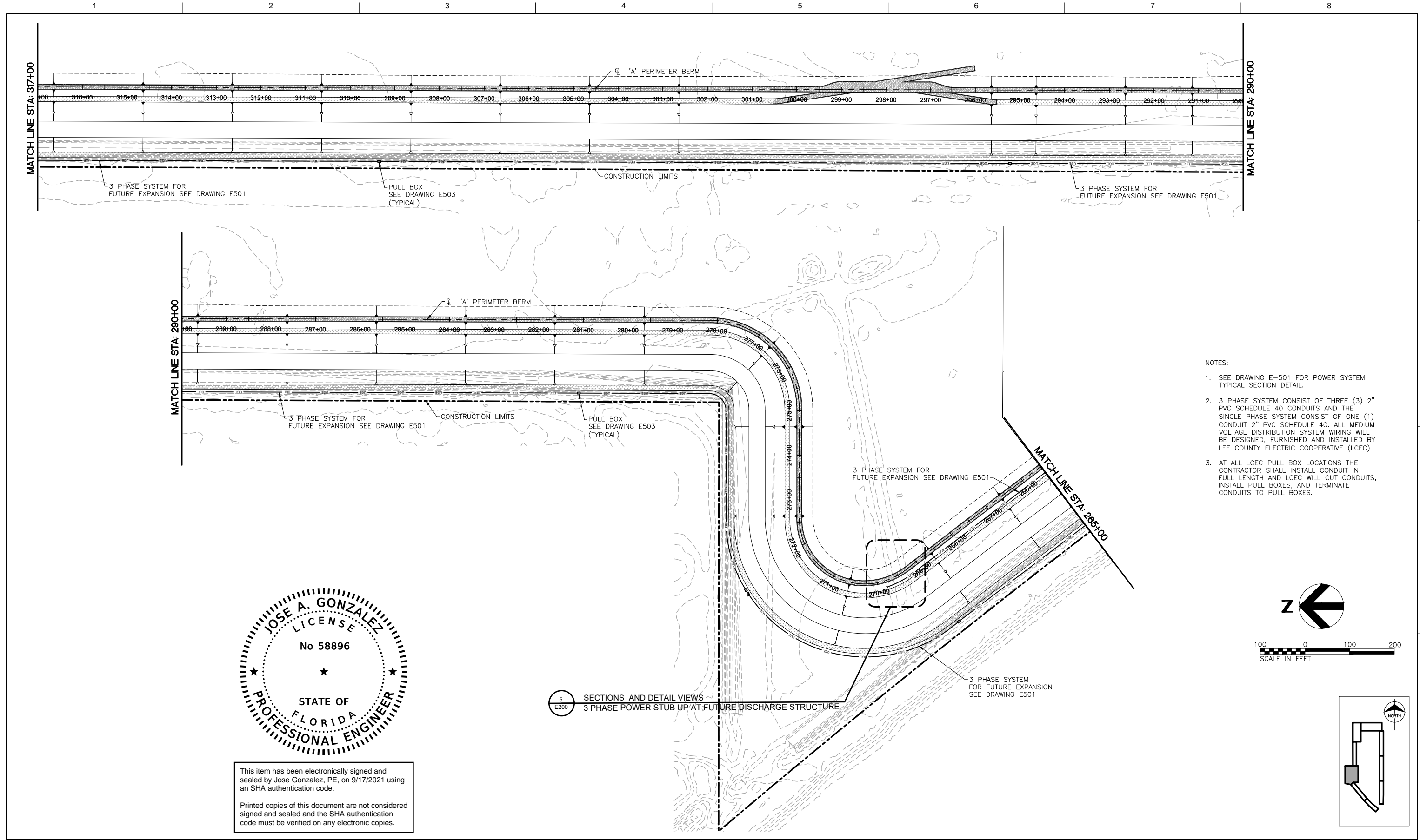
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399



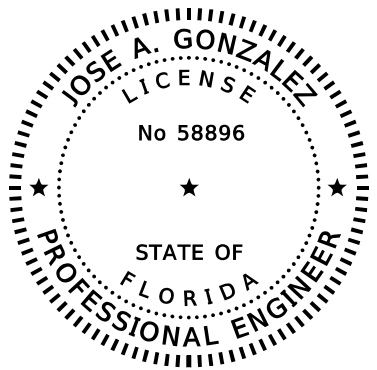
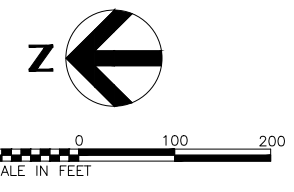
ELECTRICAL SITE PLAN (2 OF 4)

SHEET 76 of 92
 SCALE 1"=100'

DRAWING **E102**



- NOTES:
1. SEE DRAWING E-501 FOR POWER SYSTEM TYPICAL SECTION DETAIL.
 2. 3 PHASE SYSTEM CONSIST OF THREE (3) 2" PVC SCHEDULE 40 CONDUITS AND THE SINGLE PHASE SYSTEM CONSIST OF ONE (1) CONDUIT 2" PVC SCHEDULE 40. ALL MEDIUM VOLTAGE DISTRIBUTION SYSTEM WIRING WILL BE DESIGNED, FURNISHED AND INSTALLED BY LEE COUNTY ELECTRIC COOPERATIVE (LCEC).
 3. AT ALL LCEC PULL BOX LOCATIONS THE CONTRACTOR SHALL INSTALL CONDUIT IN FULL LENGTH AND LCEC WILL CUT CONDUITS, INSTALL PULL BOXES, AND TERMINATE CONDUITS TO PULL BOXES.



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5 SECTIONS AND DETAIL VIEWS
E200 3 PHASE POWER STUB UP AT FUTURE DISCHARGE STRUCTURE



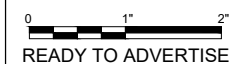
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

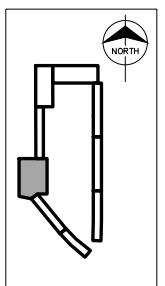
**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

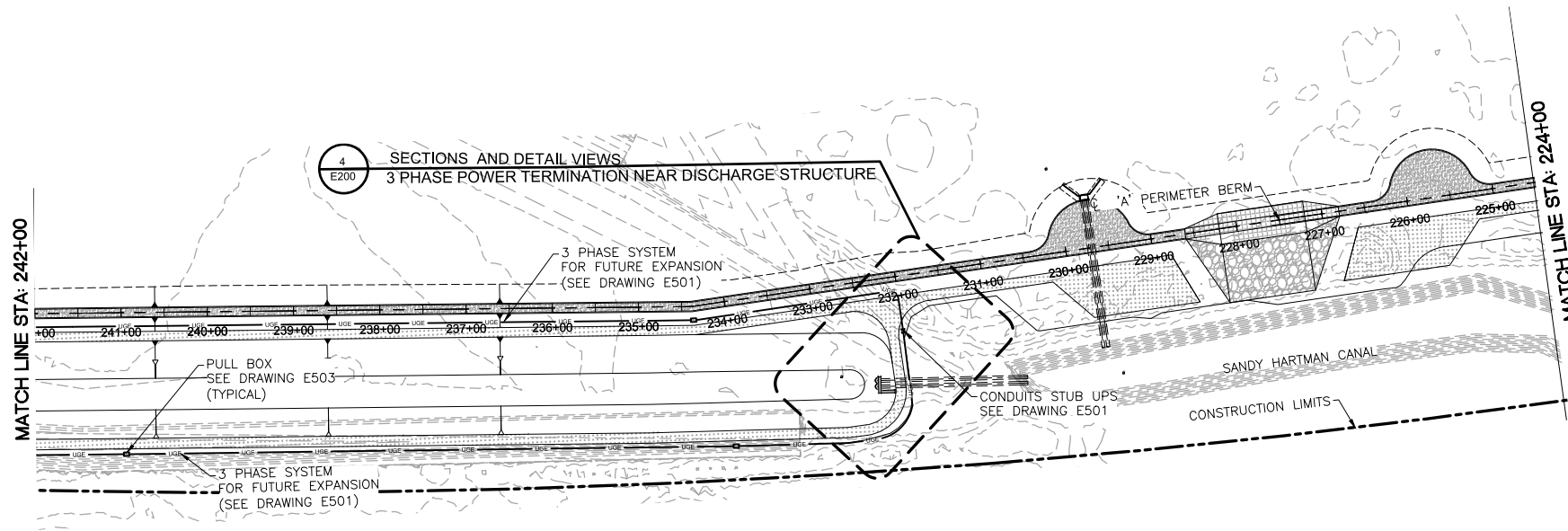
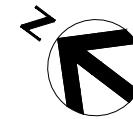
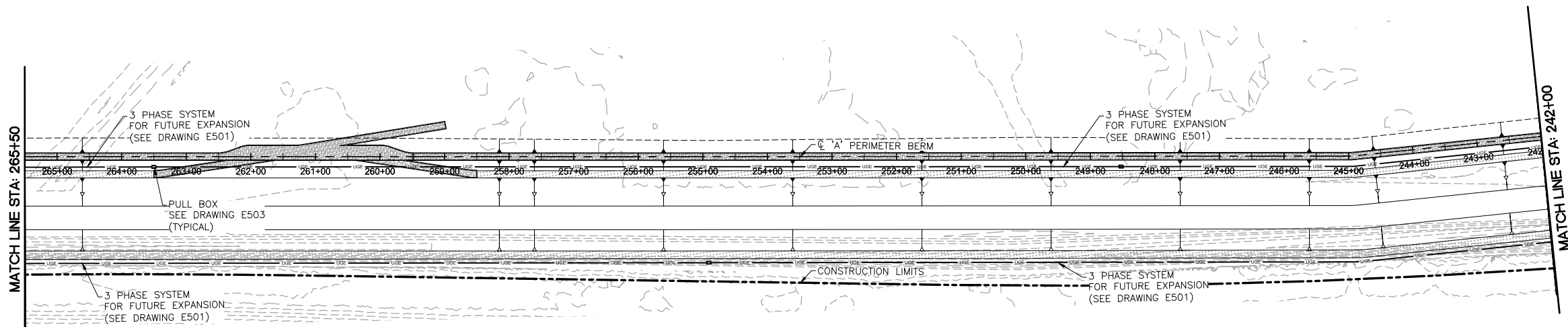


**ELECTRICAL
SITE PLAN (3 OF 4)**

SHEET 77 of 92
SCALE 1"=100'

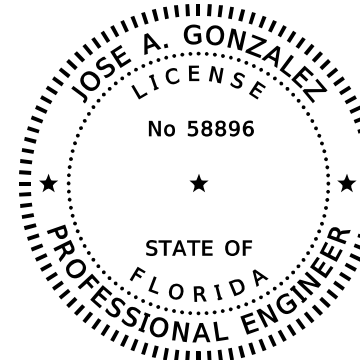


DRAWING
E103

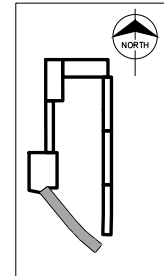


NOTES:

1. SEE DRAWING E-501 FOR POWER SYSTEM TYPICAL SECTION DETAIL.
2. 3 PHASE SYSTEM CONSIST OF THREE (3) 2" PVC SCHEDULE 40 CONDUITS AND THE SINGLE PHASE SYSTEM CONSIST OF ONE (1) CONDUIT 2" PVC SCHEDULE 40. ALL MEDIUM VOLTAGE DISTRIBUTION SYSTEM WIRING WILL BE DESIGNED, FURNISHED AND INSTALLED BY LEE COUNTY ELECTRIC COOPERATIVE (LCEC).
3. AT ALL LCEC PULL BOX LOCATIONS THE CONTRACTOR SHALL INSTALL CONDUIT IN FULL LENGTH AND LCEC WILL CUT CONDUITS, INSTALL PULL BOXES, AND TERMINATE CONDUITS TO PULL BOXES.



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4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609
 CA 4213

ISSUE	DATE	DESCRIPTION

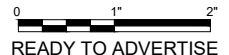
PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
 FL PE #58896
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

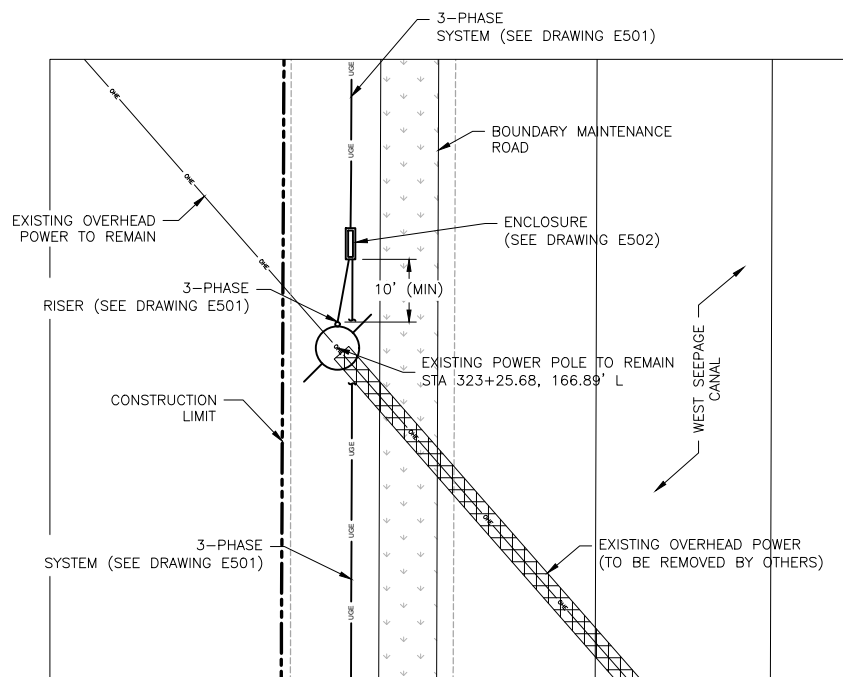
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

ELECTRICAL SITE PLAN (4 OF 4)

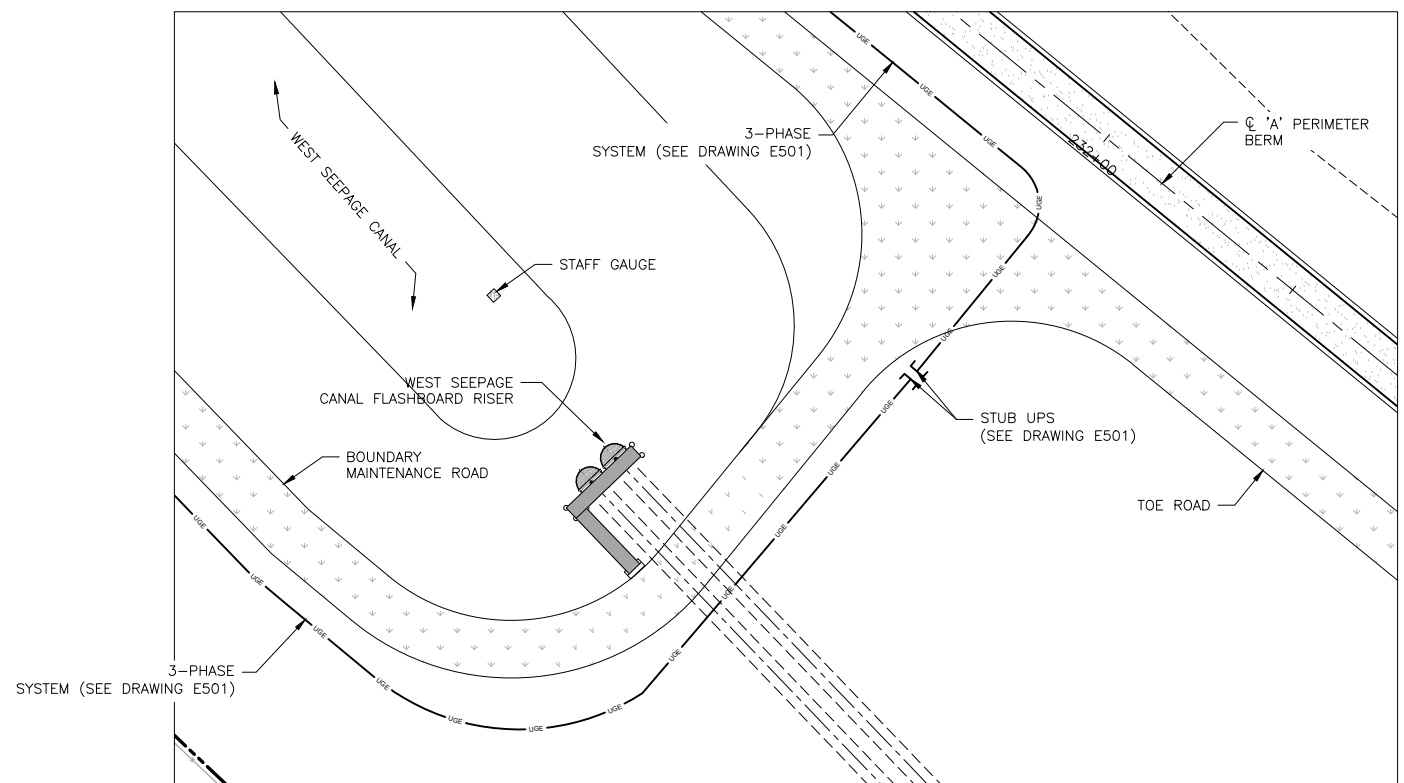


SHEET 78 of 92
 SCALE 1"=100'

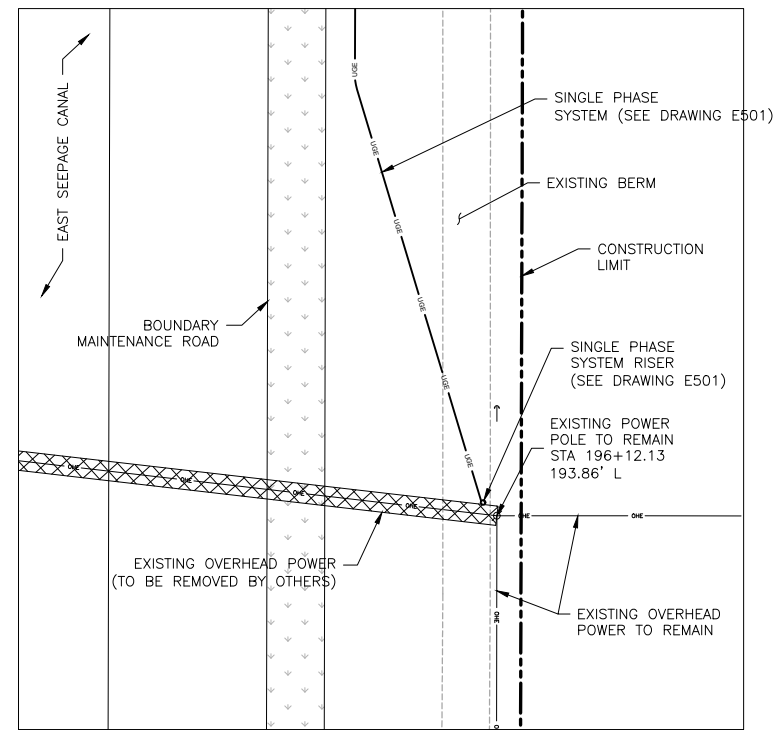
DRAWING
E104



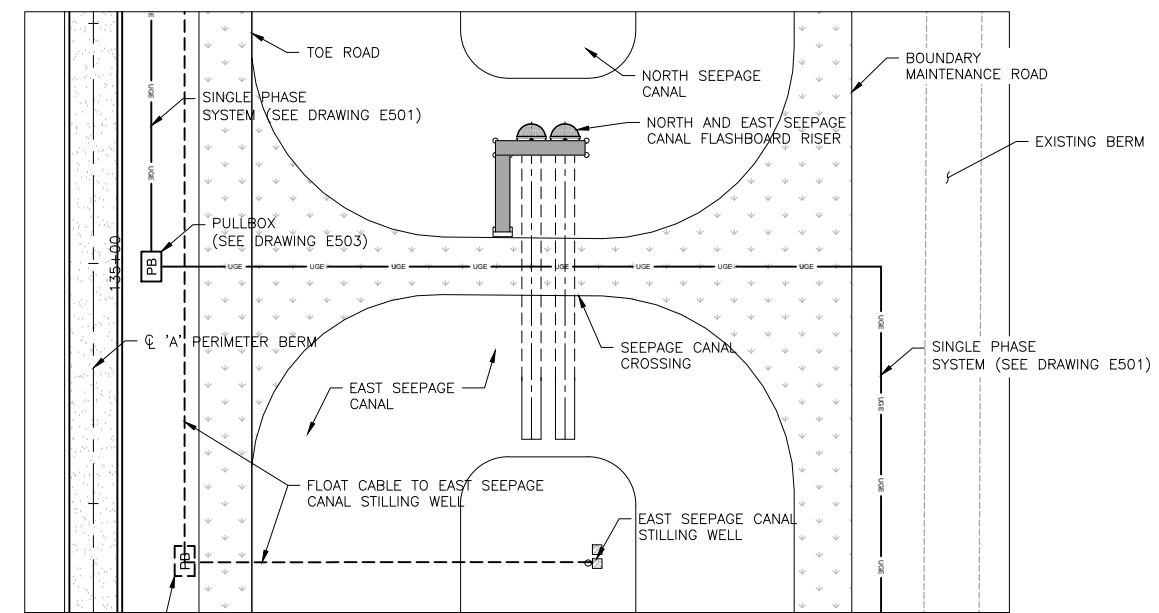
1 3 PHASE POWER INTO SITE
E101 1" = 20'



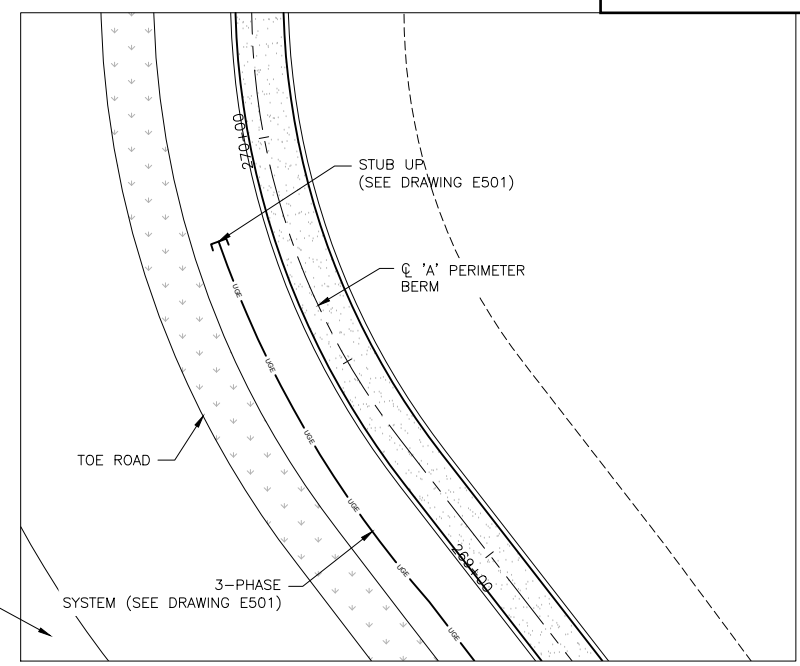
4 3 PHASE POWER TERMINATION NEAR DISCHARGE STRUCTURE
E104 1" = 20'



3 1 PHASE POWER TIE TO EXISTING
E102 1" = 20'

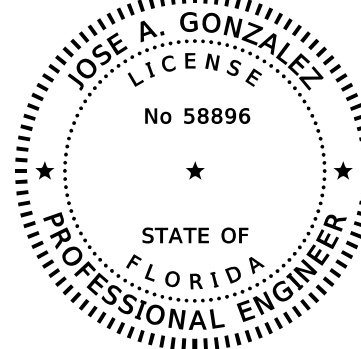
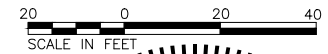


2 SEEPAGE CANAL CROSSING
E102 1" = 20'



5 3 PHASE POWER STUB OUT AT FUTURE SW DISCHARGE STRUCTURE
E103 1" = 20'

- NOTES:
- SEE DRAWING E501 FOR POWER SYSTEM TYPICAL SECTION DETAILS.
 - ALL ELECTRICAL CONDUITS CROSSING CULVERTS ARE TO BE INSTALLED A MINIMUM OF 12 INCHES ABOVE THE TOP OF CULVERT.
 - ENCLOSURE SHALL HAVE A MINIMUM OF 10' CLEARANCE FROM THE 3-PHASE RISER.



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JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

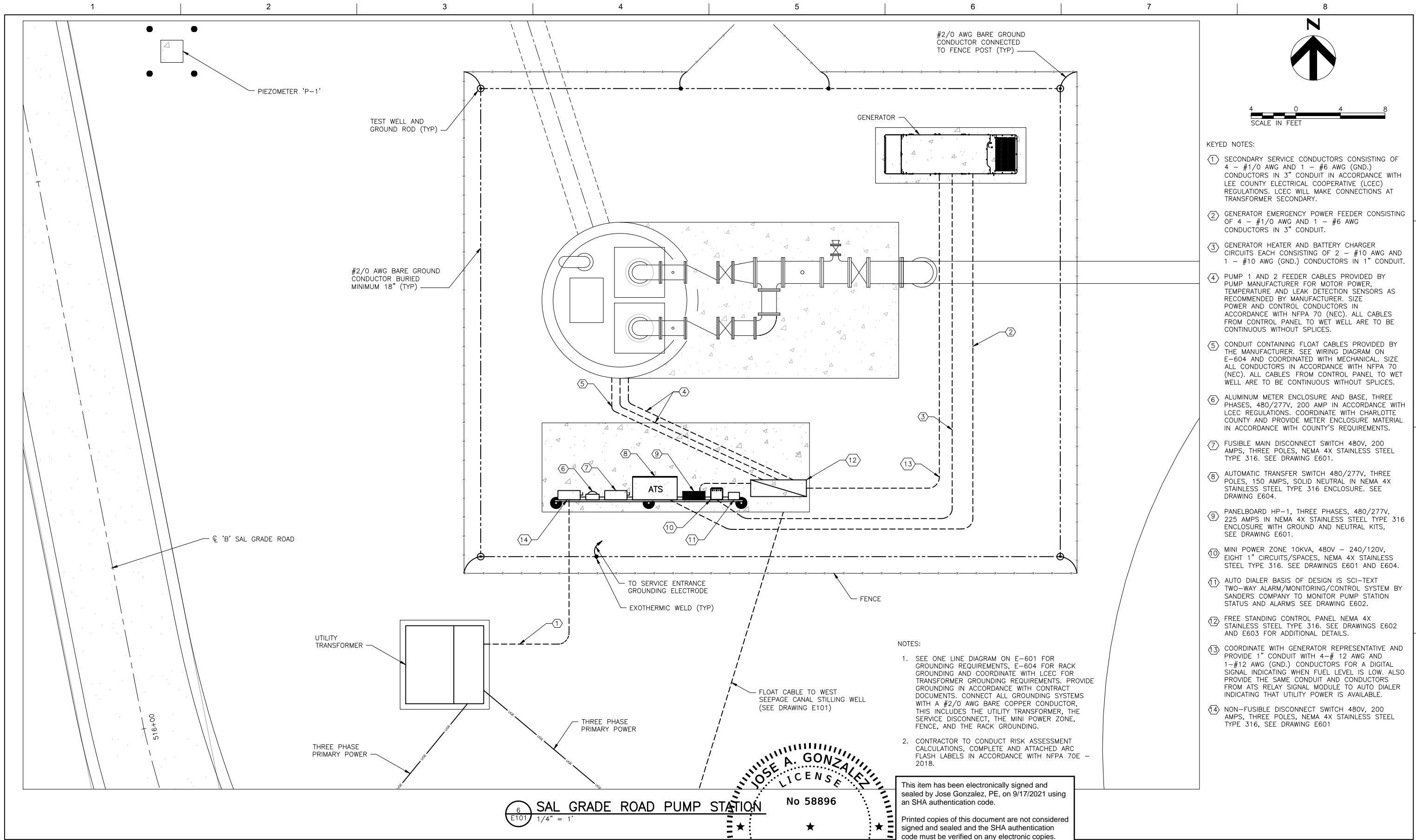
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

ELECTRICAL ENLARGED SITE PLANS (1 OF 3)

READY TO ADVERTISE

SHEET	79 of 92
SCALE	1" = 20'

DRAWING **E200**



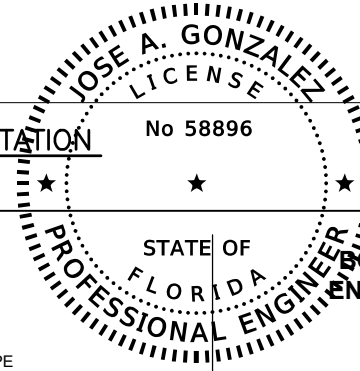
4 0 4 8
SCALE IN FEET

- KEYED NOTES:
- ① SECONDARY SERVICE CONDUCTORS CONSISTING OF 4 - #1/0 AWG AND 1 - #6 AWG (GND.) CONDUCTORS IN 3" CONDUIT IN ACCORDANCE WITH LEE COUNTY ELECTRICAL COOPERATIVE (LCEC) REGULATIONS. LCEC WILL MAKE CONNECTIONS AT TRANSFORMER SECONDARY.
 - ② GENERATOR EMERGENCY POWER FEEDER CONSISTING OF 4 - #1/0 AWG AND 1 - #6 AWG CONDUCTORS IN 3" CONDUIT.
 - ③ GENERATOR HEATER AND BATTERY CHARGER CIRCUITS EACH CONSISTING OF 2 - #10 AWG AND 1 - #10 AWG (GND.) CONDUCTORS IN 1" CONDUIT.
 - ④ PUMP 1 AND 2 FEEDER CABLES PROVIDED BY PUMP MANUFACTURER FOR MOTOR POWER, TEMPERATURE AND LEAK DETECTION SENSORS AS RECOMMENDED BY MANUFACTURER. SIZE POWER AND CONTROL CONDUCTORS IN ACCORDANCE WITH NFPA 70 (NEC). ALL CABLES FROM CONTROL PANEL TO WET WELL ARE TO BE CONTINUOUS WITHOUT SPLICES.
 - ⑤ CONDUIT CONTAINING FLOAT CABLES PROVIDED BY THE MANUFACTURER. SEE WIRING DIAGRAM ON E-604 AND COORDINATED WITH MECHANICAL. SIZE ALL CONDUCTORS IN ACCORDANCE WITH NFPA 70 (NEC). ALL CABLES FROM CONTROL PANEL TO WET WELL ARE TO BE CONTINUOUS WITHOUT SPLICES.
 - ⑥ ALUMINUM METER ENCLOSURE AND BASE, THREE PHASES, 480/277V, 200 AMP IN ACCORDANCE WITH LCEC REGULATIONS. COORDINATE WITH CHARLOTTE COUNTY AND PROVIDE METER ENCLOSURE MATERIAL IN ACCORDANCE WITH COUNTY'S REQUIREMENTS.
 - ⑦ FUSIBLE MAIN DISCONNECT SWITCH 480V, 200 AMPS, THREE POLES, NEMA 4X STAINLESS STEEL TYPE 316. SEE DRAWING E601.
 - ⑧ AUTOMATIC TRANSFER SWITCH 480/277V, THREE POLES, 150 AMPS, SOLID NEUTRAL IN NEMA 4X STAINLESS STEEL TYPE 316 ENCLOSURE. SEE DRAWING E604.
 - ⑨ PANELBOARD HP-1, THREE PHASES, 480/277V, 225 AMPS IN NEMA 4X STAINLESS STEEL TYPE 316 ENCLOSURE WITH GROUND AND NEUTRAL KITS, SEE DRAWING E601.
 - ⑩ MINI POWER ZONE 10KVA, 480V - 240/120V, EIGHT 1" CIRCUITS/SPACES, NEMA 4X STAINLESS STEEL TYPE 316. SEE DRAWINGS E601 AND E604.
 - ⑪ AUTO DIALER BASIS OF DESIGN IS SCI-TEXT TWO-WAY ALARM/MONITORING/CONTROL SYSTEM BY SANDERS COMPANY TO MONITOR PUMP STATION STATUS AND ALARMS SEE DRAWING E602.
 - ⑫ FREE STANDING CONTROL PANEL NEMA 4X STAINLESS STEEL TYPE 316. SEE DRAWINGS E602 AND E603 FOR ADDITIONAL DETAILS.
 - ⑬ COORDINATE WITH GENERATOR REPRESENTATIVE AND PROVIDE 1" CONDUIT WITH 4-#12 AWG AND 1-#12 AWG (GND.) CONDUCTORS FOR A DIGITAL SIGNAL INDICATING WHEN FUEL LEVEL IS LOW. ALSO PROVIDE THE SAME CONDUIT AND CONDUCTORS FROM ATS RELAY SIGNAL MODULE TO AUTO DIALER INDICATING THAT UTILITY POWER IS AVAILABLE.
 - ⑭ NON-FUSIBLE DISCONNECT SWITCH 480V, 200 AMPS, THREE POLES, NEMA 4X STAINLESS STEEL TYPE 316, SEE DRAWING E601

- NOTES:
1. SEE ONE LINE DIAGRAM ON E-601 FOR GROUNDING REQUIREMENTS, E-604 FOR RACK GROUNDING AND COORDINATE WITH LCEC FOR TRANSFORMER GROUNDING REQUIREMENTS. PROVIDE GROUNDING IN ACCORDANCE WITH CONTRACT DOCUMENTS. CONNECT ALL GROUNDING SYSTEMS WITH A #2/0 AWG BARE COPPER CONDUCTOR, THIS INCLUDES THE UTILITY TRANSFORMER, THE SERVICE DISCONNECT, THE MINI POWER ZONE, FENCE, AND THE RACK GROUNDING.
 2. CONTRACTOR TO CONDUCT RISK ASSESSMENT CALCULATIONS, COMPLETE AND ATTACHED ARC FLASH LABELS IN ACCORDANCE WITH NFPA 70E - 2018.

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6 SAL GRADE ROAD PUMP STATION
E101 1/4" = 1'



4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

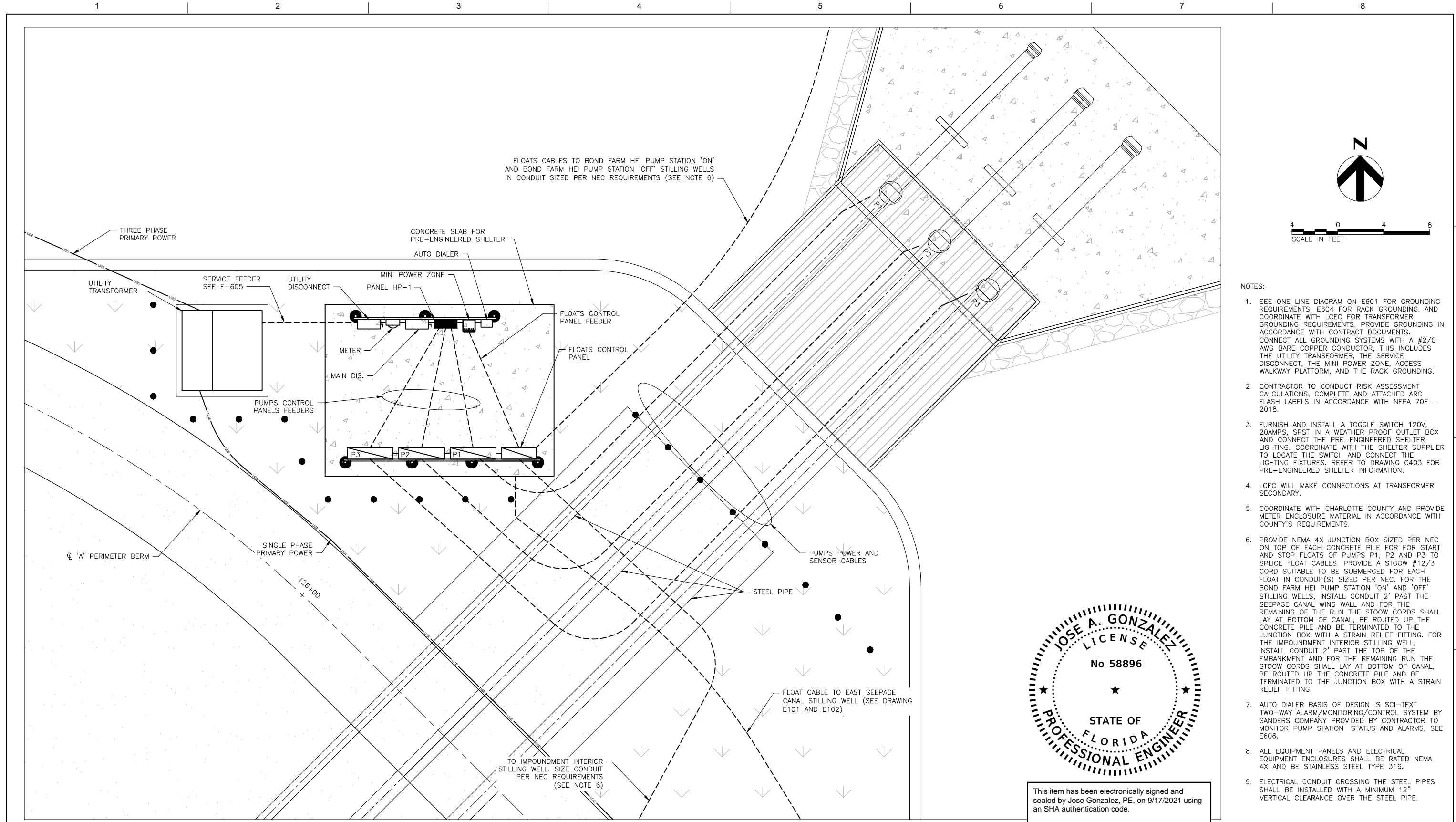
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

0 1 2
READY TO ADVERTISE

ELECTRICAL
ENLARGED SITE PLANS
(2 OF 3)

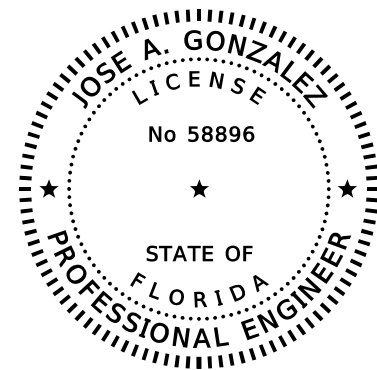
SHEET 80 of 92
SCALE 1/4"=1'

DRAWING
E201



FLOATS CABLES TO BOND FARM HEI PUMP STATION 'ON' AND BOND FARM HEI PUMP STATION 'OFF' STILLING WELLS IN CONDUIT SIZED PER NEC REQUIREMENTS (SEE NOTE 6)

- NOTES:
- SEE ONE LINE DIAGRAM ON E601 FOR GROUNDING REQUIREMENTS, E604 FOR RACK GROUNDING, AND COORDINATE WITH LCEC FOR TRANSFORMER GROUNDING REQUIREMENTS. PROVIDE GROUNDING IN ACCORDANCE WITH CONTRACT DOCUMENTS. CONNECT ALL GROUNDING SYSTEMS WITH A #2/0 AWG BARE COPPER CONDUCTOR. THIS INCLUDES THE UTILITY TRANSFORMER, THE SERVICE DISCONNECT, THE MINI POWER ZONE, ACCESS WALKWAY PLATFORM, AND THE RACK GROUNDING.
 - CONTRACTOR TO CONDUCT RISK ASSESSMENT CALCULATIONS, COMPLETE AND ATTACHED ARC FLASH LABELS IN ACCORDANCE WITH NFPA 70E - 2018.
 - FURNISH AND INSTALL A TOGGLE SWITCH 120V, 20AMPS, SPST IN A WEATHER PROOF OUTLET BOX AND CONNECT THE PRE-ENGINEERED SHELTER LIGHTING. COORDINATE WITH THE SHELTER SUPPLIER TO LOCATE THE SWITCH AND CONNECT THE LIGHTING FIXTURES. REFER TO DRAWING C403 FOR PRE-ENGINEERED SHELTER INFORMATION.
 - LCEC WILL MAKE CONNECTIONS AT TRANSFORMER SECONDARY.
 - COORDINATE WITH CHARLOTTE COUNTY AND PROVIDE METER ENCLOSURE MATERIAL IN ACCORDANCE WITH COUNTY'S REQUIREMENTS.
 - PROVIDE NEMA 4X JUNCTION BOX SIZED PER NEC ON TOP OF EACH CONCRETE PILE FOR START AND STOP FLOATS OF PUMPS P1, P2 AND P3 TO SPICE FLOAT CABLES. PROVIDE A STOOV #12/3 CORD SUITABLE TO BE SUBMERGED FOR EACH FLOAT IN CONDUIT(S) SIZED PER NEC. FOR THE BOND FARM HEI PUMP STATION 'ON' AND 'OFF' STILLING WELLS, INSTALL CONDUIT 2' PAST THE SEEPAGE CANAL WING WALL AND FOR THE REMAINING OF THE RUN THE STOOV CORDS SHALL LAY AT BOTTOM OF CANAL. BE ROUTED UP THE CONCRETE PILE AND BE TERMINATED TO THE JUNCTION BOX WITH A STRAIN RELIEF FITTING. FOR THE IMPOUNDMENT INTERIOR STILLING WELL, INSTALL CONDUIT 2' PAST THE TOP OF THE EMBANKMENT AND FOR THE REMAINING RUN THE STOOV CORDS SHALL LAY AT BOTTOM OF CANAL, BE ROUTED UP THE CONCRETE PILE AND BE TERMINATED TO THE JUNCTION BOX WITH A STRAIN RELIEF FITTING.
 - AUTO DIALER BASIS OF DESIGN IS SCI-TEXT TWO-WAY ALARM/MONITORING/CONTROL SYSTEM BY SANDERS COMPANY PROVIDED BY CONTRACTOR TO MONITOR PUMP STATION STATUS AND ALARMS, SEE E606.
 - ALL EQUIPMENT PANELS AND ELECTRICAL EQUIPMENT ENCLOSURES SHALL BE RATED NEMA 4X AND BE STAINLESS STEEL TYPE 316.
 - ELECTRICAL CONDUIT CROSSING THE STEEL PIPES SHALL BE INSTALLED WITH A MINIMUM 12" VERTICAL CLEARANCE OVER THE STEEL PIPE.



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7 BOND FARM HEI PUMP STATION
 E101 1/4" = 1'



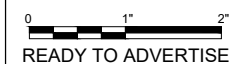
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE	
PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
 FL PE #58896
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

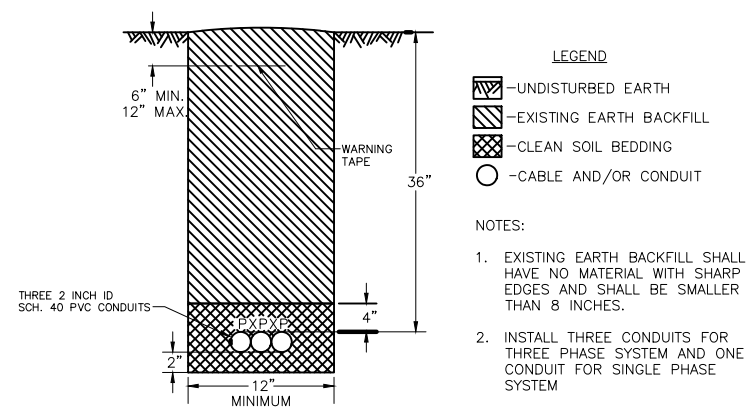
**BOND FARM HYDROLOGICAL
 ENHANCEMENT IMPOUNDMENT**
 FLORIDA FISH AND WILDLIFE
 CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399

**ELECTRICAL
 ENLARGED SITE PLAN
 (3 OF 3)**



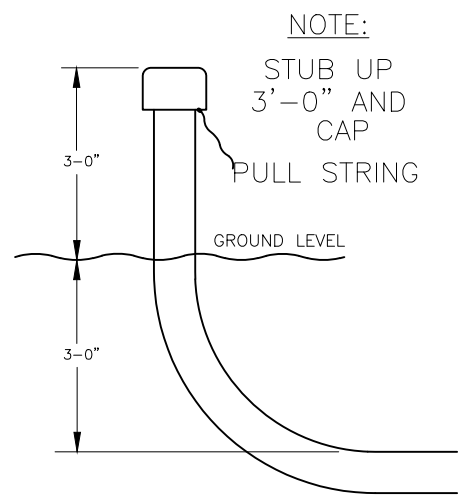
SHEET 81 of 92
 SCALE 1/4" = 1'

DRAWING
E202



- LEGEND**
- UNDISTURBED EARTH
 - EXISTING EARTH BACKFILL
 - CLEAN SOIL BEDDING
 - CABLE AND/OR CONDUIT
- NOTES:**
1. EXISTING EARTH BACKFILL SHALL HAVE NO MATERIAL WITH SHARP EDGES AND SHALL BE SMALLER THAN 8 INCHES.
 2. INSTALL THREE CONDUITS FOR THREE PHASE SYSTEM AND ONE CONDUIT FOR SINGLE PHASE SYSTEM

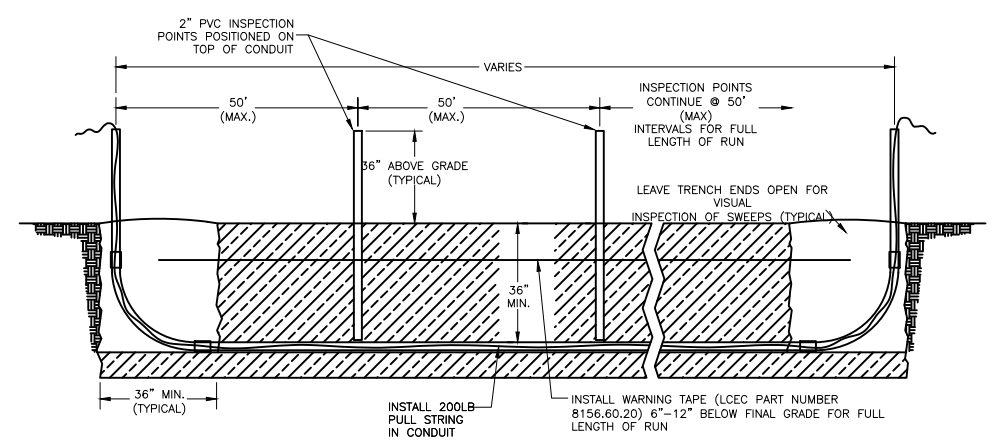
1 PRIMARY VOLTAGE TRENCH
NOT TO SCALE



NOTE:
STUB UP
3'-0" AND
CAP
PULL STRING

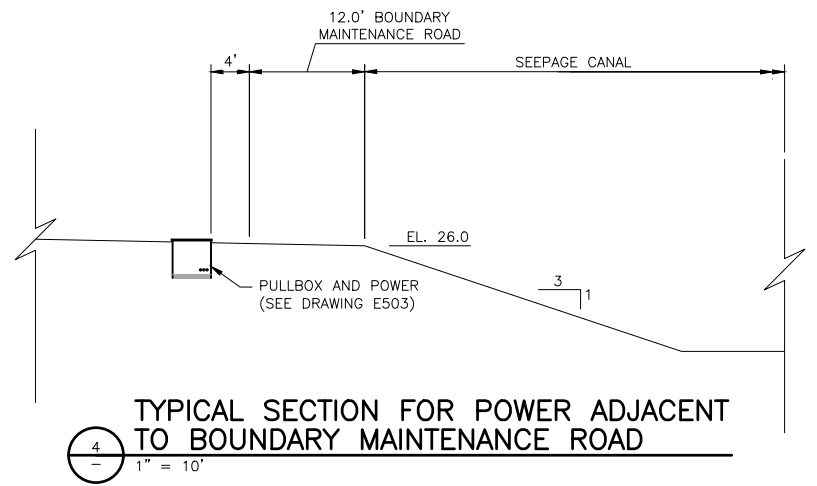
2 CONDUIT STUB UP DETAIL
NOT TO SCALE

- LEE COUNTY ELECTRICAL COOPERATIVE (LCEC) GUIDELINES FOR CUSTOMER INSTALLED CONDUIT:
1. ALL CUSTOMER INSTALLED CONDUIT IS FURNISHED BY THE CUSTOMER, INCLUDING ALL NECESSARY FITTINGS, ELBOWS, SWEEPS AND EQUIPMENT.
 2. THE CONTRACTOR BEARS THE FULL RESPONSIBILITY FOR REPAIRING OR REPLACING DAMAGED OR IMPROPERLY INSTALLED CONDUIT PRIOR TO LCEC INSTALLING CABLE IN THE CONDUIT.
 3. SCHEDULE 40 ELECTRICAL GRADE PVC CONDUIT MUST BE USED FOR CONDUCTORS RATED HIGHER THEN 600V. USE 36 INCH 90 DEGREE SWEEPS WITH CONCRETE PADS AND 24 INCH 90 DEGREE SWEEPS WITH BOX PADS.
 4. SCHEDULE 40 ELECTRICAL GRADE PVC CONDUIT MUST BE USED FOR CONDUCTORS RATED 600V AND BELOW. USE 36 INCH 90 DEGREE SWEEPS WITH CONCRETE PADS AND 24 INCH 90 DEGREE SWEEPS WITH BOX PADS.
 5. ALL ROAD CROSSING MUST BE AT A MINIMUM DEPTH OF 36 INCHES.
 6. THERE MUST BE NO LESS THAN 12 INCHES OF EARTH SEPARATION BETWEEN THE ELECTRICAL CONDUIT AND OTHER UTILITIES IN A JOINT TRENCH.
 7. THE MINIMUM DEPTH FOR CONDUCTORS RATED HIGHER THAN 600V IS 36 INCHES FROM FINISHED GRADE TO THE TOP OF THE CONDUIT, EXCEPT AT ENCLOSURE AND TRANSFORMER LOCATIONS WHERE THE MINIMUM DEPTH IS 40 INCHES FROM FINISHED GRADE TO THE TOP OF THE CONDUIT.
 8. THE MINIMUM DEPTH FOR CONDUCTORS RATED 600V AND LOWER IN 24 INCHES FROM FINISHED GRADE TO THE TOP OF THE CONDUIT.
 9. ALL DIRECTIONAL BORES WILL BE MADE BY LCEC OR AN LCEC PROVIDED CONTRACTOR. DIRECTIONAL BORES MUST BE CONNECTED TO CONDUIT USING A SPECIAL COUPLING. THE COUPLING CAN BE FURNISHED BY LCEC.
 10. THE SITE MUST BE WITHIN 6 INCHES OF FINAL GRADE OR GRADING STAKES MUST BE USED TO DETERMINE THE TRENCH DEPTH.
 11. INSTALL A 200 POUND PULL STRING IN ALL CONDUITS USING A MANDREL, WHICH WILL ASSURE THE CLEANLINESS OF THE CONDUIT.
 12. THE END OF ALL CONDUITS MUST BE PLUGGED TO KEEP THEM CLEAN.
 13. A RED MARKING TAPE MUST BE INSTALLED 12 INCHES BELOW FINAL GRADE. THE TAPE CAN BE FURNISHED BY LCEC.
 14. INSTALL FAULT CURRENT INDICATORS ON THE LOAD SIDE PRIMARY CABLES.
 15. AT ALL LCEC PULL BOX LOCATIONS, THE CONTRACTOR SHALL INSTALL CONDUIT IN FULL LENGTH AND LCEC WILL CUT CONDUITS, INSTALL PULL BOXES AND TERMINATE CONDUITS TO PULL BOXES.

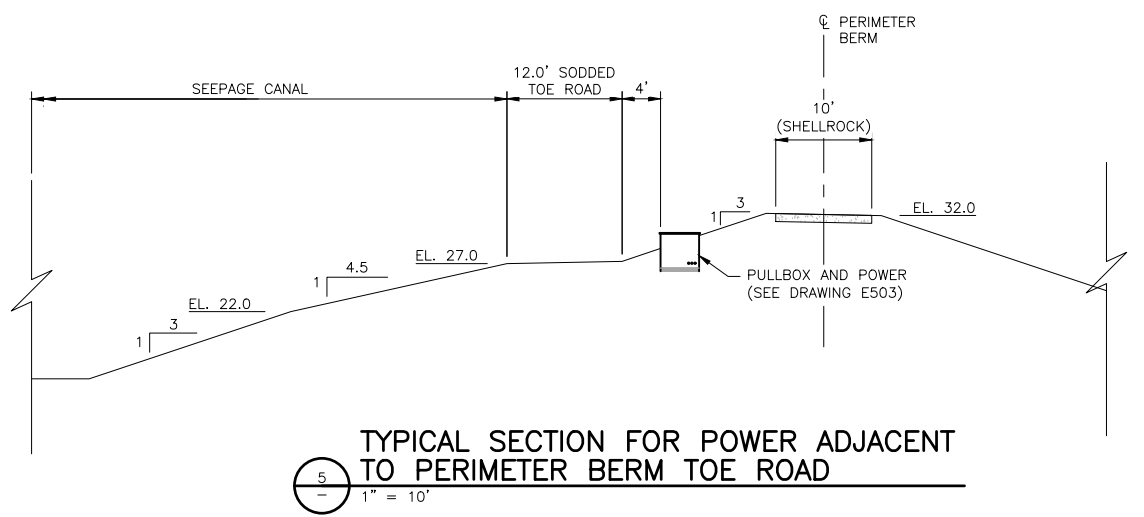


- LEGEND**
- CABLE AND/OR CONDUIT
 - UNDISTURBED EARTH
 - EXISTING EARTH BACKFILL
- NOTES:**
1. EXISTING EARTH BACKFILL SHALL HAVE NO MATERIAL WITH SHARP EDGES AND SHALL BE SMALLER THAN 8 INCHES.
 2. COORDINATE WITH LCEC, OWNER AND/OR REPRESENTATIVE AND SUBMIT TO LCEC PRIMARY CONDUIT INSPECTION SHEET

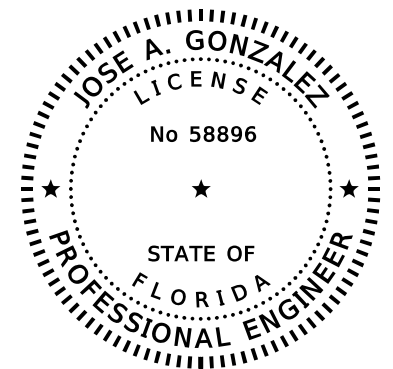
3 PRIMARY CONDUIT INSPECTION POINTS
NOT TO SCALE



4 TYPICAL SECTION FOR POWER ADJACENT TO BOUNDARY MAINTENANCE ROAD
1" = 10'



5 TYPICAL SECTION FOR POWER ADJACENT TO PERIMETER BERM TOE ROAD
1" = 10'



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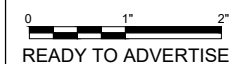


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PROJECT NUMBER	10061267

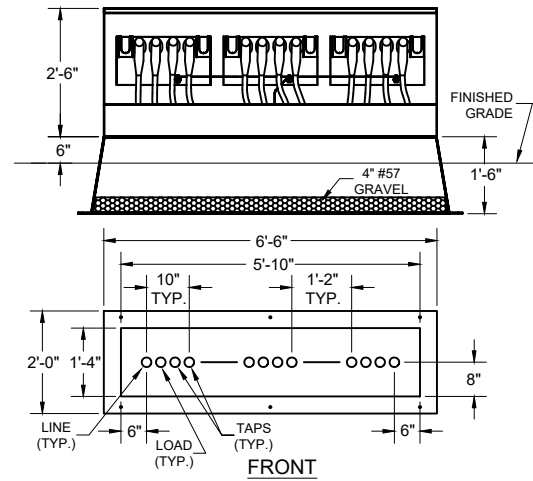
JOSE A. GONZALEZ, PE
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TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

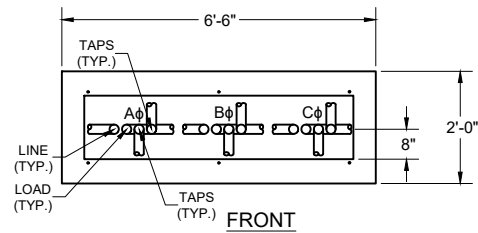


ELECTRICAL DETAILS (1 OF 3)
SHEET 82 of 92
SCALE VARIES

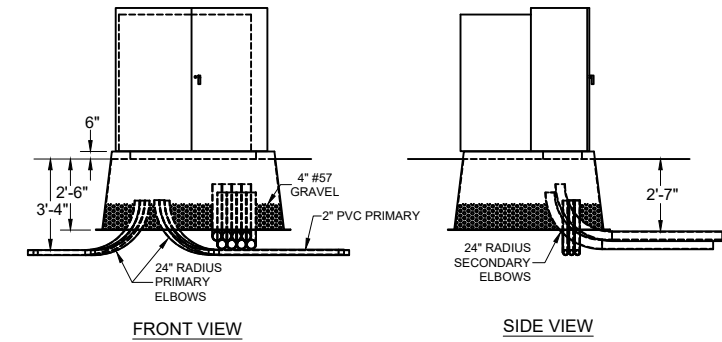
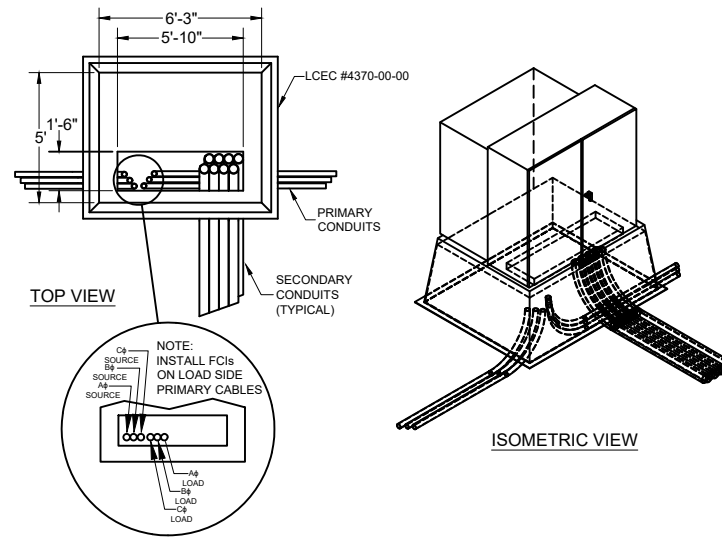
DRAWING
E501



LINE: TYPICAL INCOMING FEED. 2 INCH PRIMARY CONDUIT
 LOAD: TYPICAL OUTGOING FEED. 24 INCH RADIUS SWEEPS
 TAP: TYPICALLY TRANSFORMER, 30 INCHES MINIMUM COVER
 LATERAL TAP OR SURGE ARRESTOR POSITION.



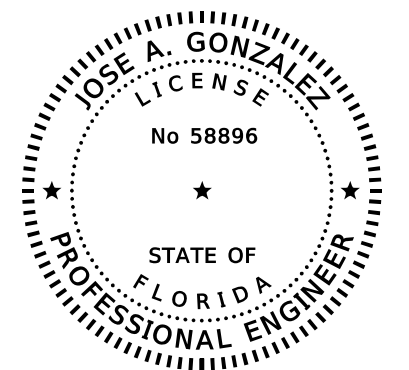
4 **THREE PHASE ENCLOSURE WITH GROUND SLEEVE STUB-UP DETAIL**
 NOT TO SCALE



5 **TRANSFORMERS THREE PHASE, PAD MOUNT BOX PAD**
 NOT TO SCALE

- LEE COUNTY ELECTRICAL COOPERATIVE (LCEC) GUIDELINES FOR CUSTOMER INSTALLED CONDUIT:
1. ALL CUSTOMER INSTALLED CONDUIT IS FURNISHED BY THE CUSTOMER, INCLUDING ALL NECESSARY FITTINGS, ELBOWS, SWEEPS AND EQUIPMENT.
 2. THE CUSTOMER/CONTRACTOR BEARS THE FULL RESPONSIBILITY FOR REPAIRING OR REPLACING DAMAGED OR IMPROPERLY INSTALLED CONDUIT PRIOR TO LCEC INSTALLING CABLE IN THE CONDUIT.
 3. SCHEDULE 40 ELECTRICAL GRADE PVC CONDUIT MUST BE USED FOR CONDUCTORS RATED HIGHER THEN 600V. USE 36 INCH 90 DEGREE SWEEPS WITH CONCRETE PADS AND 24 INCH 90 DEGREE SWEEPS WITH BOX PADS.
 4. SCHEDULE 40 ELECTRICAL GRADE PVC CONDUIT MUST BE USED FOR CONDUCTORS RATED 600V AND BELOW. USE 36 INCH 90 DEGREE SWEEPS WITH CONCRETE PADS AND 24 INCH 90 DEGREE SWEEPS WITH BOX PADS.
 5. ALL ROAD CROSSING MUST BE AT A MINIMUM DEPTH OF 36 INCHES.
 6. THERE MUST BE NO LESS THAN 12 INCHES OF EARTH SEPARATION BETWEEN THE ELECTRICAL CONDUIT AND OTHER UTILITIES IN A JOINT TRENCH.
 7. THE MINIMUM DEPTH FOR CONDUCTORS RATED HIGHER THAN 600V IS 36 INCHES FROM FINISHED GRADE TO THE TOP OF THE CONDUIT, EXCEPT AT ENCLOSURE AND TRANSFORMER LOCATIONS WHERE THE MINIMUM DEPTH IS 40 INCHES FROM FINISHED GRADE TO THE TOP OF THE CONDUIT.
 8. THE MINIMUM DEPTH FOR CONDUCTORS RATED 600V AND LOWER IN 24 INCHES FROM FINISHED GRADE TO THE TOP OF THE CONDUIT.
 9. ALL DIRECTIONAL BORES WILL BE MADE BY LCEC OR AN LCEC PROVIDED CONTRACTOR. DIRECTIONAL BORES MUST BE CONNECTED TO CONDUIT USING A SPECIAL COUPLING. THE COUPLING CAN BE FURNISHED BY LCEC.
 10. THE SITE MUST BE WITHIN 6 INCHES OF FINAL GRADE OR GRADING STAKES MUST BE USED TO DETERMINE THE TRENCH DEPTH.
 11. INSTALL A 200 POUND PULL STRING IN ALL CONDUITS USING A MANDREL, WHICH WILL ASSURE THE CLEANLINESS OF THE CONDUIT.
 12. THE END OF ALL CONDUITS MUST BE PLUGGED TO KEEP THEM CLEAN.
 13. A RED MARKING TAPE MUST BE INSTALLED 12 INCHES BELOW FINAL GRADE. THE TAPE CAN BE FURNISHED BY LCEC.
 14. INSTALL FAULT CURRENT INDICATORS ON THE LOAD SIDE PRIMARY CABLES.

- NOTES:
1. COORDINATE WITH LEE COUNTY ELECTRICAL COOPERATIVE (LCEC), THE OWNER AND/OR THE OWNERS REPRESENTATIVE FOR THE INSTALLATION OF THE ENCLOSURE AND TRANSFORMERS WHERE SHOWN IN THE PLANS.
 2. THE CONTRACTOR WILL PROVIDE ALL THE EARTH WORK INCLUDING BUT NOT LIMITED TO DIGGING, INSTALLING THE 4" #57 STONE/GRAVEL, FILL/DIG TO LEVEL THE ENCLOSURE AND TRANSFORMER BOX PADS AND FILL TO MATCH THE FINAL GRADE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
 3. THE SITE CONDUITS INSTALLED BY THE CONTRACTOR SHALL BE CAPPED ABOVE THE GRAVEL AS COORDINATED WITH LCEC AND AS SHOWN IN THE DETAILS.
 4. LEE COUNTY ELECTRICAL COOPERATIVE WILL FURNISH AND INSTALL THE ENCLOSURE AND TRANSFORMERS AND FURNISH THE 4" #57 STONE/GRAVEL FOR THE CONTRACTOR TO INSTALL PER LCEC REQUIREMENTS.



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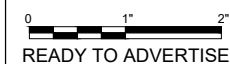


ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	SUSAN RAY, PE
PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
 FL PE #58896
 4830 W. KENNEDY BLVD, STE 400
 TAMPA, FL 33609

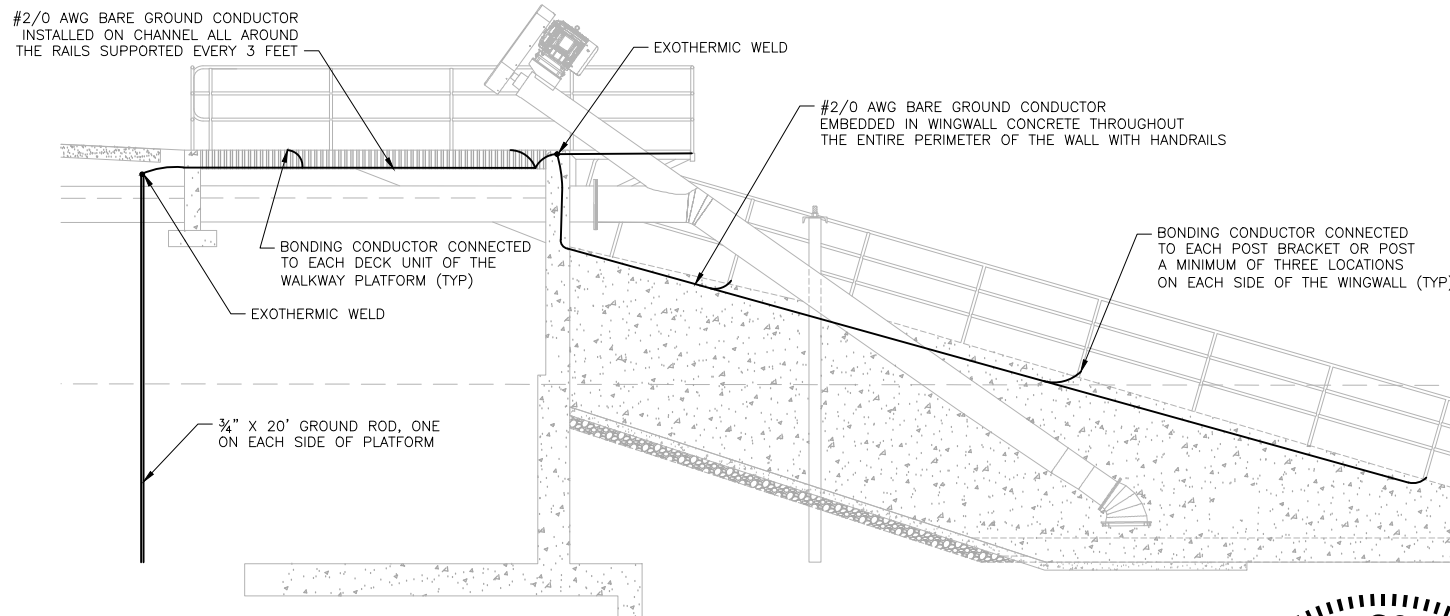
BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT
 FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 620 SOUTH MERIDIAN STREET
 TALLAHASSEE, FL 32399



ELECTRICAL DETAILS (2 OF 3)

SHEET 83 of 92
 SCALE NOT TO SCALE

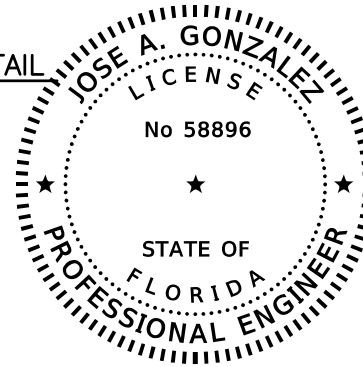
DRAWING **E502**



8 TYPICAL ACCESS WALKWAY PLATFORM GROUNDING DETAIL
NOT TO SCALE

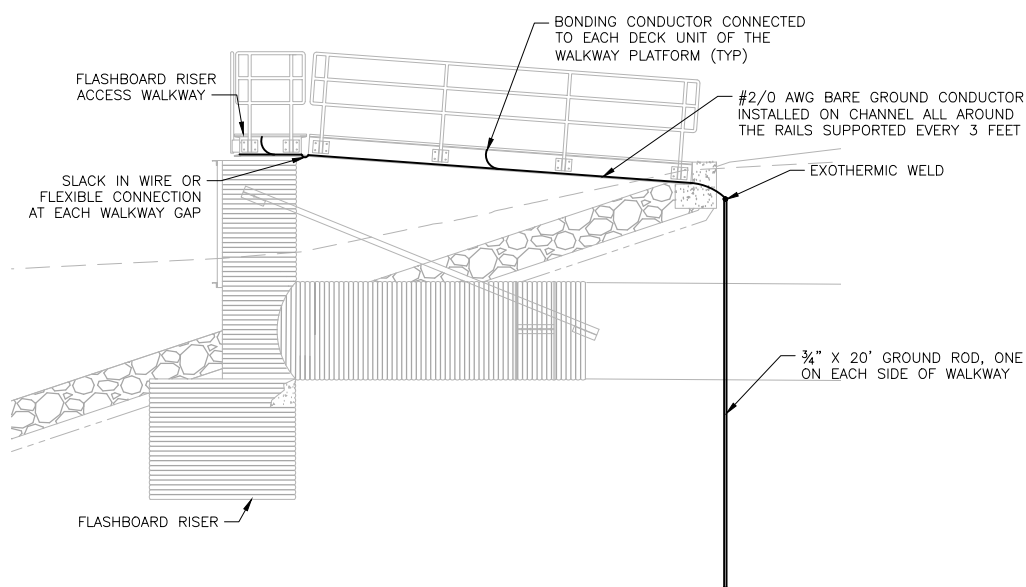
TYPICAL FLASHBOARD RISER WALKWAY, ACCESS WALKWAY PLATFORM, AND HANDRAIL GROUNDING DETAIL NOTES:

1. PROVIDE CORROSION PROTECTION FOR DISSIMILAR METALS WHERE NEEDED. USE BI-METALLIC CONNECTORS, OR ANY OTHER APPROVED MEANS.
2. GROUND ALL RAILING AND WALKING PLATFORMS IN THE PROJECT IN A SIMILAR MANNER USING MINIMUM TWO GROUNDING ELECTRODE LOCATIONS ON OPPOSITE OR DIAGONAL SIDES OF THE STRUCTURE AND RUNNING ONE GROUNDING CONDUCTOR THROUGHOUT THE PERIMETER OF THE STRUCTURE.
3. AT LOCATIONS WHERE THE RAILING IS SUPPORTED FROM THE CONCRETE STRUCTURE, SUCH AS THE PRIMARY DISCHARGE STRUCTURE, BOND IN A SIMILAR MANNER TO ABOVE DETAIL, EXCEPT RUN GROUND CONDUCTOR EMBEDDED IN CONCRETE AND BOND EVERY SECTION OF RAILING AT THE PLATE OR POST USING APPROVED CONNECTORS FOR GROUNDING OR LIGHTNING PROTECTION SYSTEMS.
4. BOND GROUNDING SYSTEM FOR PLATFORMS AND RAILINGS TO THE ELECTRICAL SERVICE ELECTRODES WHERE AVAILABLE.

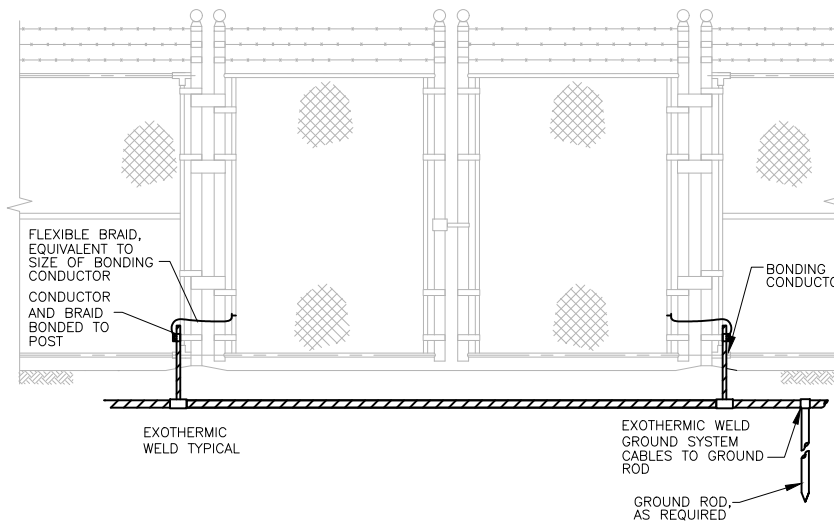


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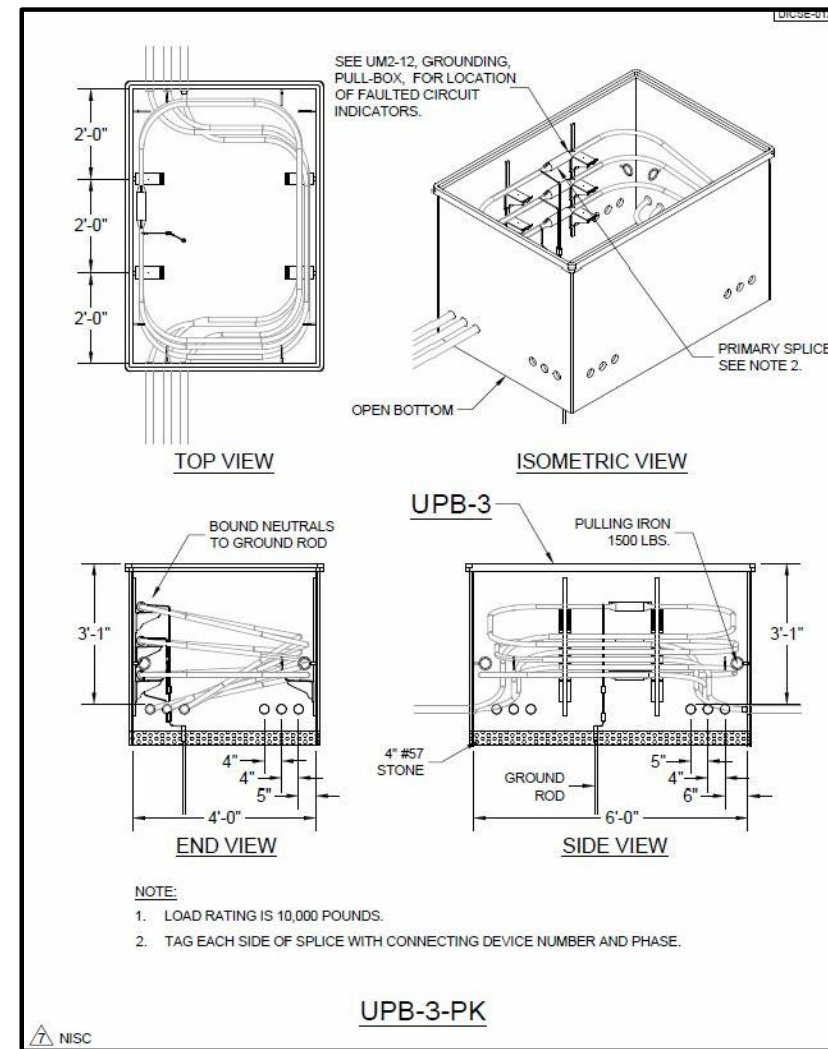
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7 TYPICAL FLASHBOARD RAILING GROUNDING DETAIL
NOT TO SCALE



9 FENCE POST GROUNDING DETAIL
NOT TO SCALE



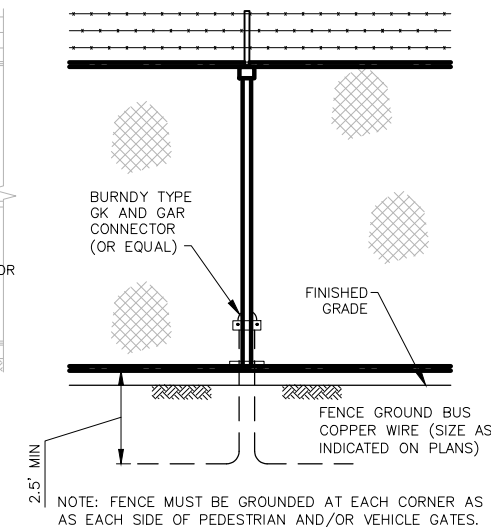
6 LCEC PULL BOX DETAILS
NOT TO SCALE

LEE COUNTY ELECTRICAL COOPERATIVE (LCEC) GUIDELINES FOR CUSTOMER INSTALLED CONDUIT:

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2. THE CUSTOMER/CONTRACTOR BEARS THE FULL RESPONSIBILITY FOR REPAIRING OR REPLACING DAMAGED OR IMPROPERLY INSTALLED CONDUIT PRIOR TO LCEC INSTALLING CABLE IN THE CONDUIT.
3. SCHEDULE 40 ELECTRICAL GRADE PVC CONDUIT MUST BE USED FOR CONDUCTORS RATED HIGHER THAN 600V. USE 36 INCH 90 DEGREE SWEEPS WITH CONCRETE PADS AND 24 INCH 90 DEGREE SWEEPS WITH BOX PADS.
4. SCHEDULE 40 ELECTRICAL GRADE PVC CONDUIT MUST BE USED FOR CONDUCTORS RATED 600V AND BELOW. USE 36 INCH 90 DEGREE SWEEPS WITH CONCRETE PADS AND 24 INCH 90 DEGREE SWEEPS WITH BOX PADS.
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12. THE END OF ALL CONDUITS MUST BE PLUGGED TO KEEP THEM CLEAN.
13. A RED MARKING TAPE MUST BE INSTALLED 12 INCHES BELOW FINAL GRADE. THE TAPE CAN BE FURNISHED BY LCEC.
14. INSTALL FAULT CURRENT INDICATORS ON THE LOAD SIDE PRIMARY CABLES.
15. AT ALL LCEC PULL BOX LOCATIONS THE CONTRACTOR SHALL PROVIDE CONDUIT IN FULL LENGTH AND LCEC WILL CUT CONDUITS, INSTALL PULL BOX AND TERMINATE CONDUIT TO PULL BOX.

GENERAL NOTES:

1. COORDINATE WITH LEE COUNTY ELECTRICAL COOPERATIVE (LCEC), THE OWNER AND/OR THE OWNERS REPRESENTATIVE FOR THE INSTALLATION OF THE PULL BOXES WHERE SHOWN IN THE PLANS.
2. THE CONTRACTOR WILL PROVIDE ALL THE EARTH WORK INCLUDING BUT NOT LIMITED TO DIGGING, INSTALLING THE 4" #57 STONE/GRAVEL, FILL/DIG TO LEVEL THE PULL BOX AND FILL TO MATCH THE FINAL GRADE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
3. THE SITE CONDUITS INSTALLED BY THE CONTRACTOR SHALL BE CAPPED ADJACENT TO ALL PULL BOXES FOR TERMINATION BY LCEC TO THE PULL BOXES.
4. LEE COUNTY ELECTRICAL COOPERATIVE WILL FURNISH AND INSTALL THE PULL BOX AND FURNISH THE 4" #57 STONE/GRAVEL FOR THE CONTRACTOR TO INSTALL PER LCEC REQUIREMENTS.



4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
CA 4213

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

PROJECT NUMBER 10061267

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

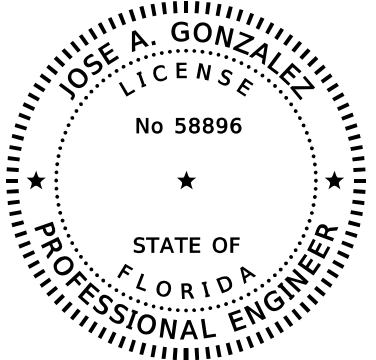
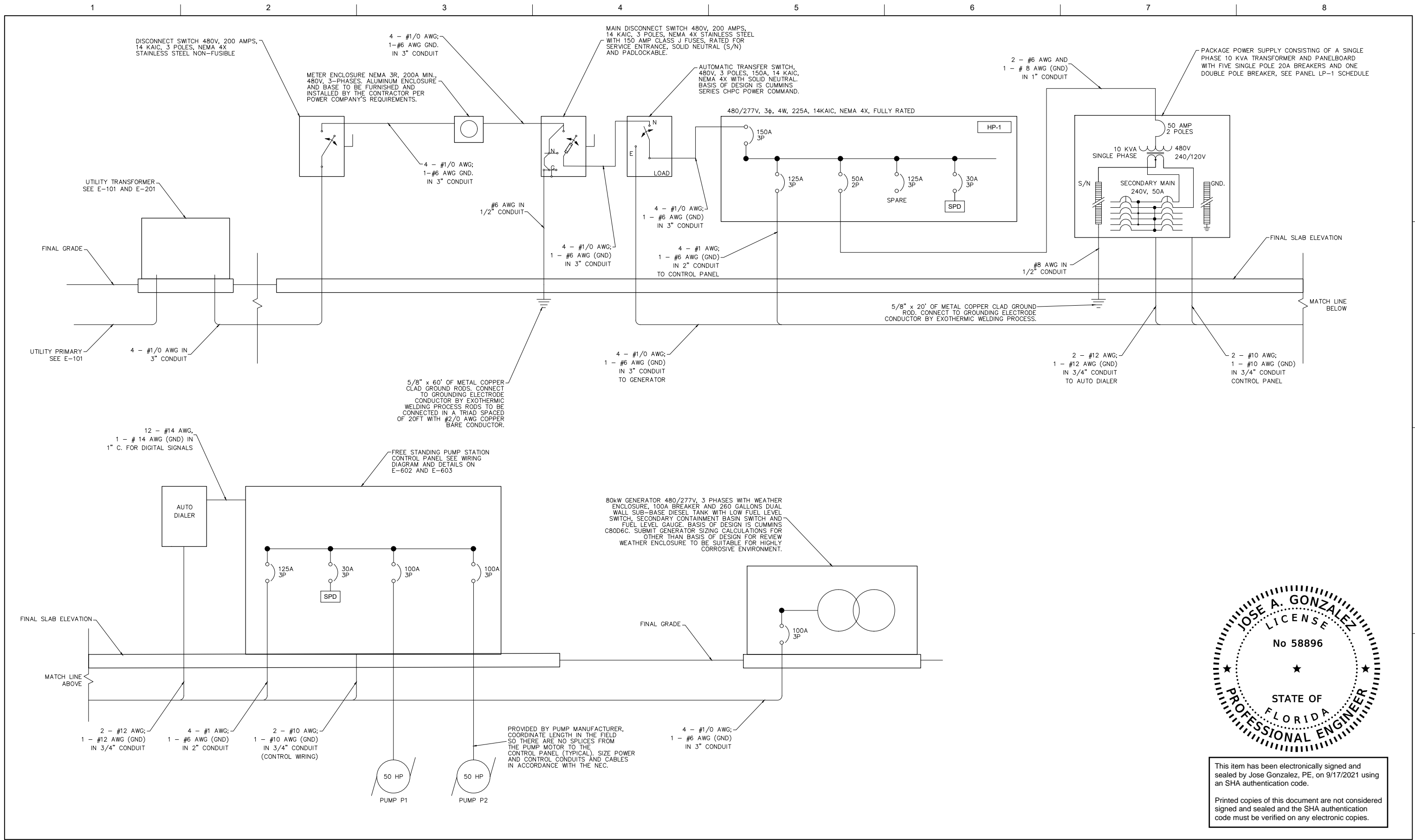
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

ELECTRICAL DETAILS (3 OF 3)

0 1" 2"
READY TO ADVERTISE

SHEET 84 of 92
SCALE NOT TO SCALE

DRAWING
E503



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PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION

620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

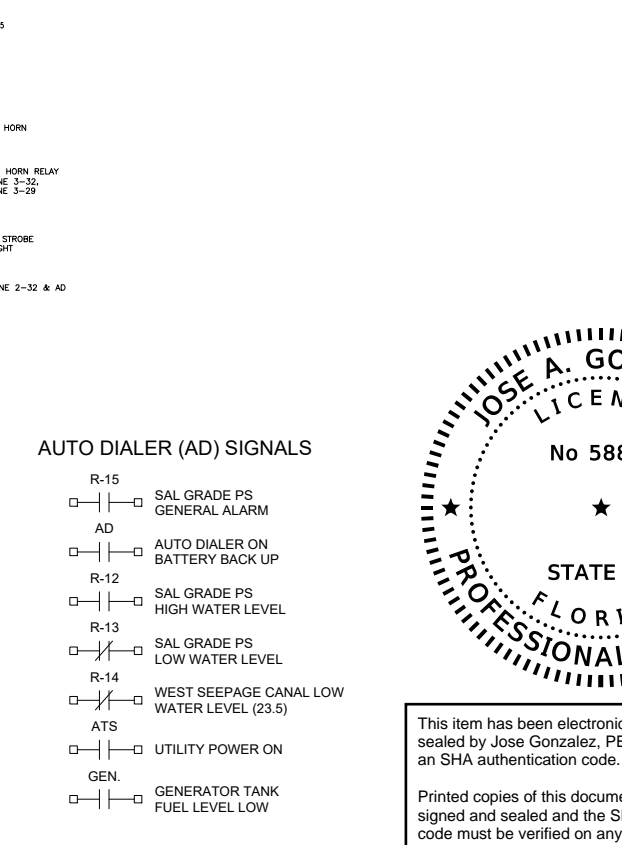
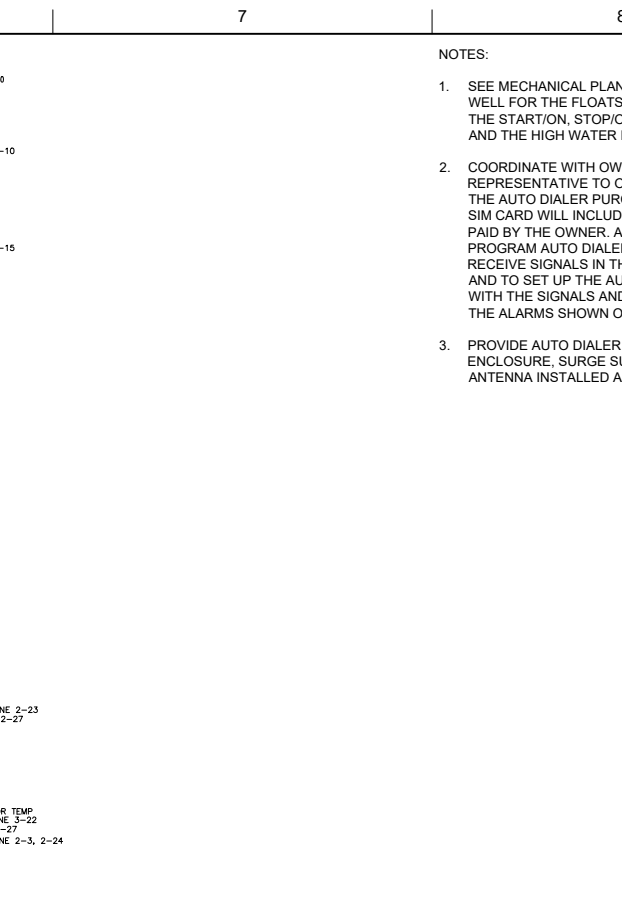
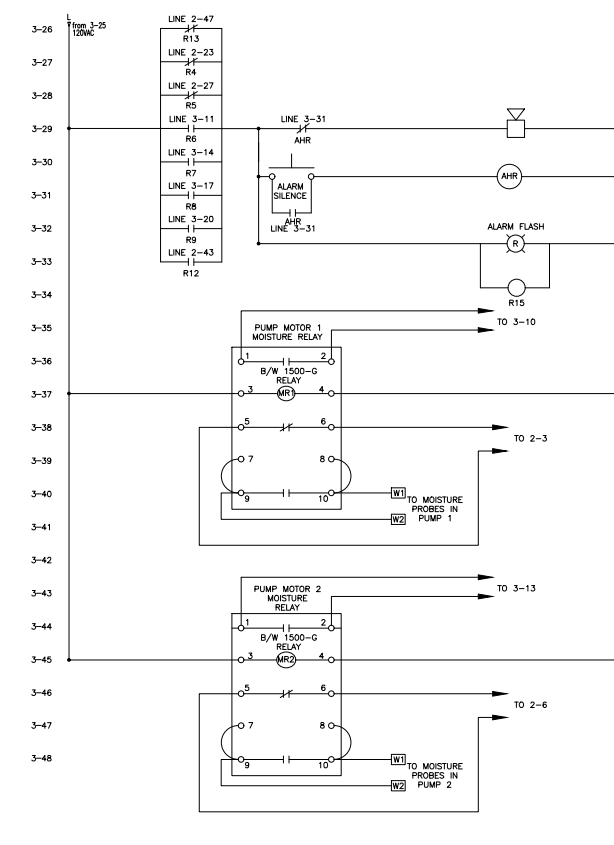
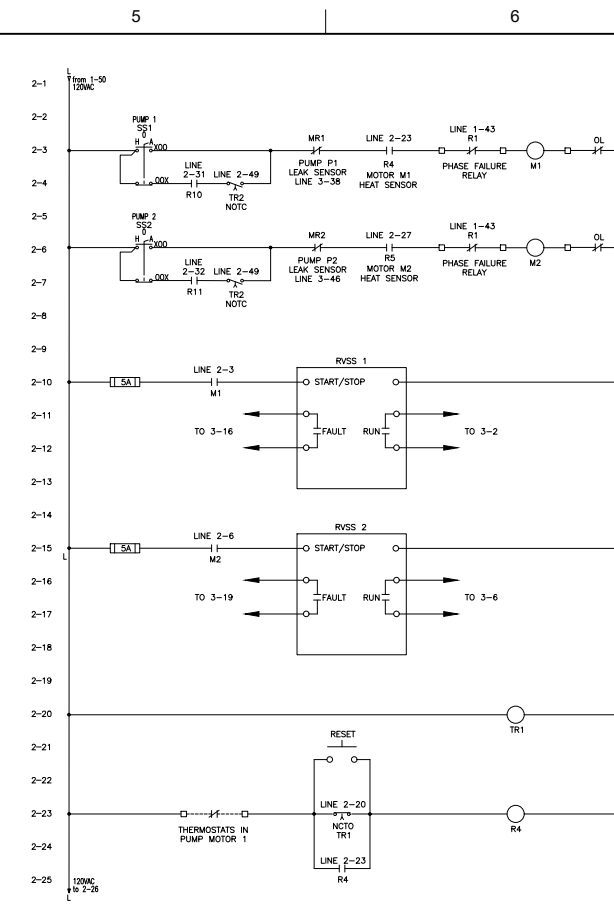
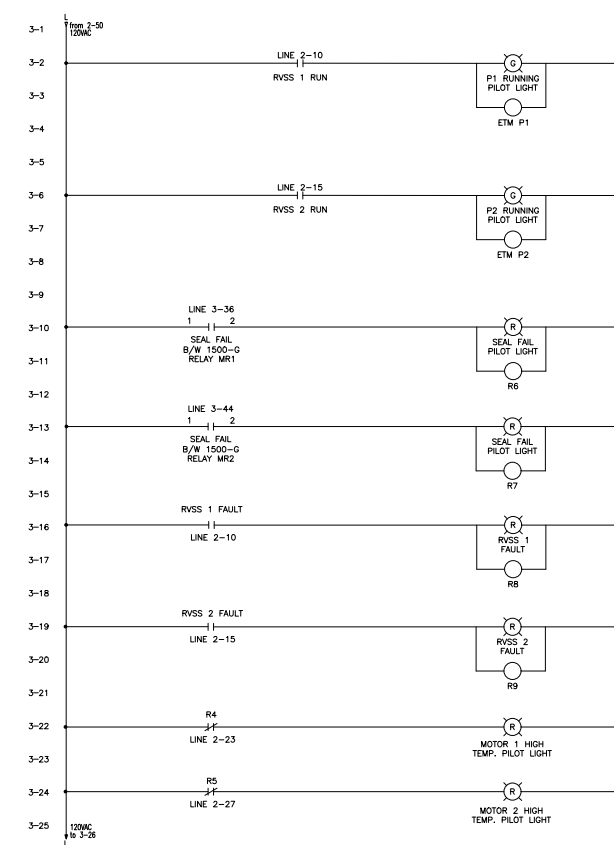
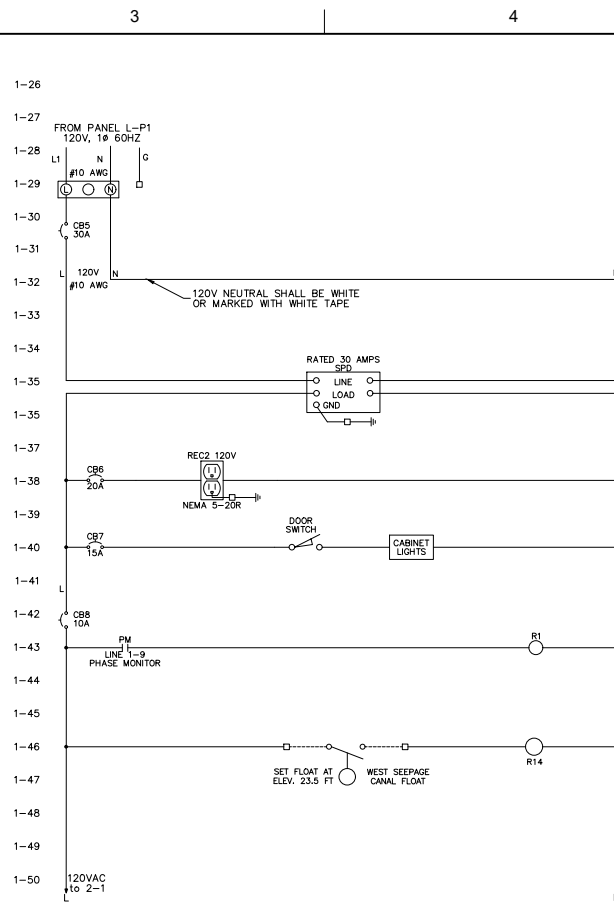
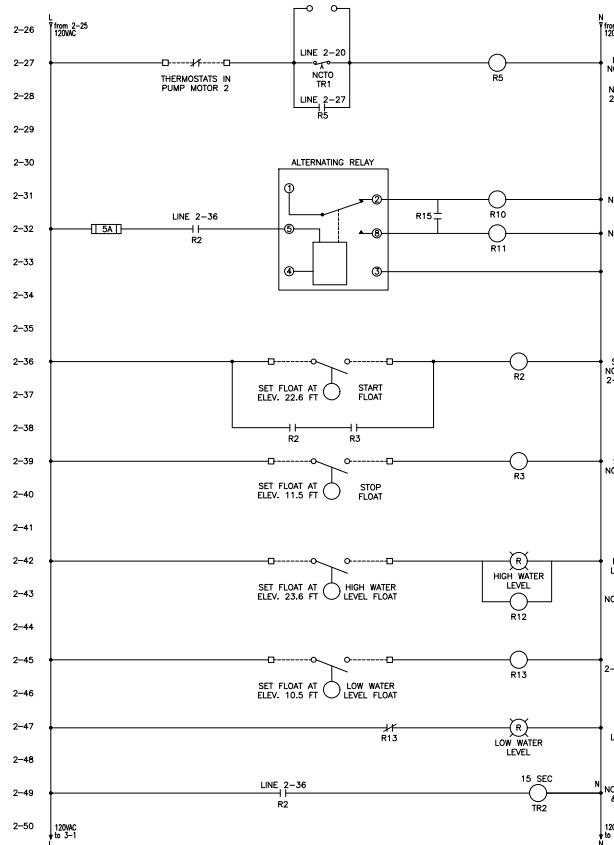
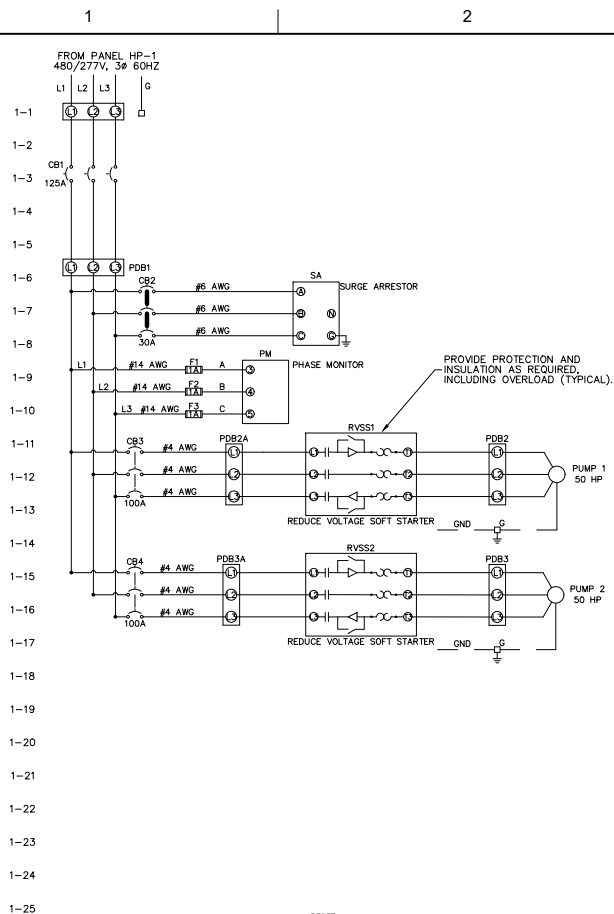
**ELECTRICAL
SAL GRADE ROAD PUMP STATION
ONE LINE DIAGRAM**

0 1" 2"

READY TO ADVERTISE

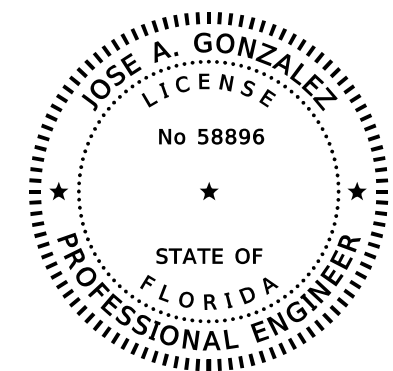
SHEET 85 of 92
SCALE NOT TO SCALE

DRAWING
E601



- NOTES:
- SEE MECHANICAL PLANS FOR THE STILLING WELL FOR THE FLOATS AND THE ELEVATION OF THE START/ON, STOP/OFF, LOW WATER LEVEL AND THE HIGH WATER LEVEL ALARMS
 - COORDINATE WITH OWNER AND AUTO DIALER REPRESENTATIVE TO OBTAIN A SIM CARD FOR THE AUTO DIALER PURCHASE BY THE OWNER. SIM CARD WILL INCLUDE A MONTHLY FEE TO BE PAID BY THE OWNER. ALSO COORDINATE TO PROGRAM AUTO DIALER AND USERS THAT WILL RECEIVE SIGNALS IN THEIR MOBILE DEVICES AND TO SET UP THE AUTO DIALER PROPERLY WITH THE SIGNALS AND/OR TEXT MESSAGES OF THE ALARMS SHOWN ON THIS SHEET.
 - PROVIDE AUTO DIALER WITH A NEMA 4X ENCLOSURE, SURGE SUPPRESSOR AND ANTENNA INSTALLED AND WIRED AT FACTORY.

- AUTO DIALER (AD) SIGNALS
- R-15 SAL GRADE PS GENERAL ALARM
 - AD AUTO DIALER ON BATTERY BACK UP
 - R-12 SAL GRADE PS HIGH WATER LEVEL
 - R-13 SAL GRADE PS LOW WATER LEVEL
 - R-14 WEST SEEPAGE CANAL LOW WATER LEVEL (23.5)
 - ATS
 - UTILITY POWER ON
 - GEN. GENERATOR TANK FUEL LEVEL LOW



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PROJECT MANAGER SUSAN RAY, PE

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

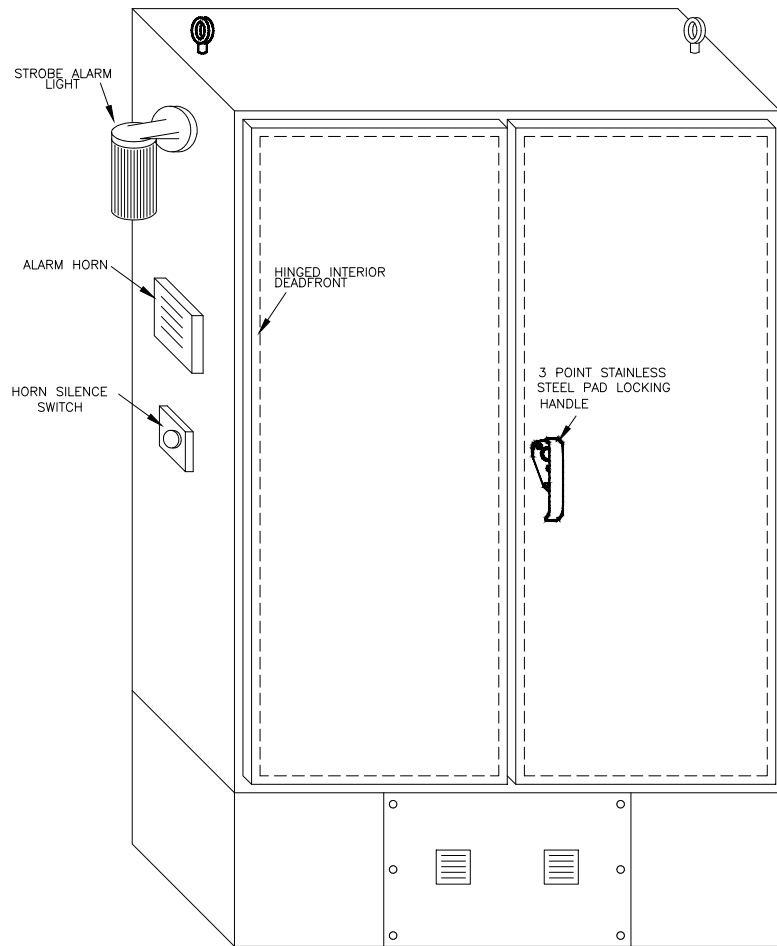
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**ELECTRICAL
SAL GRADE ROAD PUMP STATION
CONTROL WIRING DIAGRAM**

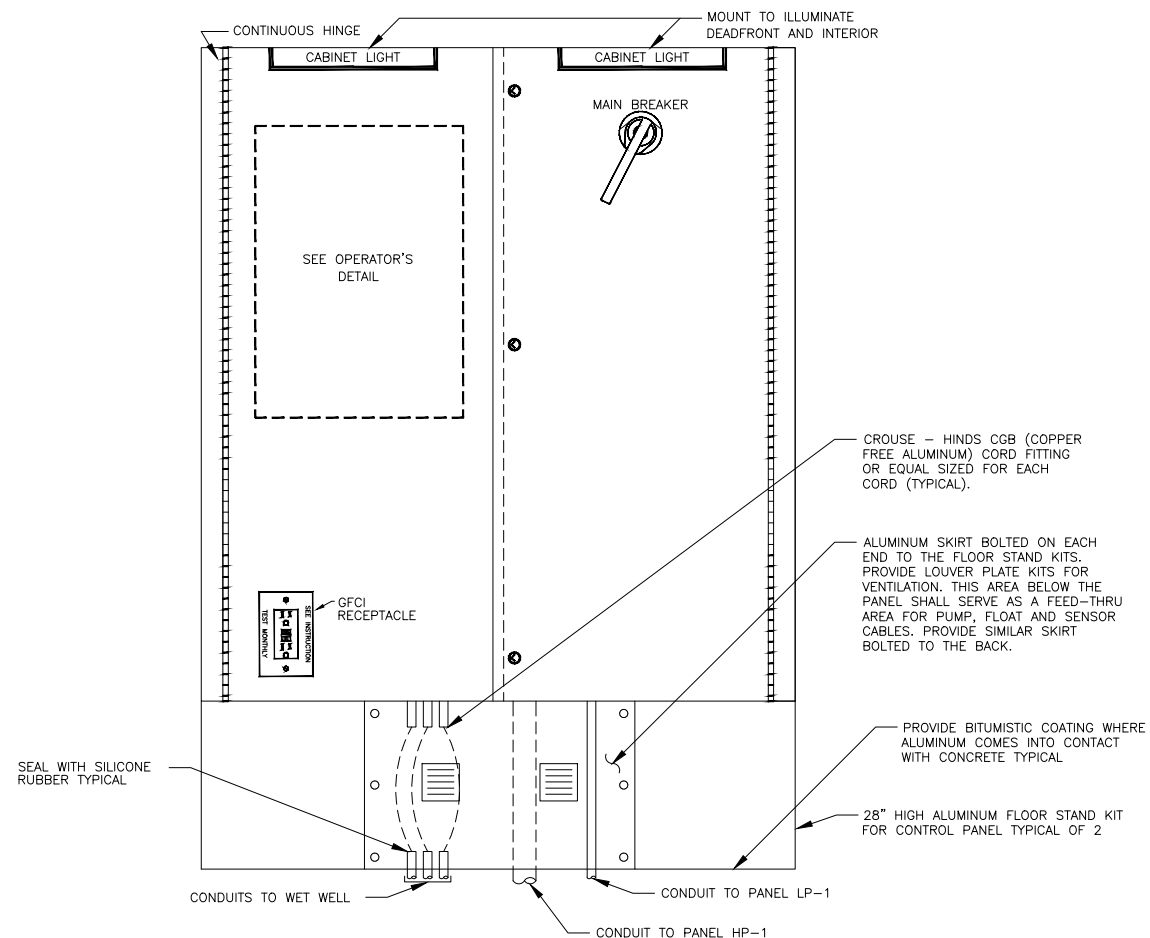
0 1" 2"
READY TO ADVERTISE

SHEET 86 of 92
SCALE NOT TO SCALE

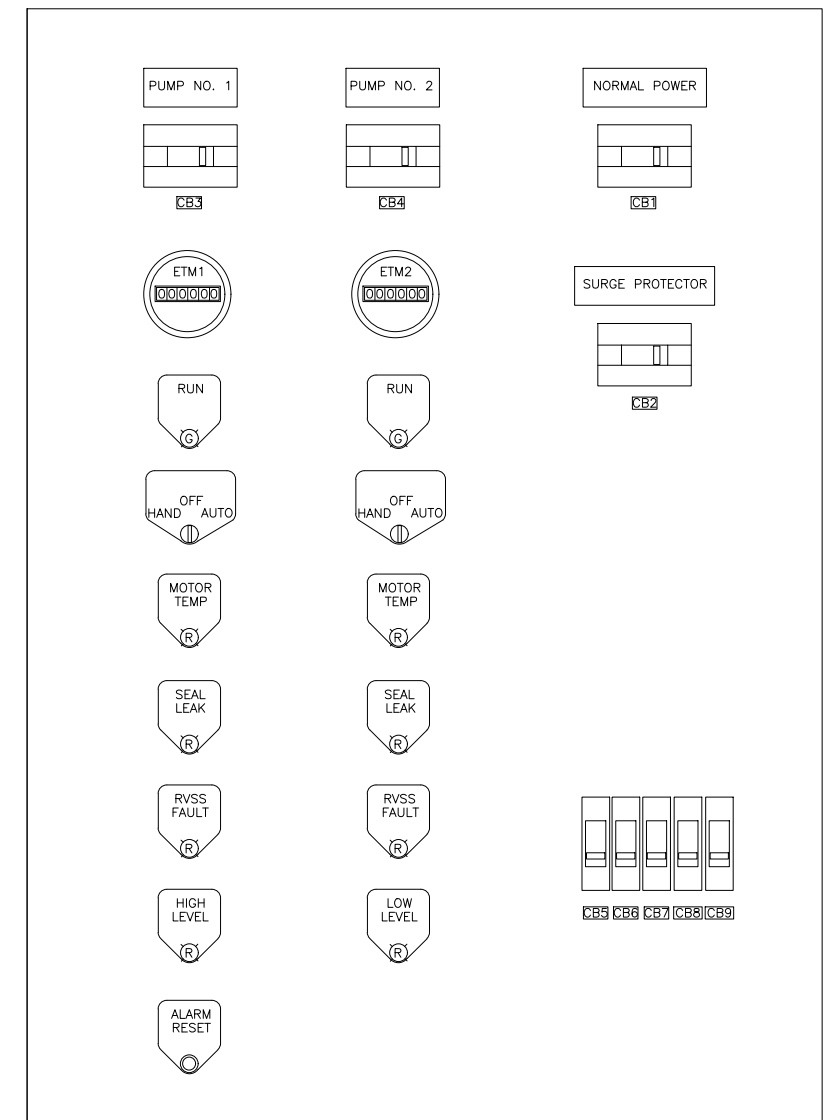
DRAWING
E602



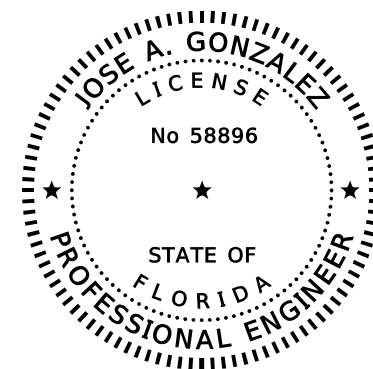
NEMA 4X STAINLESS STEEL ENCLOSURE
(PROPERLY SIZED AS REQUIRED)
PUMP STATION CONTROL PANEL
ENCLOSURE DETAIL



PUMP STATION CONTROL PANEL
DEAD FRONT DETAIL



OPERATOR DETAIL



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CONTROL PANEL GENERAL NOTES

1. SHOWN IS A TYPICAL PANEL LAYOUT, THE PANEL MAY BE ARRANGED TO A STANDARD MANUFACTURER'S LAYOUT, PROVIDED THAT ALL CONTROLS SHOWN IN THE CONTRACT DOCUMENTS ARE INCLUDED.
2. NAME PLATES SHALL HAVE WHITE ENGRAVED CHARACTERS ON A FLAT BLACK LAMINATED PLASTIC BACK PLAT. FASTEN WITH SCREWS.
3. NAMEPLATES SHALL BE PROVIDED FOR THE DISCONNECT SWITCH.
4. PROVIDE WARNING SIGNS AS REQUIRED BY NFPA 70 NATIONAL ELECTRICAL CODE.
5. SEE WIRING THE CONTROL WIRING DIAGRAM FOR CIRCUIT BREAKERS ON E-602.



4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609
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FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

PROJECT NUMBER 10061267

BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT

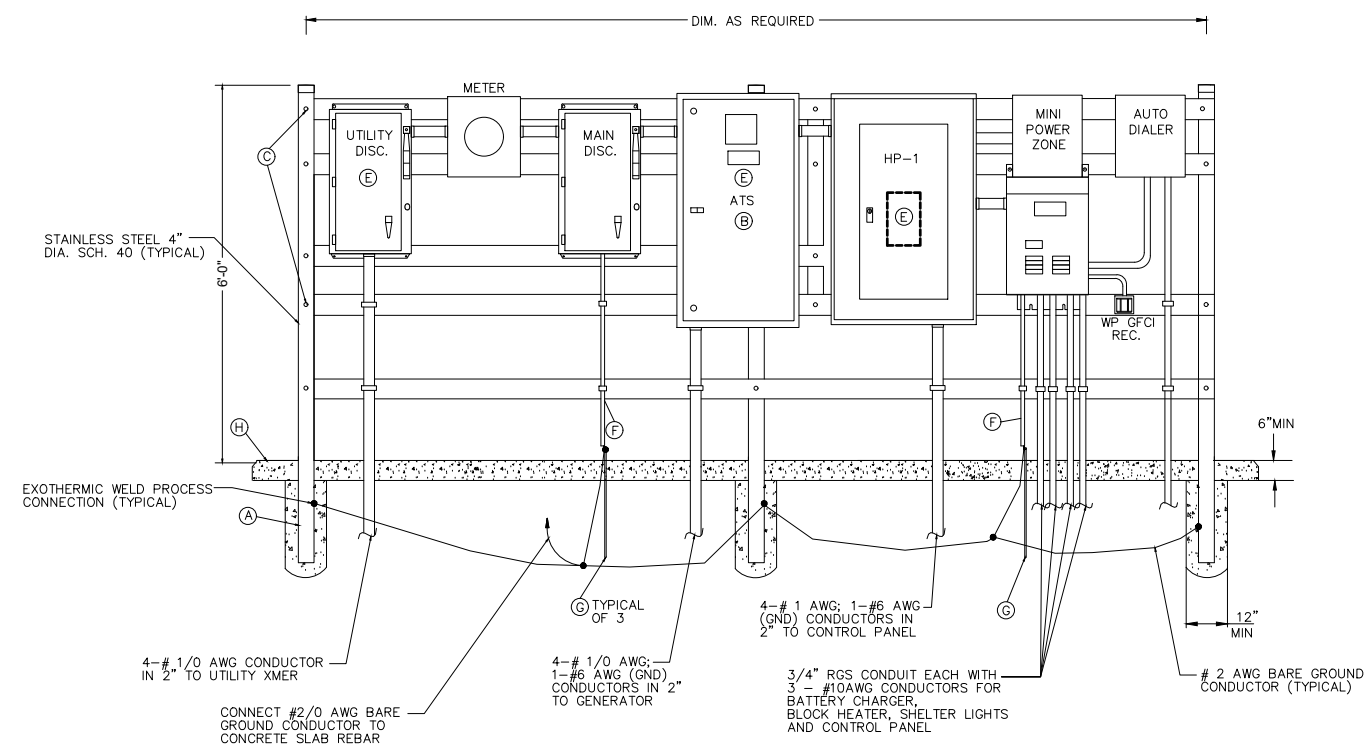
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

ELECTRICAL
SAL GRADE ROAD PUMP STATION
CONTROL PANEL DETAILS

0 1" 2"
READY TO ADVERTISE

SHEET 87 of 92
SCALE NOT TO SCALE

DRAWING
E603



EQUIPMENT RACK TYPICAL MOUNTING DETAIL
NOT TO SCALE

- DETAIL NOTES:**
- A. THREE (3) 4" STAINLESS STEEL PIPE SCH 40 CAPPED WITH A 4" STAINLESS STEEL CAP, MINIMUM OF 10 FEET LONG. A MIN. OF 4' BURIED PIPE SHALL BE ANCHORED IN 12" DIAMETER CONCRETE. PIPE SHALL BE FURNISHED AND INSTALLED WITH STAINLESS STEEL H-1 7/8" HORIZONTAL CHANNEL STRUT C/W STAINLESS STEEL NUTS AND BOLTS TO SUIT, AS SUPPLIED BY B-LINE SYSTEMS OR EQUAL. ISOLATE DISSIMILAR METALS WITH RUBBER GASKETS.
 - B. AUTOMATIC TRANSFER SWITCH, BASIS OF DESIGN IS CUMMINS CHPC ATS 1200, 150 AMPS, 480/277V, 3-POLE WITH SOLID NEUTRAL AND NEMA 4X ENCLOSURE.
 - C. ALL FASTENERS FOR CONSTRUCTION OF THE RACK SYSTEM SHALL BE STAINLESS STEEL SCREWS, NUTS, BOLTS AND WASHERS.
 - D. ALL STRUCTURAL OR ELECTRICAL COMPONENTS SHALL BE AS SPECIFIED HEREIN, OR APPROVED EQUAL. ALL ELECTRICAL COMPONENTS AND WIRING SHALL BE IN ACCORDANCE WITH N.E.C. - LATEST REVISION. ANY LOCAL ELECTRIC CODES IN CONFLICT WITH THE DETAIL SHOWN, SHALL BE RESOLVED BY THE ELECTRICAL CONTRACTOR WITH THE APPROVAL OF ENGINEER, PRIOR TO CONSTRUCTION.
 - E. PLASTIC WARNING LABELS STATING "DANGER HIGH VOLTAGE" AND THE PROPER ARC FLASH LABEL MUST BE INSTALLED ON THE OUTSIDE OF THE ENCLOSURE DOOR (TO O.S.H.A. AND NFPA 70E SPECIFICATIONS). SECURE LABEL TO DOOR WITH SCREWS AND GASKETING THAT DO NOT VOID THE NEMA 4X ENCLOSURE RATING.
 - F. ONE # 6 AWG GROUND WIRE IN 1/2" RGS CONDUIT.
 - G. 5/8" DIAMETER BY 20 FEET LONG COPPER CLAD STEEL GROUND ROD.
 - H. CONSTRUCT CONCRETE SLAB SIZED AS REQUIRED FOR A WORKING SPACE PER NEC. A MIN. OF 6" THICK AND 3000 PSI.

PANELBOARD NO: LP-1

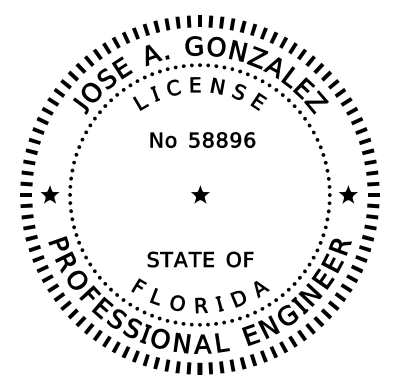
VOLTAGE: 240/120	BUS RATING (A): 60	ENCLOSURE: NEMA 4X
PHASE: 1	MAIN OC DEVICE: 50/2	MOUNTING: SURFACE
WIRE: 3+GND	INTERRUPTING RATING (KA): 10	LOCATION: ELECTRICAL RACK
200% NEUTRAL: NO	SERVICE ENTRANCE LABEL: NO	

CKT NO.	DESCRIPTION	CONNECTED LOAD (VA)						CONNECTED LOAD (VA)						CKT NO.				
		LTS	REC	MECH	MISC	AMPS	P	LTS	REC	MECH	MISC	DESCRIPTION						
1	CONTROL PANEL				2,880	30	1	A	20	1			180			2	GFCI REC.	
3	BATTERY CHARGER				1,800	20	1	B	20	1				1,200			4	AUTO DIALER
5	GENERATOR HEATER				1,250			A	20	1		148					6	SHELTER LIGHTING
7					1,250			B	20	1							8	SPARE
9								A									10	
11								B									12	
13								A									14	
15								B									16	

LOAD SUMMARY

	LTS	REC	MECH	MISC	SPARE	TOTAL	PHASE BALANCE	
CONNECTED LOAD (KVA)	0.1	0.2	2.5	5.9	---	8.7	240	LINE-TO-LINE VOLTS
DEMAND FACTOR	1.25	NEC	1.00	1.00	10%	---	36	CONNECTED AMPS
DESIGN LOAD (KVA)	0.2	0.2	2.5	5.9	0.9	9.6	40	DESIGN AMPS

MINI POWER ZONE PANELBOARD SCHEDULE
NOT TO SCALE



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PROJECT NUMBER	10061267

JOSE A. GONZALEZ, PE
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4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

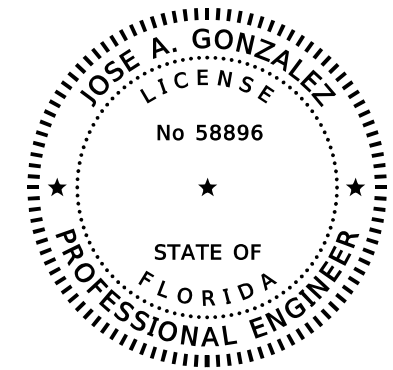
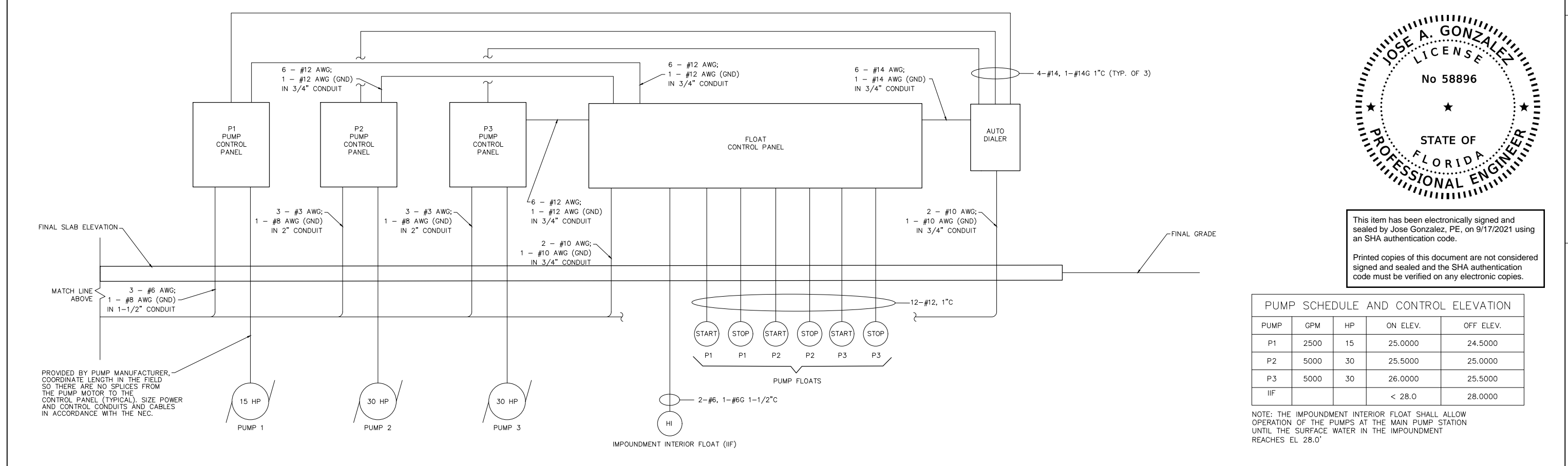
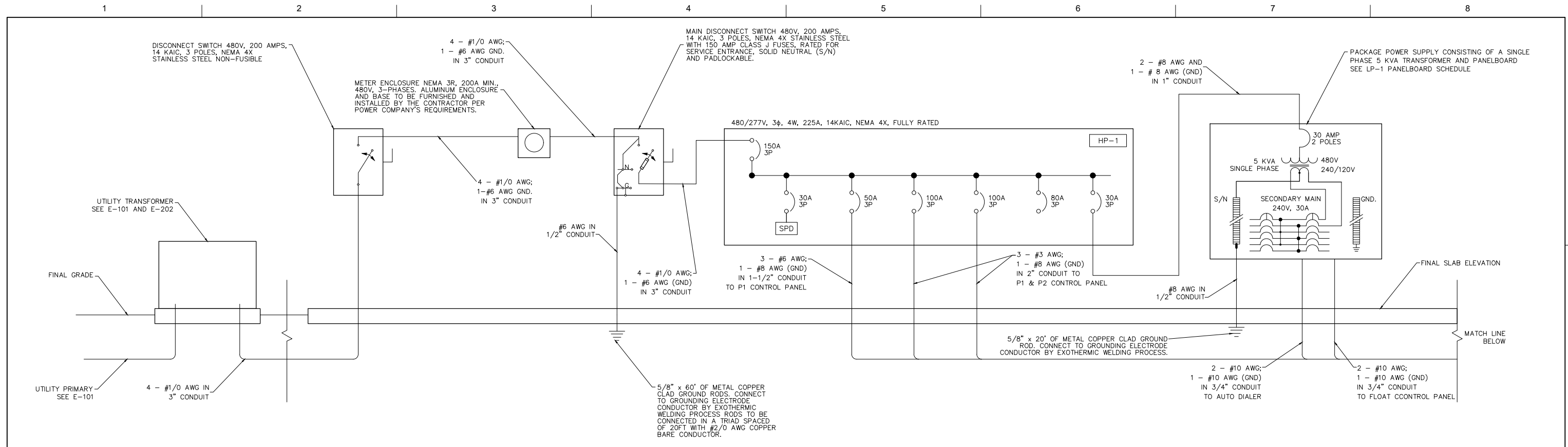
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**ELECTRICAL
SAL GRADE ROAD PUMP STATION
RACK DETAILS AND
PANELBOARD SCHEDULE**

0 1" 2"
READY TO ADVERTISE

SHEET 88 of 92
SCALE NOT TO SCALE

DRAWING
E604



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER SUSAN RAY, PE

PROJECT NUMBER 10061267

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**

FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

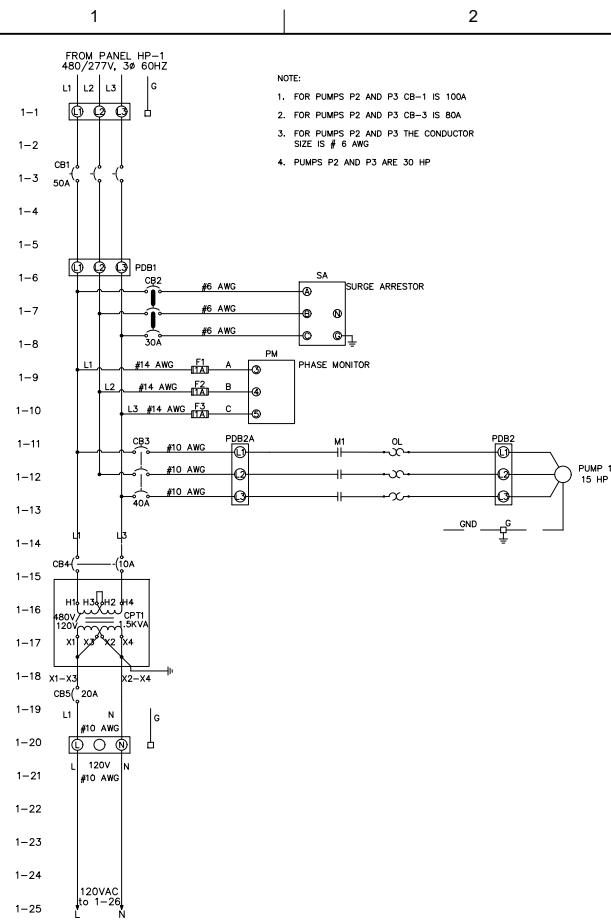
**ELECTRICAL
BOND FARM HEI PUMP STATION
ONE LINE DIAGRAM**

0 1" 2"

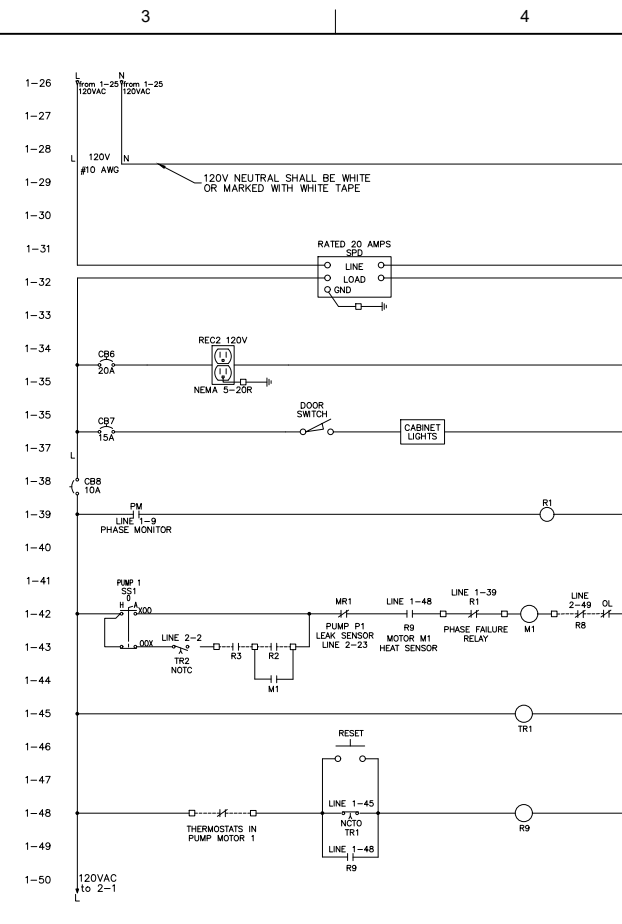
READY TO ADVERTISE

SHEET 89 of 92
SCALE NOT TO SCALE

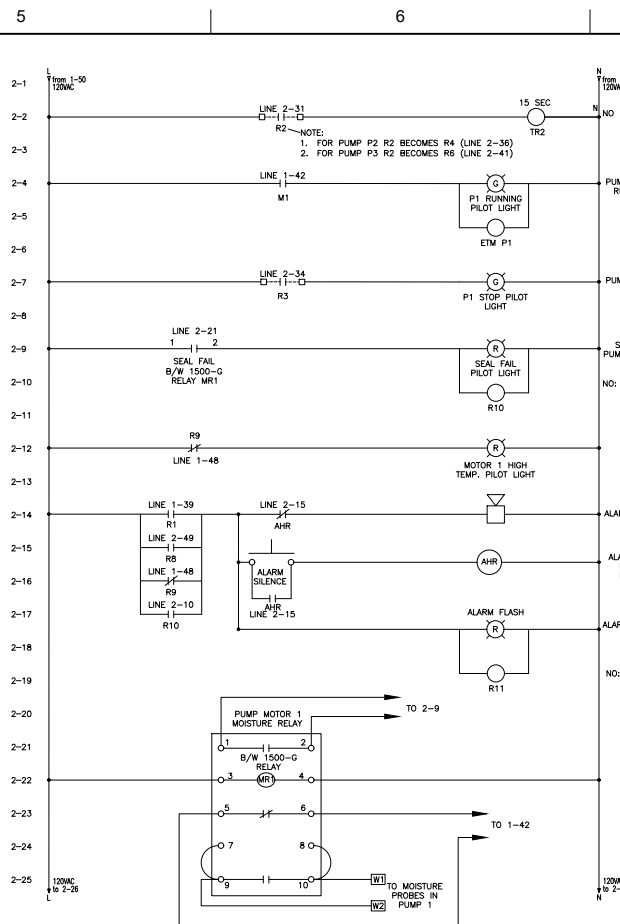
DRAWING
E605



- NOTE:
- FOR PUMPS P2 AND P3 CB-1 IS 100A
 - FOR PUMPS P2 AND P3 CB-3 IS 80A
 - FOR PUMPS P2 AND P3 THE CONDUCTOR SIZE IS # 6 AWG
 - PUMPS P2 AND P3 ARE 30 HP



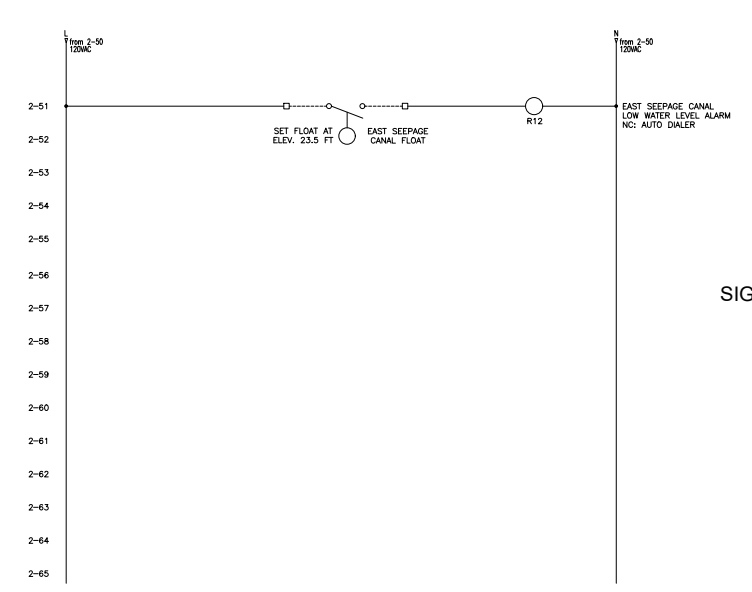
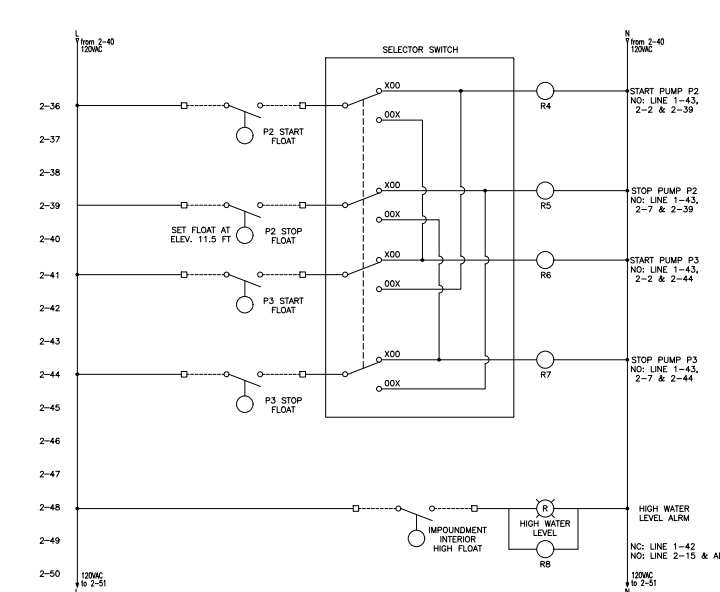
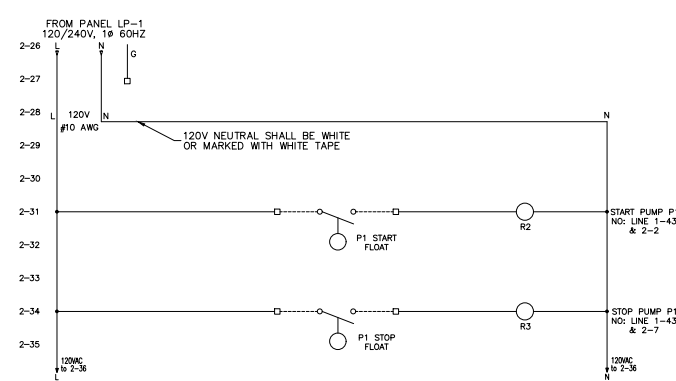
- NOTE:
- FOR PUMP P2 R9 BECOMES R4 (NO LINE 2-36)
 - FOR PUMP P3: R2 BECOMES R6 (NO LINE 2-41)
 - FOR PUMP P2 R3 BECOMES R5 (NO LINE 2-39)
 - FOR PUMP P3: R3 BECOMES R7 (NO LINE 2-44)



- NOTE:
- FOR PUMP P2 R3 BECOMES R5 (NO LINE 2-39)
 - FOR PUMP P3: R3 BECOMES R7 (NO LINE 2-44)

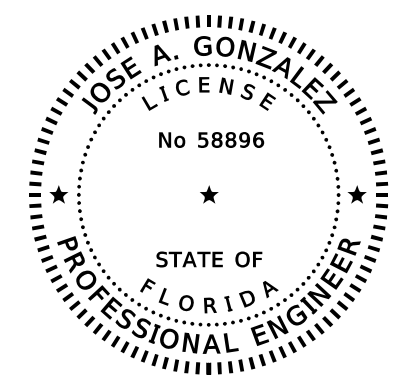
- NOTES:
- SEE MECHANICAL PLANS FOR THE STILLING WELL FOR THE FLOATS AND THE ELEVATION OF THE START/ON, STOP/OFF AND THE HIGH WATER LEVEL ALARM FLOATS
 - COORDINATE WITH OWNER AND AUTO DIALER REPRESENTATIVE TO OBTAIN A SIM CARD FOR THE AUTO DIALER PURCHASE BY THE OWNER. SIM CARD WILL INCLUDE A MONTHLY FEE TO BE PAID BY THE OWNER. ALSO COORDINATE TO PROGRAM AUTO DIALER AND USERS THAT WILL RECEIVE SIGNALS IN THEIR MOBILE DEVICES AND TO SET UP THE AUTO DIALER PROPERLY WITH THE SIGNALS AND/OR TEXT MESSAGES OF THE ALARMS SHOWN ON THIS SHEET.
 - PROVIDE AUTO DIALER WITH A NEMA 4X ENCLOSURE, SURGE SUPPRESSOR AND ANTENNA INSTALLED AND WIRED AT FACTORY.

TYPICAL SCHEMATIC WIRING DIAGRAM FOR PUMPS P1, P2 AND P3 CONTROL PANELS



SIGNALS TO AUTO DIALER (AD)

- R11(P1) TO AUTO DIALER (AD) (GENERAL ALARM P1)
- R11(P2) TO AUTO DIALER (AD) (GENERAL ALARM P2)
- R11(P3) TO AUTO DIALER (AD) (GENERAL ALARM P3)
- AD AUTO DIALER ON BATTERY BACKUP
- R12 EAST SEEPAGE CANAL LOW WATER LEVEL
- R8 IMPOUNDMENT HIGH WATER LEVEL



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SCHEMATIC WIRING DIAGRAM FOR FLOAT CONTROL PANEL



ISSUE	DATE	DESCRIPTION

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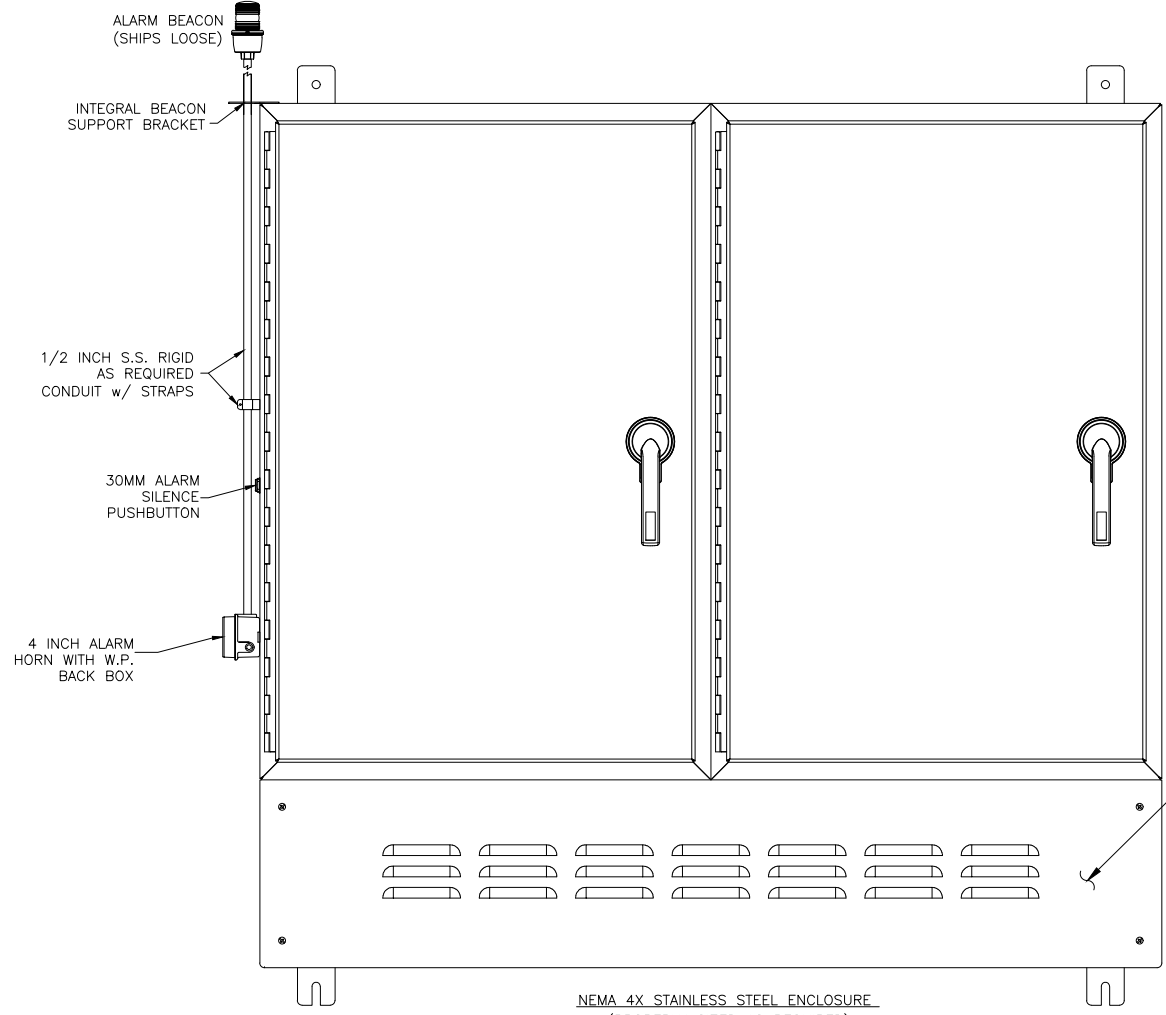
PROJECT NUMBER 10061267

JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

BOND FARM HYDROLOGICAL ENHANCEMENT IMPOUNDMENT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

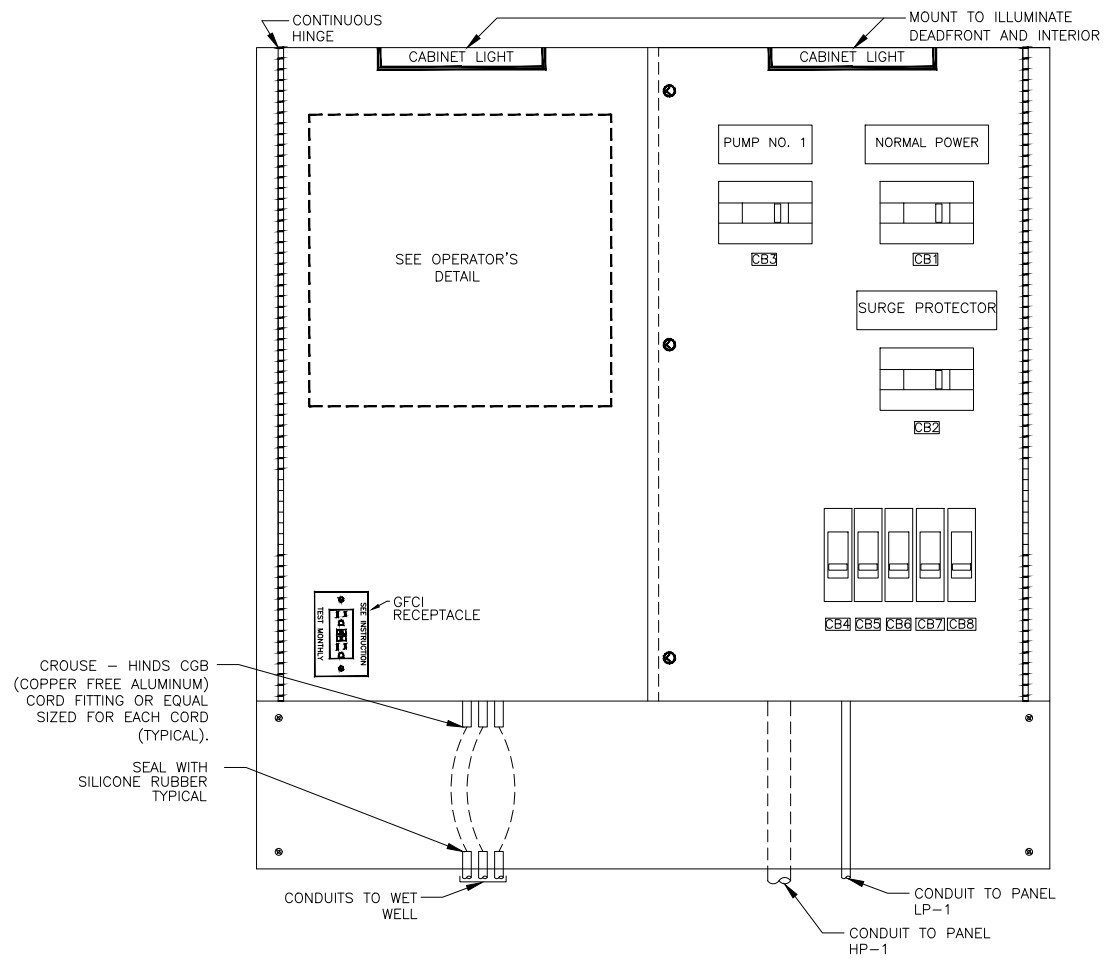
ELECTRICAL BOND FARM HEI PUMP STATION CONTROL WIRING DIAGRAMS



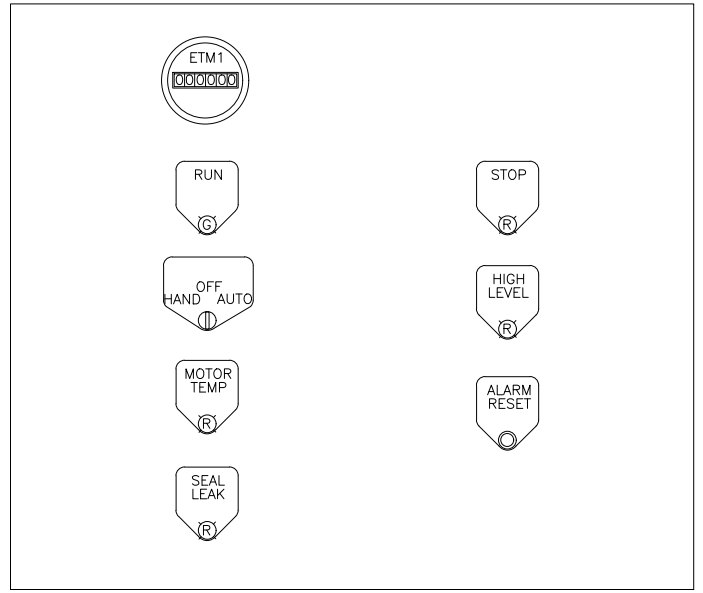
NEMA 4X STAINLESS STEEL ENCLOSURE
(PROPERLY SIZED AS REQUIRED)
TYPICAL PUMP STATION CONTROL PANEL
SURFACE MOUNTED ENCLOSURE DETAIL

- CONTROL PANEL GENERAL NOTES
1. SHOWN IS A TYPICAL PANEL LAYOUT, THE PANEL MAY BE ARRANGED TO A STANDARD MANUFACTURER'S LAYOUT, PROVIDED THAT ALL CONTROLS SHOWN IN THE CONTRACT DOCUMENTS ARE INCLUDED.
 2. NAME PLATES SHALL HAVE WHITE ENGRAVED CHARACTERS ON A FLAT BLACK LAMINATED PLASTIC BACK PLAT. FASTEN WITH SCREWS.
 3. NAMEPLATES SHALL BE PROVIDED FOR THE DISCONNECT SWITCH.
 4. PROVIDE WARNING SIGNS AS REQUIRED BY NFPA 70 NATIONAL ELECTRICAL CODE.
 5. SEE WIRING THE CONTROL WIRING DIAGRAM FOR CIRCUIT BREAKERS ON E-606.

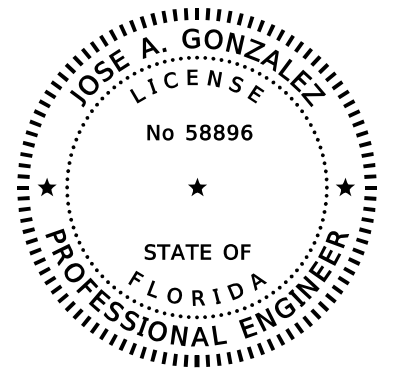
PROVIDE LOUVER PLATE KITS FOR VENTILATION. THIS AREA BELOW THE PANEL SHALL SERVE AS A FEED-THRU AREA FOR PUMP, FLOAT AND SENSOR CABLES. PROVIDE SIMILAR SKIRT BOLTED TO THE BACK.



TYPICAL PUMP STATION CONTROL PANEL
DEAD FRONT DETAIL



OPERATOR DETAIL



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ISSUE	DATE	DESCRIPTION

PROJECT NUMBER	10061267
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JOSE A. GONZALEZ, PE
FL PE #58896
4830 W. KENNEDY BLVD, STE 400
TAMPA, FL 33609

**BOND FARM HYDROLOGICAL
ENHANCEMENT IMPOUNDMENT**
FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION
620 SOUTH MERIDIAN STREET
TALLAHASSEE, FL 32399

**ELECTRICAL
BOND FARM HEI PUMP STATION
CONTROL PANEL DETAILS**

0 1" 2"
READY TO ADVERTISE

SHEET 91 of 92
SCALE NOT TO SCALE

DRAWING
E607

As-Built Certification And Request for Conversion to Operation Phase

Instructions: Complete and submit this page within 30 days of completion of the entire project, or any independent portion of the project, as required by the permit conditions. The operation phase of the permit is effective when the construction certification for the entire permit/application is approved by the Agency. If the final operation and maintenance entity is not the permittee, the permittee shall operate the project, system, works, or other activities temporarily until such time as the transfer to the operation entity is finalized (use Form 62-330.310(2)).

Permit No: _____ Application No: _____ Permittee: _____
 Project Name: _____ Phase or Independent Portion (if applicable): _____

I HEREBY CERTIFY THAT (please check only one box):

- To the best of my knowledge, information, and belief, construction of the project has been completed in substantial conformance with the plans specifications and conditions permitted by the Agency. Any minor deviations will not prevent the project from functioning in compliance with the requirements of Chapter 62-330, F.A.C. Attached are documents to demonstrate satisfaction of the outstanding permit conditions, other than long term monitoring and inspection requirements.
- Construction of the project was NOT completed in substantial conformance with the plans and specifications permitted by the Agency. Any deviations or independent phasing will not prevent the project from functioning in compliance with the requirements of Chapter 62-330, F.A.C. (Contact the permitting agency to determine whether a modification of the permit will be required in accordance with Rule 62-330.315, F.A.C.) Attached is a description of substantial deviations, a set of as-built drawings, and documents to demonstrate satisfaction of the outstanding permit conditions, other than long term monitoring and inspection requirements.
- Construction of the project was NOT completed in substantial conformance with the plans and specifications permitted by the Agency. There are substantial deviations that prevent the project from functioning in compliance with the requirements of Chapter 62-330, F.A.C. I acknowledge that corrections to the project and/or a modification of the permit will likely be required, and that conversion to the operation phase cannot be approved at this time. As-built or record drawings reflecting the substantial deviations are attached.

For activities that require certification by a registered professional:

By: _____ (Print Name) (Fla. Lic. or Reg. No.)
 Signature
 (Company Name) (Company Address)
 (Telephone Number) (Email Address)

AFFIX SEAL

(Date)

For activities that do not require certification by a registered professional:

By: _____ (Print Name)
 Signature
 (Company Name) (Company Address)



(Telephone Number)

(Email Address)

(Date)



Drawings and Information Checklist

Following is a list of information that is to be verified and/or submitted by the Registered Professional or Permittee:

1. All surveyed dimensions and elevations shall be certified by a registered Surveyor or Mapper under Chapter 472, F.S.
2. The registered professional's certification shall be based upon on-site observation of construction (scheduled and conducted by the registered professional of record or by a project representative under direct supervision) and review of as-built drawings, with field measurements and verification as needed, for the purpose of determining if the work was completed in accordance with original permitted construction plans, specifications, and conditions.
3. If submitted, the as-built drawings are to be based on the permitted construction drawings revised to reflect any substantial deviations made during construction. Both the original design and constructed condition must be clearly shown. The plans need to be clearly labeled as "as-built" or "record" drawings that clearly highlight (such as through "red lines" or "clouds") any substantial deviations made during construction. As required by law, all surveyed dimensions and elevations required shall be verified and signed, dated, and sealed by an appropriate registered professional. The following information, at a minimum, shall be verified on the as-built drawings and supplemental documents if needed:
 - a. Discharge structures - Locations, dimensions and elevations of all, including weirs, orifices, gates, pumps, pipes, and oil and grease skimmers;
 - b. Detention/Retention Area(s) – Identification number, size in acres, side slopes (h:v), dimensions, elevations, contours, or cross-sections of all, sufficient to determine stage-storage relationships of the storage area and the permanent pool depth and volume below the control elevation for normally wet systems,
 - c. Side bank and underdrain filters, or exfiltration trenches - locations, dimensions, and elevations of all, including clean-outs, pipes, connections to control structures, and points of discharge to receiving waters;
 - d. System grading - dimensions, elevations, contours, final grades, or cross-sections to determine contributing drainage areas, flow directions, and conveyance of runoff to the system discharge point(s);
 - e. Conveyance - dimensions, elevations, contours, final grades, or cross-sections of systems utilized to divert off-site runoff around or through the new system;
 - f. Benchmark(s) - location and description (minimum of one per major water control structure);
 - g. Datum- All elevations should be referenced to a vertical datum clearly identified on the plans, preferably the same datum used in the permit plans.
4. Wetland mitigation or restoration areas - Show the plan view of all areas, depicting a spatial distribution of plantings conducted by zone (if plantings are required by permit), with a list showing all species planted in each zone, numbers of each species, sizes, date(s) planted, and identification of source of material; also provide the dimensions, elevations, contours, and representative cross-sections depicting the construction.
5. A map depicting the phase or independent portion of the project being certified, if all components of the project authorized in the permit are not being certified at this time.
6. Any additional information or outstanding submittals required by permit conditions or to document permit compliance, other than long-term monitoring or inspection requirements.

Request for Transfer of Environmental Resource Permit to the Perpetual Operation and Maintenance Entity

Instructions: Complete this form to transfer to the permit to the operation and maintenance entity. This form can be completed concurrently with, or within 30 days of approval of, the As-Built Certification and Request for Conversion to Operation Phase (Form 62-330.310(1)). Please include all documentation required under Section 12.2.1(b) of Applicant's Handbook Volume I (see checklist below). **Failure to submit the appropriate final documents will result in the permittee remaining liable for operation and maintenance of the permitted activities.**

Permit No.: _____ Application No(s): _____
 Project Name: _____ Phase (if applicable): _____

A. **Request to Transfer:** The permittee requests that the permit be transferred to the legal entity responsible for operation and maintenance (O&M).

By: _____
 Signature of Permittee _____ Name and Title _____

 Company Name _____ Company Address _____

 Phone/email address _____ City, State, Zip _____

B. **Agreement for System Operation and Maintenance Responsibility:** The below-named legal entity agrees to operate and maintain the works or activities in compliance with all permit conditions and provisions of Chapter 62-330, Florida Administrative Code (F.A.C.) and Applicant's Handbook Volumes I and II.

The operation and maintenance entity does not need to sign this form if it is the same entity that was approved for operation and maintenance in the issued permit.

Authorization for any proposed modification to the permitted activities shall be applied for and obtained prior to conducting such modification.

By: _____
 Signature of Representative of O&M Entity _____ Name of Entity for O&M _____

 Name and Title _____ Address _____

 Email Address _____ City, State, Zip _____

 Phone _____ Date _____

Enclosed are the following documents, as applicable:

- Copy of recorded transfer of title to the operating entity for the common areas on which the stormwater management system is located (unless dedicated by plat)
- Copy of all recorded plats
- Copy of recorded declaration of covenants and restrictions, amendments, and associated exhibits
- Copy of filed articles of incorporation (if filed before 1995)
- A Completed documentation that the operating entity meets the requirements of Section 12.3 of Environmental Resource Permit Applicant's Handbook Volume I. (Note: this is optional, but aids in processing of this request)



OPERATION AND MAINTENANCE INSPECTION CERTIFICATION

Instructions: Submit this form to the Agency within 30 days of completion of the inspection after any failure of a stormwater management system or deviation from the permit. This form may also be used to document inspections required under Section 12.4 of Applicant's Handbook Volume I, however submittal to the Agency is not required unless requested by the Agency.

Permit No.: _____ Application No.: _____ Date Issued: _____

Identification or Name of Stormwater Management System: _____

Phase of Stormwater Management System (if applicable): _____

Inspection Date: _____

Inspection results: (check all that apply)

The undersigned hereby certifies that the works or activities are functioning in substantial conformance with the permit. This certification is based upon on-site observation of the system conducted by me or my designee under my direct supervision and my review of as-built plans.

The following maintenance was conducted since the last inspection (attach additional pages if needed):

The undersigned hereby certifies that I or my designee under my direct supervision has inspected this surface water management system and the system does not appear to be functioning in substantial conformance with the permit. I am aware that maintenance or alteration is required to bring the system into substantial compliance with the terms and conditions of the permit. As appropriate, I have informed the owner of the following:

- (a) The system does not appear to be functioning properly;
- (b) That maintenance or repair is required to bring the system into compliance; and
- (c) If maintenance or repair measures are not adequate to bring the system into compliance, the system may have to be replaced or an alternative design constructed subsequent to approval by the agency below.

The following components of the system do not appear to be functioning properly (attach additional pages if needed):

Any components of the constructed system that are not in substantial conformance with the permitted system shall require a written request to modify the permit in accordance with the provisions of Rule 62-330.315, F.A.C. If such modification request is not approved by the agency below, the components of the system that are not in conformance with the permit are subject to enforcement action under Sections 373.119, .129, .136, and .430, F.S.



Name of Inspector: _____ Florida Registration Number: _____

Company Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Phone: _____ Fax: _____ Email: _____

Signature of Inspector

Date

Report Reviewed by Permittee:

Name of Permittee: _____

Signature of Permittee

Date

Title (if any)



Monitoring Plan

Bond Farm Hydrological Enhancement Impoundment

Charlotte County, Florida

April 10, 2020



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1.0 Project Overview

The Bond Farm Hydrological Enhancement Impoundment (HEI) Project located in south-central Charlotte County includes a 538-acre impoundment on the 669-acre Bond Farm property, which is adjacent to the 2,108-acre Babcock/Webb Wildlife Management Area (WMA) Restoration Area (**Figure 1**). A 9.67-acre portion of the Bond Farm HEI will extend into the Babcock/Webb WMA, along (but outside of) the western boundary of the restoration area. The total Bond Farm HEI Project area, including this addition, is 678.67 acres. The Bond Farm HEI Project will store up to 4 feet of water for approximately 4 to 6 months annually during the wet season and continue discharge to the south to the headwaters of Powell Creek and Gator Slough via the Prairie Pines Preserve. Excess surface water impounded on the adjacent Babcock/Webb WMA to the northeast will be withdrawn during the wet season by pumping. The goal of the withdrawal will be to reduce water levels on the Babcock/Webb WMA between 0.1 feet up to 1.0 feet from the atypical conditions currently existing on that parcel.

The purpose of this Hydrologic Monitoring Plan is to establish mitigation goals and expectations for each of the two sites, Bond Farm HEI Project and Babcock/Webb WMA, present a systematic approach to assess the post-impoundment/post-restoration hydrological conditions and vegetative communities, and to provide quantifiable criteria to measure Project success from an ecological perspective.

The Babcock/Webb WMA and the Bond Farm HEI Project were evaluated using the Uniform Mitigation Assessment Method (UMAM) (Chapter 62-345, F.A.C.), which was used to develop the success criteria herein. The UMAM provided a standardized format for assessing ecological functions provided by the enhanced and impounded wetlands, the amount that those functions were enhanced or reduced by the hydrologic changes, and the amount of habitat mitigation associated with the changes. The UMAM quantified three parameters for each area, including: 1) **location and landscape support** (*i.e.* relationship to surroundings); 2) **water environment** (*i.e.* water quality and quantity); and 3) **community structure** (*i.e.* plant cover). The parameters were scored on a scale between 1 (minimal benefit) and 10 (highest benefit).

2.0 Existing Conditions

BABCOCK/WEBB WMA

The Babcock/Webb WMA lies at the headwaters of the Gator Slough Watershed, which historically drained southwest via the Yucca Pens Unit towards Matlacha Pass and Charlotte Harbor. Surface water flows off the Babcock/Webb WMA have been altered by various land management and land use changes, including cattle grazing, rock mining, and linear transportation facilities. Today, the Babcock/Webb WMA experiences a deeper and longer duration of seasonal flooding. Surface water draining from the Babcock/Webb WMA headwaters has been restricted and wet season stages and hydroperiods in the southwest portions of the Babcock/Webb WMA are now wetter than typical for the historic communities, including mesic and hydric flatwoods and basin and depression marshes.

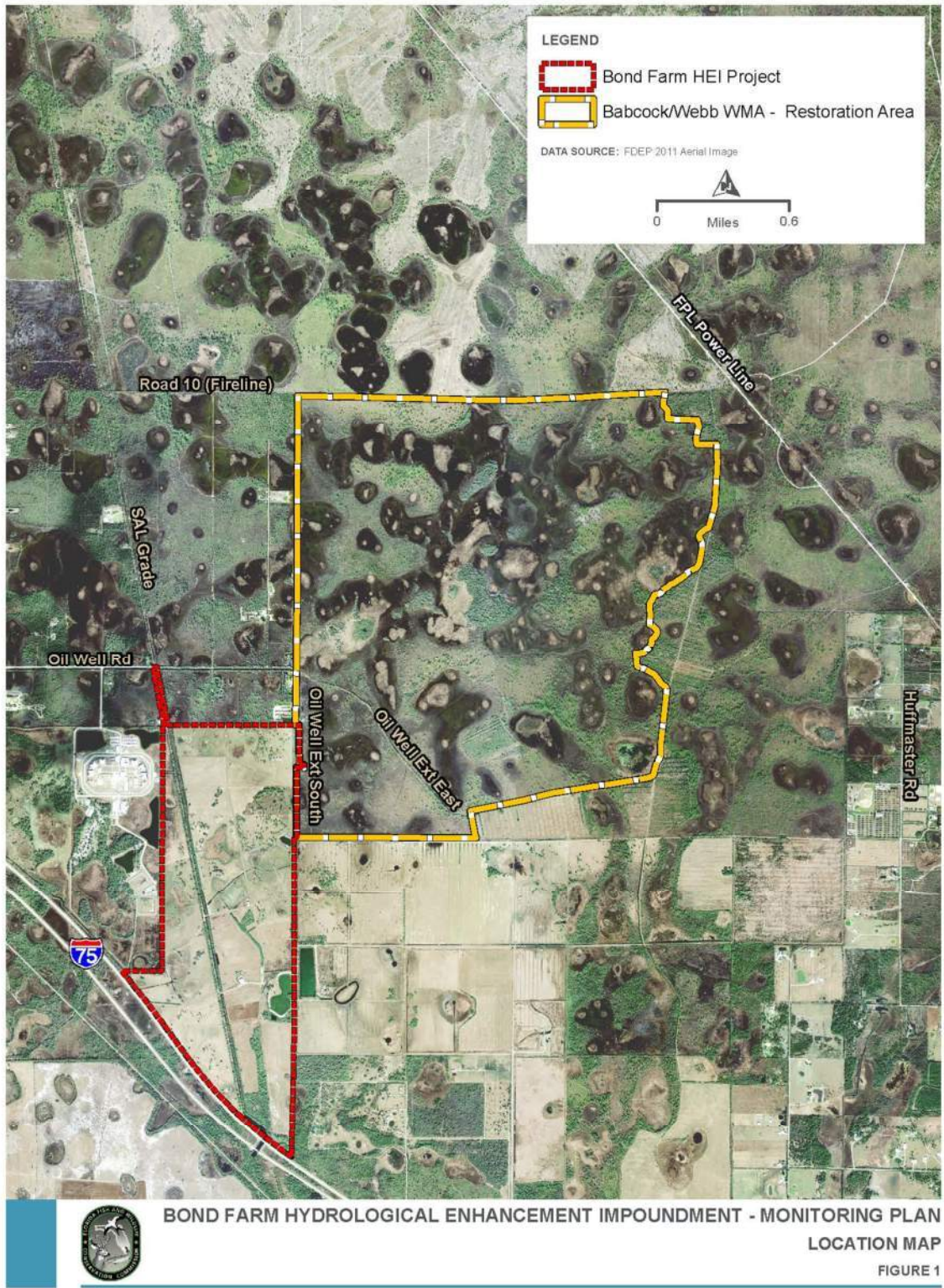


Figure 1: Location Map

BOND FARM HEI PROJECT

The Bond Farm property was purchased to help alleviate these drainage concerns and facilitate flows through the Gator Slough Watershed by conversion of the property to an impoundment that captures, stores, and conveys water to help restore hydroperiods in wetlands upstream on Babcock/Webb WMA and eventually the Yucca Pens Unit with the implementation of the next phase of the Project. The Bond Farm HEI Project is within the historic flow way for much of the Babcock/Webb WMA, and the configuration of previous landowner constructed perimeter berms around the property has blocked flow. The Bond Farm property, which had been routinely pumped dry by the previous landowner for cattle grazing prior to purchase by the State, will be used to store excess water from the Babcock/Webb WMA during the wet season and release the water downstream during the onset of the dry season. Removal of excess surface water flows from the Babcock/Webb WMA by the Bond Farm HEI Project will restore hydroperiods on the Babcock/Webb WMA.

3.0 Proposed Conditions

Florida can experience inconsistent precipitation episodes due to interannual variability with notable periods of drought and extreme precipitation. Various factors influence precipitation in Florida including sea breeze convection, El Niño/La Niña, and tropical systems, as well as human-influenced changes and microclimates. Typically, the Florida rainy season occurs around May/June and into September/October and the dry season from around October/November through April/May.

BABCOCK/WEBB WMA

The following existing communities are anticipated to be enhanced within the Babcock/Webb WMA.

- Mesic flatwoods
- Hydric flatwoods
- Basin marsh
- Depression marsh

These communities are expected to benefit from reduced hydroperiods and seasonal water levels, which currently over-inundate the areas and alter/stress native vegetation. The target water level reduction (i.e. restoration) for each community is between 0.1 feet up to 1.0 feet.

The UMAM analysis did not assume full restoration (i.e. score 10), but rather a *partial increase* in each the landscape, water, and community structure scores to correspond to a *partial decrease* in hydrology sufficient to trend these communities towards more natural hydrologic conditions. The anticipated functional gain in habitat quality was reflected in the **location and landscape support** score (through hydrological refinement of the habitat mosaic); in the **water environment** score (through reduced hydroperiods and seasonal flooding); and in the **community structure** score (through improved vegetative health). The Florida Natural Areas Inventory *Guide to the Natural Communities of Florida: 2010 Edition* was used as the baseline for the target communities. In the post-restoration condition, these communities will continue to be managed in accordance with the Florida Fish and Wildlife Conservation Commission (FWC) *Management Plan for Fred C. Babcock-Cecil M. Webb Wildlife Management Area 2014-2024* (FWC, 2014).

Based on the UMAM analysis, upon implementation of the Bond Farm HEI Project, the functional gain across the 2,108-acre Babcock/Webb WMA restoration area (**Figure 1**) will total 111 units.

BOND FARM HEI PROJECT

The following existing communities are expected to be inundated within the Bond Farm HEI Project.

- Herbaceous marsh
- Willow marsh
- Hydric flatwoods
- Wet prairie/wet pasture

These communities are expected to transition to new habitats due to increased hydroperiods and seasonal water levels. The expected water level increase for each community is between 2 to 4 feet.

The UMAM analysis did not assume full impact in all cases (*i.e.* score 0) but rather a *partial decrease* in habitat value for each the landscape, water, and community structure scores due to an *increase in hydrology* that would alter existing communities. Fill impacts were scored zero. Flooded areas were assumed to retain some wetland value in a post-impoundment condition, as reflected in the **location and landscape support** score (although habitat type and quality change, an alternate ecological relationship would be created); in the **water environment** score (increased hydroperiods and seasonal flooding would provide water quality benefits); and in the **community structure** score (creation of an alternative community structure). Upon impoundment, existing communities would be expected to transition to the following:

- Littoral Zone
- Shallow Lake
- Wetland Island

Based on the UMAM analysis, upon implementation of the Bond HEI project, the functional loss across the 678.67-acre Bond Farm HEI Project area (**Figure 1**) will total 84.97 units.

4.0 Monitoring Plan

Monitoring will be conducted on the Babcock/Webb WMA and within the Bond Farm HEI Project. The monitoring efforts for each site will be used to qualitatively and quantitatively assess the post-restoration/post-impoundment hydrological conditions and changing vegetative communities in order to apply success criteria appropriate for enhanced habitats within the Babcock/Webb WMA (*i.e.* mesic flatwoods, hydric flatwoods, basin marsh, depression marsh) and impounded wetlands within the Bond Farm HEI Project (*i.e.* littoral zone, shallow lake, wetland island).

Prior to construction of the Impoundment, a time-zero monitoring event will occur (between October and March) in both the Babcock/Webb WMA and the Bond Farm HEI Project in order to document in-situ baseline conditions. Annual monitoring events will begin the first year after construction completion/as-built certification and will continue for five consecutive years on each site.

Due to existing seasonal flooding (on Babcock/Webb WMA) and proposed deep-water conditions (on Bond Farm HEI Project), annual monitoring events will occur between October and March (during the dry season) to accommodate safe field access to the sampling stations. Annual monitoring reports will be submitted the following June. Piezometer data will be downloaded quarterly, as conditions allow for safe passage to the wells.

5.0 Methodology

BABCOCK/WEBB WMA

The objective will be to demonstrate a decrease in deep-water impoundment sufficient to enhance native habitats through expansion of vegetation representative of each reference community – mesic flatwoods, hydric flatwoods, basin marsh, and depression marsh (Florida Natural Areas Inventory (FNAI) *Guide to the Natural Communities of Florida*: 2010 Edition). The anticipated UMAM functional gain in habitat quality was reflected in the **location and landscape support** score through a hydrological refinement of the historic habitat mosaics; in the **water environment** score through reduced hydroperiods and seasonal flooding; and the **community structure** score through improved vegetative health.

Permanent monitoring stations will be established to collect hydrologic data (i.e. piezometers), vegetative data (i.e. quadrats), qualitative data (i.e. photographs), and wildlife data (i.e. tabular log) to monitor success of the proposed restoration within the four target vegetative communities - mesic flatwoods, hydric flatwoods, basin marsh, and depression marsh. The target water level reduction for each community is between 0.1 feet up to 1.0 feet.

Piezometers and vegetative monitoring stations are shown on **Figure 2**. Monitoring methodology is explained in **Section 6.0**. Adaptive management will be incorporated into the long-term management of the restoration area consistent with (FWC) *Management Plan for Fred C. Babcock-Cecil M. Webb Wildlife Management Area 2014-2024* (FWC, 2014).

Hydrologic Data

Six Bluetooth-enabled piezometers with digital data loggers will collect *in situ* daily water levels. Data will be downloaded quarterly, as conditions allow for safe passage to the wells. Data will be correlated annually with regional rainfall data obtained from the existing rain gauge at Station SR-6.

Four (4) piezometers will be monitored within the restoration area and two will be monitored outside the restoration area (but still within the Babcock/Webb WMA) to ensure a representative analysis of the entire area. The four restoration area piezometers correspond to the southern and northern limits of the proposed hydrologic restoration area located at varying distance from the Bond Farm HEI Project surface water intake area. These include STA-6 within a basin marsh along Oil Well Road Extension South near the proposed eastern conveyance (Babcock/Webb Intake Structure) to the Bond Farm HEI Project; STA-8 within wet flatwoods along Oil Well Road Extension East; and STA-7 within mesic flatwoods and STA-9 within a basin marsh along Road 10 (i.e. fire line). In addition, two piezometers will be installed north and east of the restoration area to supplement the monitoring data. These include SP-10 located 1.5 miles to the northwest along SAL Grade Road and SR-6 located one mile east along the FPL power line. Data collected from piezometers will be correlated to vegetative coverage.

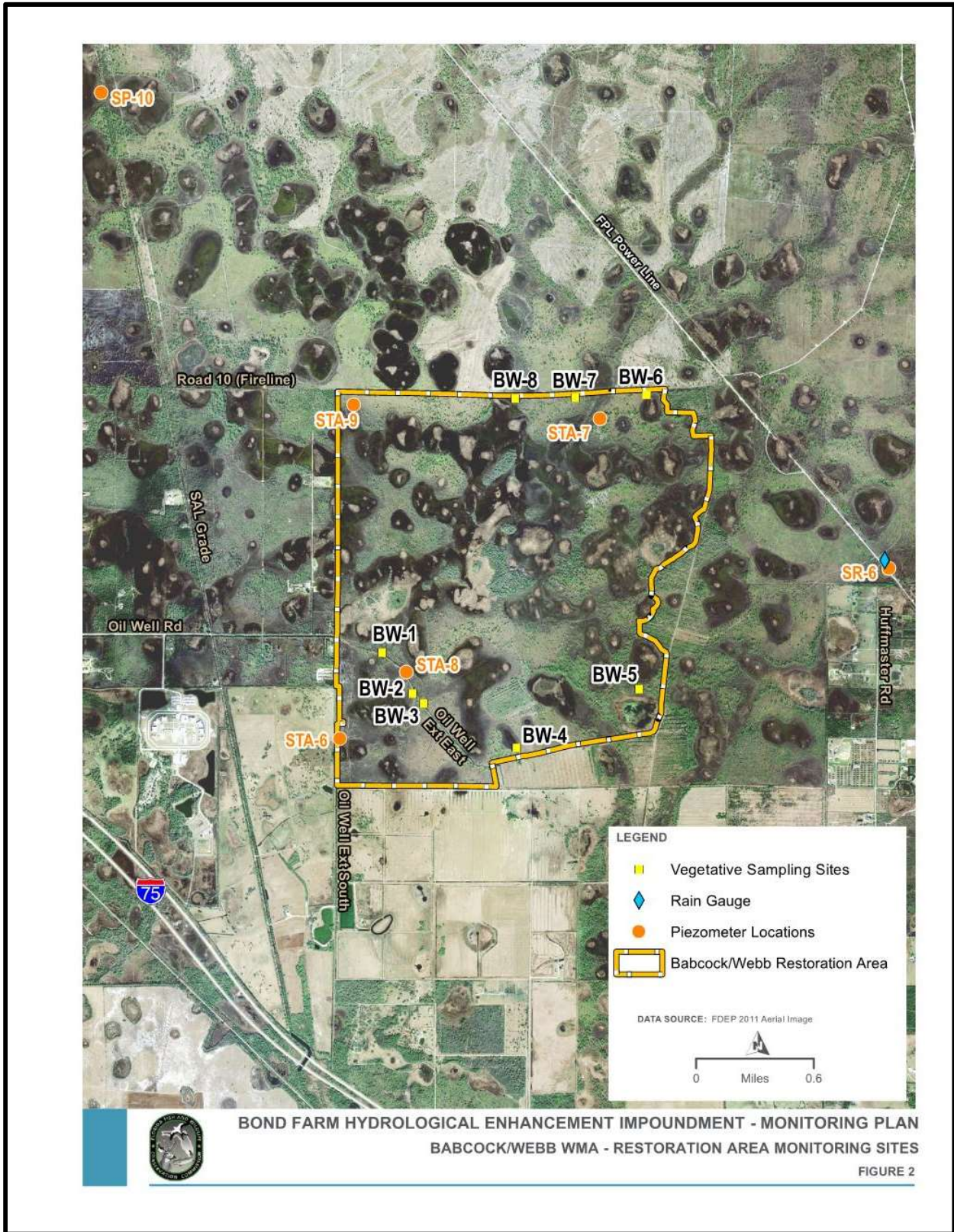
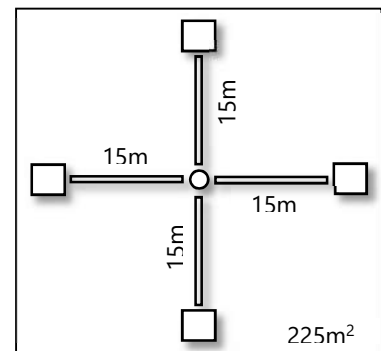


Figure 2: Babcock/Webb WMA - Monitoring Sites

Quantitative Data

Eight (8) vegetative monitoring stations will be established. Monitoring stations will be used to monitor vegetative trends and were selected to be representative of the four target vegetative communities including, two (2) mesic flatwoods (BW-3 and BW-7), two (2) hydric flatwoods (BW-1 and BW-5), two (2) basin marsh (BW-2 and BW-6) and two (2) depression marsh (BW-4 and BW-8). Four (4) vegetative monitoring stations (one for each target community) will be established in the southwest along Oil Well Road Extension East and four (4) stations will be established in the north and east. Monitoring stations were established along existing management roads recognizing that seasonal flooding can limit safe access throughout the Babcock/Webb WMA.

A 2-inch PVC pole will be installed to permanently mark each vegetative monitoring station. Each pole will be GPS-located (latitude and longitude) and numbered for consistent reporting. A meter square (m^2) PVC plot will be the tool used to record vegetative coverage, species type, and indicator status within four (4) fixed quadrats located 15 meters - north, south, east and west - of each of the eight (8) monitoring station poles. A total of 32 quadrats will be sampled within the restoration site: 8 within mesic flatwoods, 8 within hydric flatwoods, 8 within basin marsh, and 8 within depression marsh.



Herbaceous, shrub and seedling data will be recorded within each fixed quadrat. Plants will be identified to species of the lowest practical taxon and average percent cover will be estimated within each plot. The monitoring observer will record field data using a data monitoring sheet consistent with the example in **Appendix B**. All field data will be input into an Excel database in order to run analytics and create pivot tables to graphically track vegetation trends over the 5-year monitoring period.

Not all vegetative communities support trees; however, trees should be monitored when present. The mesic and hydric flatwoods would be expected to support pines. Any tree (6 inches DBH or greater) within the $225m^2$ sample area will be qualitatively monitored for health to track hydrological stress or improvement over time. Any saplings will be recorded as percent cover when present within a quadrat.

Qualitative Data

Due to the existing site conditions and seasonally variable rainfall making the Babcock/Webb WMA difficult to traverse, photo stations will be established at each permanent vegetative monitoring station to visually depict changing landscape conditions. Photos will be taken annually to provide a visual representation of tree health (when trees are present), as well as landscape-scale changes to the restoration area. The PVC poles will be used as the point-of-reference to photo document the landscape. A compass will be used to photograph conditions north, south, east and west of each PVC station and a panoramic photo will be provided to support an annual narrative characterizing habitat and discussing vegetative coverage.

Wildlife Data

Wildlife observation data will be recorded, e.g. tracks, droppings, sightings, vocalizations, burrows, and nests. All data will be maintained in an Excel database for the duration of the monitoring program.

BOND FARM HEI PROJECT

The objective will be to document the expected changes to the existing vegetative communities that will be inundated following completion of the Bond Farm HEI Project. The goal will be to demonstrate a vegetative transition to the inundated conditions (i.e. shallow lake, littoral zone, and wetland islands). As discussed, flooded areas were assumed to retain habitat value in the post-impoundment condition, per the UMAM scoring methodology and as reflected in the **location and landscape support** score (ecological relationship between the new habitats); **water environment** score (variable hydroperiods and seasonal flooding); and **community structure** score (recruitment and persistence of obligate and facultative-wet vegetation).

Permanent monitoring stations will be established to collect hydrologic data (i.e. piezometers), qualitative data (i.e. landscape-level photographs), and wildlife data (i.e. tabular log). Piezometer and photo station locations are shown on **Figure 3**. Monitoring methodology is explained in **Section 6.0**. Long-term management of the Bond Farm HEI Project will be conducted per the *Biological Assessment Bond Farm Regional Hydrological Restoration* (HDR, April 2018).

Hydrologic Data

Four Bluetooth-enabled piezometers with digital data loggers will be installed around the Bond Farm HEI Project outside of the impoundment to collect *in situ* daily water levels. One piezometer will be installed at the northern region west of SAL Grade Road near the SAL Grade Road Pump Station (P-1), one at the northeast corner near the Bond Farm HEI Pump Station (P-2), one at the south eastern tip of the parcel near I-75 and the East Seepage Canal (P-3), and one along the west boundary near I-75 and the future location of the Southwest Discharge Structure (P-4). Piezometer data will be downloaded quarterly, as conditions allow for safe passage to the wells. The piezometer data will be used to evaluate the duration and timing of flooding and to monitor the hydrologic landscape. Data will be correlated with regional rainfall data obtained from the rain gauge at Station SR-6 on the Babcock/Webb WMA.

Qualitative Data

Six (6) monitoring stations will be established near the toe-of-slope of the perimeter berm to photo-document conditions inside the impoundment to visually depict landscape-scale changes in vegetative cover. Monitoring stations were selected based on existing vegetative communities, including three (3) within marsh areas (BF-1, BF-5, and BF-6) and three (3) within wet prairie (BF-2, BF-3, and BF-4) (**Figure 3**). A 2-inch PVC pole will be installed to mark each photo station and each pole will be GPS-located (latitude and longitude) and numbered for consistent reporting. A compass will be used to photograph conditions from each PVC pole looking north, south, east and west, and a panoramic photo will be taken toward the Impoundment at each station to document changing conditions and vegetative coverage. Monitoring stations were purposefully located along the Impoundment berm recognizing that seasonal flooding will likely limit safe access throughout the interior of the Bond Farm HEI Project.

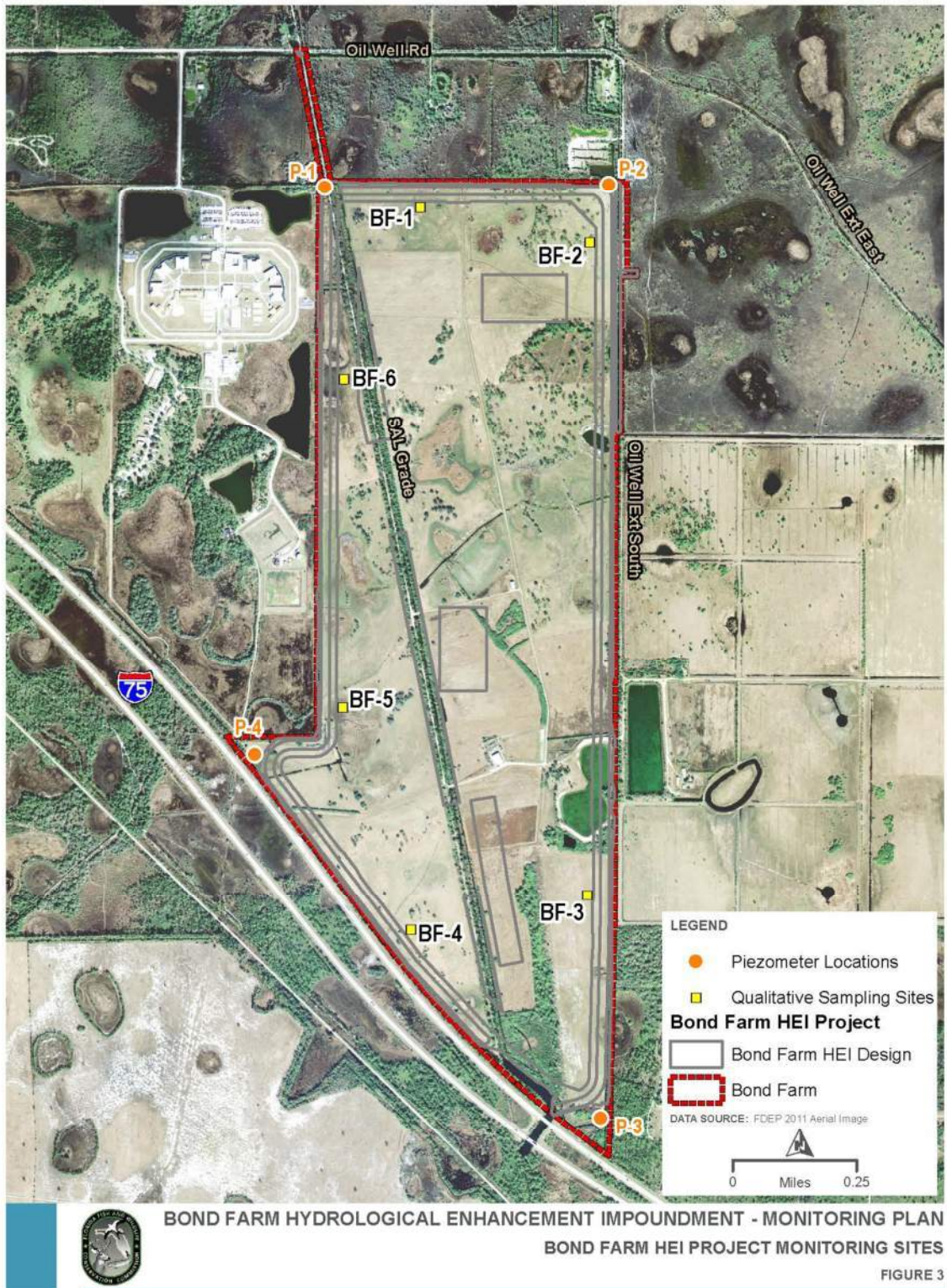


Figure 3: Bond Farm HEI Project Monitoring Sites

Wildlife Data

Wildlife observations will be recorded, e.g. tracks, droppings, sightings, vocalizations, burrows, and nests. Additional wildlife benefits at the Bond Farm HEI Project include wetland islands created by segmenting (and saturating) SAL Grade Road and tree snags created by flooding uplands. The wetland islands will provide nesting and roosting substrate for birds and tree snags will benefit cavity roosting and nesting species. Tree island photos will be taken from monitoring sites BF-4, BF-5, BF-6 and binoculars used to identify nesting birds. All data will be maintained in Excel for the duration of the monitoring program.

6.0 Performance Standards / Success Criteria

6.1 Babcock/Webb WMA

Four vegetative communities would be expected to benefit from reduced hydroperiods and seasonal water levels on the Babcock/Webb WMA, including mesic flatwoods, hydric flatwoods, basin marsh, and depression marsh. The target water level reduction for the Babcock/Webb WMA is between 0.1 feet up to 1.0 feet. However, as explained above, hydroperiods may experience seasonal variability due to interannual rainfall fluctuations associated with periods of drought or extreme precipitation. Using these assumptions, the intent of the monitoring effort will be to verify that the four target vegetative communities are trending towards success as measured against conditions found at the reference wetlands discussed below.

For this monitoring plan, success criteria were established based on the UMAM scoring presented above (i.e. functional gain). The functional gain in habitat quality was reflected in the **location and landscape support** score through an anticipated hydrological refinement of the habitat mosaic; in the **water environment** score through reduced hydroperiods and seasonal flooding; and the **community structure** score through improved vegetative health.

Given that the UMAM analysis did not assume full restoration (i.e. score 10), but rather a *partial increase* in each the landscape, water, and community structure scores to correspond to a *partial decrease* in hydrology, the success criteria for each of the four communities were apportioned as follows.

6.1.1 Mesic Flatwoods

REFERENCE SITE: Myakka River State Park (FNAI)

The following parameters have been proposed as success criteria for the Babcock/Webb WMA mesic flatwoods based on the recommended vegetative coverage ranges for the mesic flatwoods reference site at the Myakka River State Park (**Appendix A**).

Per the approved UMAM scores, the **location and landscape support** within the Babcock-Webb WMA mesic flatwoods would be expected to gain a functional lift of one (1) unit (out of 10) as a result of the restoration effort. This is a 10% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- Maintain a $\leq 5\%$ coverage by invasive exotic plants, as listed in Florida Natural Areas Inventory *Guide to the Natural Communities of Florida: 2010 Edition*.
- Assess the 225m² monitoring site to demonstrate that the area is trending towards success over the five year monitoring program targeting the following coverage by native species outlined in the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida: 2010 Edition*: 20-25% cover by herbaceous/grass species, 10-25% cover by palmetto, less than 25% cover by shrubs, and observable pine regeneration (seedling/saplings).
- Record the presence of mature pines (n=X). Document health annually.

Per the approved UMAM scores, the **water environment** within the Babcock-Webb WMA mesic flatwoods would be expected to gain a functional lift of two (2) units (out of 10) as a result of the restoration effort. This is a 20% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- The target water level decrease for this area is between 0.1 feet up to 1.0 feet.
- Demonstrate a downward trend in the *in situ* water levels over the five year monitoring period when correlated to rainfall data obtained from the existing rain gauge at **Station SR-6**. Piezometer data from **STA-6, 7, 8 and 9** will be tabulated and analyzed to identify hydrological trends. Data will be compared to regional rainfall data to ensure the five year monitoring period is representative of climatic conditions and not an outlier (i.e. excess rainfall or extreme drought).
- **The target inundation for this community is ≤ 1 month.** However, the goal of this restoration effort is to demonstrate that the area is trending towards success; therefore, the area could be expected to be inundated beyond this target until additional hydrologic improvements are implemented in the future.

Per the approved UMAM score, **community structure** within the Babcock/Webb WMA mesic flatwoods would be estimated to gain a functional lift of two (2) units (out of 10) as a result of the restoration effort. This is a 20% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- Field monitoring data to demonstrate a trend over the five year monitoring program towards a 20% increase in vegetative species coverage characteristic of mesic flatwoods, per the species outlined in the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida: 2010 Edition*.

6.1.2 Hydric Flatwoods

REFERENCE SITE: Babcock/Webb WMA (FNAI)

The following parameters have been proposed as success criteria for the Babcock/Webb WMA hydric flatwoods based on the recommended vegetative coverage ranges for the hydric flatwoods reference site on the Babcock/Webb WMA (**Appendix A**).

Per the approved UMAM score, the **location and landscape support** within the Babcock/Webb WMA hydric flatwoods would be expected to gain a functional lift of one (1) unit (out of 10) as a result of the restoration effort. This is a 10% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- Maintain a $\leq 5\%$ coverage by invasive exotic plants, as listed in Florida Natural Areas Inventory *Guide to the Natural Communities of Florida*: 2010 Edition.
- Assess the 225m² monitoring site to demonstrate that the area is trending towards success over the five year monitoring program targeting the following coverage by native species outlined in the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida*: 2010 Edition: 35% herbaceous/grass species cover, $\leq 10\%$ cover by palmetto, $\leq 10\%$ cover by shrubs, and observable pine regeneration (seedling/saplings).
- Record the presence of mature pines (n=X). Document health annually.

Per the approved UMAM score, the **water environment** within the Babcock/Webb WMA hydric flatwoods would be expected to gain a functional lift of two (2) units (out of 10) as a result of the restoration effort. This is a 20% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- The target water level decrease for this area is between 0.1 feet up to 1.0 feet.
- Demonstrate a downward trend in the *in situ* water levels over the five year monitoring period when correlated to rainfall data obtained from the existing rain gauge at **Station SR-6**. Piezometer data from **STA-6, 7, 8 and 9** will be tabulated and analyzed to identify hydrological trends. Data will be compared to regional rainfall data to ensure the five year monitoring period is representative of climatic conditions and not an outlier (i.e. excess rainfall or extreme drought).
- **The target inundation for this community is 1 to 2 months.** However, the goal of this restoration effort is to demonstrate that the area is trending towards success; therefore, the area could be expected to be inundated beyond this target until additional hydrologic improvements are implemented in the future.

Per the approved UMAM score, **community structure** within the Babcock-Webb WMA hydric flatwoods would be estimated to gain a functional lift of two (2) units (out of 10) as a result of the restoration effort. This is a 20% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- Field monitoring data to demonstrate a trend over the five year monitoring program towards a 20% increase in vegetative cover characteristic of hydric flatwoods, per the species outlined in the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida*: 2010 Edition.

6.1.3 Basin Marsh

REFERENCE SITE: Babcock-Webb WMA (FNAI)

The following parameters have been proposed as success criteria for the Babcock-Webb WMA basin marsh based on the recommended vegetative coverage ranges for the basin marsh reference site on the Babcock-Webb WMA (**Appendix A**).

Per the approved UMAM score, the **location and landscape support** within the Babcock-Webb WMA basin marsh would be expected to gain a functional lift of one (1) unit (out of 10) as a result of the restoration effort. This is a 10% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- Maintain a $\leq 5\%$ coverage by invasive nuisance or exotic plants, as listed in Florida Natural Areas Inventory *Guide to the Natural Communities of Florida: 2010 Edition*.
- Assess the 225m² monitoring site to demonstrate that the area is trending towards success over the five year monitoring program targeting the following coverage by native species outlined in the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida: 2010 Edition*: >25% herbaceous cover and ≤ 5 cover by shrubs.

Evidence of vegetative zonation indicating variations in length of hydroperiods, depth of flooding, and hydrological refinement of the habitat mosaic. Per the approved UMAM score, the **water environment** within the existing basin marsh would be expected to gain a functional lift of two (2) units (out of 10) as a result of the restoration effort. This is a 20% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- The target water level decrease for this area is between 0.1 feet up to 1.0 feet.
- Demonstrate a downward trend in the *in situ* water levels over the five year monitoring period when correlated to rainfall data obtained from the existing rain gauge at **Station SR-6**. Piezometer data from **STA-6, 7, 8 and 9** will be tabulated and analyzed to identify hydrological trends. Data will be compared to regional rainfall data to ensure the five year monitoring period is representative of climatic conditions and not an outlier (i.e. excess rainfall or extreme drought).
- **The target inundation for this community is 4 to 6 months.** However, the goal of this restoration effort is to demonstrate that the area is trending towards success; therefore, the area could be expected to be inundated beyond this target until additional hydrologic improvements are implemented in the future.

Per the approved UMAM score, **community structure** within the existing basin marsh would be estimated to gain a functional lift of one (1) unit (out of 10) as a result of the restoration effort. This is a 20% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- Field monitoring data to demonstrate a trend over the five year monitoring program towards a 10% increase in vegetative cover characteristic of basin marsh, per the species outlined in the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida*: 2010 Edition.
- Evidence of establishment or enhancement of a transitional zone of St. John's St. John's-wort (*Hypericum* spp.) along a saw palmetto edge (if present).

6.1.4 Depression Marsh

REFERENCE SITE: Triple N Ranch Wildlife Management Area (Osceola County)

The following parameters have been proposed as success criteria for the Babcock-Webb WMA basin marsh based on the recommended vegetative coverage recommendations from the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida*: 2010 Edition and consistent with the reference site on the Triple N Ranch Wildlife management Area in Osceola County (**Appendix A**).

Per the approved UMAM scores, the **location and landscape support** within the existing depression marsh would be expected to gain a functional lift of one (1) unit (out of 10) as a result of the restoration effort. This is a 10% increase assuming a total possible score of 100%.

The following will be used to demonstrate success.

- Maintain a $\leq 5\%$ coverage by invasive nuisance or exotic plants, as listed in *Florida Natural Areas Inventory Guide to the Natural Communities of Florida*: 2010 Edition.
- Assess the 225m² monitoring site to demonstrate that the area is trending towards success over the five year monitoring program targeting vegetative coverage by native species outlined in the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida* (2010).

Establishment or enhancement of concentric zones of herbaceous vegetation indicating variations in hydroperiods, depth of flooding, and hydrological refinement of the habitat mosaic. Per the approved UMAM, the **water environment** within the existing depression marsh would be expected to gain a functional lift of two (2) units (out of 10) as a result of the restoration effort. This is a 20% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- The target water level decrease for this area is between 0.1 feet up to 1.0 feet.
- Demonstrate a downward trend in the *in situ* water levels over the five year monitoring period when correlated to rainfall data obtained from the existing rain gauge at **Station SR-6**. Piezometer data from **STA-6, 7, 8 and 9** will be tabulated and analyzed to identify hydrological trends. Data will be compared to regional rainfall data to ensure the five year monitoring period is representative of climatic conditions and not an outlier (i.e. excess rainfall or extreme drought).
- **The target inundation for this community is 6 to 10 months.** However, the goal of this restoration effort is to demonstrate that the area is trending towards success; therefore, the area could be expected to be inundated beyond this target until additional hydrologic improvements are implemented in the future.

Per the approved UMAM, **community structure** within the existing depression marsh would be estimated to gain a functional lift of one (1) unit (out of 10) as a result of the restoration effort. This is a 10% improvement assuming a total possible score of 100%.

The following will be used to demonstrate success.

- Field monitoring data to demonstrate a trend over the five year monitoring program towards a 10% increase in vegetative cover characteristic of a depression marsh, per the species outlined in the *Florida Natural Areas Inventory Guide to the Natural Communities of Florida*: 2010 Edition.

6.2 Bond Farm HEI Project

Existing vegetative communities would be expected to be impacted by increased hydroperiods on the Bond Farm HEI Project resulting in a shift in community type from herbaceous marsh, willow marsh, wet prairie/wet pasture, and flatwoods to a littoral zone, shallow lake and wetland island(s).

Operation and management of the Bond Farm HEI Project, including timing of water capture, storage, and release will vary annually dependent on the onset of the wet season rainfall. The Bond Farm HEI Project will store up to 4 feet of water for approximately 4 to 6 months annually during the wet season until the downstream release at the onset of the dry season.

Given that the Bond Farm HEI Project is a hydrological impoundment, the success criteria differ from the Babcock/Webb WMA habitat restoration area. The Bond Farm HEI Project success criteria are qualitative based on the UMAM scoring presented above and have been established to substantiate the expectation that the Bond Farm HEI Project will provide ecological value in its operational stage. The Bond Farm HEI Project UMAM analysis did not assume full impact (*i.e.* score 0), but rather a *partial (but substantial) decrease* in each the landscape, water, and community structure scores to correspond to a *partial (but substantial) increase* in hydrology. The success criteria were established accordingly.

Per the UMAM assessment, the functional loss in the **landscape and landscape support** within the Bond Farm HEI Project was computed given the expectation that although habitat type and quality would be altered and reduced, an alternate ecological relationship between new habitat types would be created. For the **water environment** score although the project would result in increased hydroperiods and seasonal flooding, water quality benefits would still be realized. For **community structure**, the project would result in reduced vegetative diversity and quality; however, a new community structure would be created, which would benefit wildlife.

The following qualitative conditions would be monitored within the Bond Farm HEI Project:

- Establishment of ecological zonation along the perimeter habitats surrounding the Bond Farm HEI Impoundment
- Establishment of habitat zonation within higher elevation areas (*i.e.* remaining SAL Grade Road (Wave Barrier), former uplands, and former wet prairie) within the interior impoundment area
- Variable hydroperiods and seasonal flooding, as recorded by the four piezometers
- Photo-documentation showing persistent obligate and facultative-wet vegetation
- Utilization of the wetland islands created by segmenting SAL Grade Road for a Wave Barrier by nesting and roosting birds
- Utilization of the Bond Farm HEI Project by wetland-dependent wildlife

7.0 Adaptive Management and Maintenance Plan

BABCOCK/WEBB WMA

In the post-restoration condition, these communities will continue to be managed in accordance with the FWC *Management Plan for Fred C. Babcock-Cecil M. Webb Wildlife Management Area 2014-2024* (FWC, 2014). In order to maintain nuisance and exotic vegetation below the thresholds outlined for each target restoration communities discussed in **Section 6.1**, semi-annual maintenance could be implemented, as needed.

BOND FARM HEI PROJECT

Operation and management of the Bond Farm HEI Project will require the seasonal capture, storage, and discharge of excess waters from the Babcock/Webb WMA. Adaptive management will be consistent with the *Biological Assessment - Bond Farm Regional Hydrological Restoration* (HDR, April 2018).

8.0 Annual Reporting

Annual monitoring reports will be submitted to the Florida Department of Environmental Protection (FDEP) and U.S. Army Corps of Engineers (USACE) in the June following the monitoring event, which will occur during the dry season (between October and March).

Each report will include the hydrologic data (i.e. piezometers), quantitative data (i.e. vegetation monitoring quadrats), qualitative data (i.e. landscape-scale photographs), and wildlife data (i.e. tabular log) outlined above to monitor the success of the proposed restoration targets within the four target vegetative communities - mesic flatwoods, hydric flatwoods, basin marsh, and depression marsh – for the Babcock/Webb WMA and a narrative (including a photo log) discussing the landscape transitions, water level variations, and wildlife utilization within the littoral zone, shallow lake, and wetland island(s) for the Bond Farm HEI Project.

The monitoring observer will record field data using a format similar to the attached Monitoring Data Sheet. Additionally, field data – hydrologic data and vegetative data – will be input into Excel or a compatible program to run analytics and create pivot tables to graphically track water levels and vegetation trends over the 5-year monitoring period. A database will be set up to track wildlife utilization and photo records will be maintained to visually compare vegetative changes over the monitoring period. Each report will include written analysis of overall trends toward compliance with project goals and permit success criteria.

9.0 References

- Bardi, E., M.T. Brown, K.C. Reiss, M.J. Cohen. 2005. Uniform Mitigation Assessment Method Training Manual. The University of Florida Howard T. Odum Center for Wetlands (UF-CFW). Florida Department of Environmental Regulation.
- Florida Fish and Wildlife Conservation Commission (FWC). 2014. A Management Plan for Fred C. Babcock-Cecil M. Webb Wildlife Management Area 2014-2024. Accessed on the Internet at <http://chnep.wateratlas.usf.edu/upload/documents/cmp-babcock-webb.pdf>
- FNAI. 2010. *Guide to the Natural Communities of Florida*: 2010 Edition. Accessed on the Internet at: https://www.fnai.org/PDF/FNAI-Natural-Community-Classification-Guide-2010_20150218.pdf.
- HDR. 2018. Biological Assessment – Bond Farm Regional Hydrological Restoration.

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Appendix A

REFERENCE WETLANDS

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OVERVIEW

LOCATION

Sarasota County

Latitude 27° 15' 18.2" N

Longitude 82° 15' 06.8" W

COMMUNITY DESCRIPTION

Myakka River State Park lies on the De Soto Slope in the Southwestern Flatwoods District, a broad plain characterized by prairies, flatwoods and swamps. Although the park is known for its extensive dry prairie, it also supports areas of high quality mesic flatwoods. The reference site for mesic flatwoods is within a small patch east of Lake Myakka in a large dry prairie matrix with embedded depression marshes.



There is a moderately dense canopy with several age classes of longleaf pine (*Pinus palustris*), with trees up to about 18 inches dbh and 60 feet tall. A few flat-topped, older mature trees are present. The moderate to dense shrub layer (30 to 60%) is dominated by saw palmetto (*Serenoa repens*) that averages approximately three to four feet in height. Other dominant components are fetterbush (*Lyonia lucida*), dwarf live oak (*Quercus minima*), shiny blueberry (*Vaccinium myrsinites*), and coastalplain staggerbush (*Lyonia fruticosa*). Less frequent, but common shrubs include dwarf huckleberry (*Gaylussacia dumosa*), roundpod St. John's wort (*Hypericum cistifolium*), four-petal St. John's wort (*Hypericum tetrapetalum*), gallberry (*Ilex glabra*), and wax myrtle (*Myrica cerifera*). Herb cover is sparse to moderate, represented primarily by wiregrass (*Aristida stricta* var. *beyrichiana*). Other dominant herbaceous components are narrowleaf silkgrass (*Pityopsis graminifolia*), blackroot (*Pterocaulon pycnostachyum*), witchgrass (*Dichanthelium* sp.), little bluestem (*Schizachyrium scoparium*), and bottlebrush threeawn (*Aristida spiciformis*). Other common herbaceous species include lopsided indiagrass (*Sorghastrum secundum*), vanillaleaf (*Carphephorus odoratissimus*), coastalplain chaffhead (*Carphephorus corymbosus*), tall elephantsfoot (*Elephantopus elatus*), bretonica peluda (*Melochia spicata*), rosy camphorweed (*Pluchea rosea*), queensdelight (*Stillingia sylvatica*), yellow hatpins (*Syngonanthus flavidulus*), and savannah yellow-eyed grass (*Xyris flabelliformis*).

This reference example of mesic flatwoods is at the end of the desired fire return interval, resulting in the high shrub and low herbaceous cover. Several of old firebreaks cross the site. No other disturbances are present. Gopher tortoises (*Gopherus polyphemus*) were noted at this site during monitoring. Data were originally collected at this site during February 2009, and a second data set was collected during November 2015.

After further consultation with the park biologist, FNAI may consider replacing this reference area with another Myakka site in the future.

Date of Last Burn

May 2013

Notable Species Management Considerations

The structure and composition of this reference site is within recommended state guidelines for red-cockaded woodpecker (*Picoides borealis*) and gopher tortoise (*Gopherus polyphemus*). See the Florida Fish and Wildlife Conservation Commission's *Florida Wildlife Conservation Guide*: http://fwcg.myfwc.com/docs/RCW_Management_Plan.pdf and <http://myfwc.com/media/2286685/GT-Management-Plan.pdf>.

STATISTICAL SUMMARY

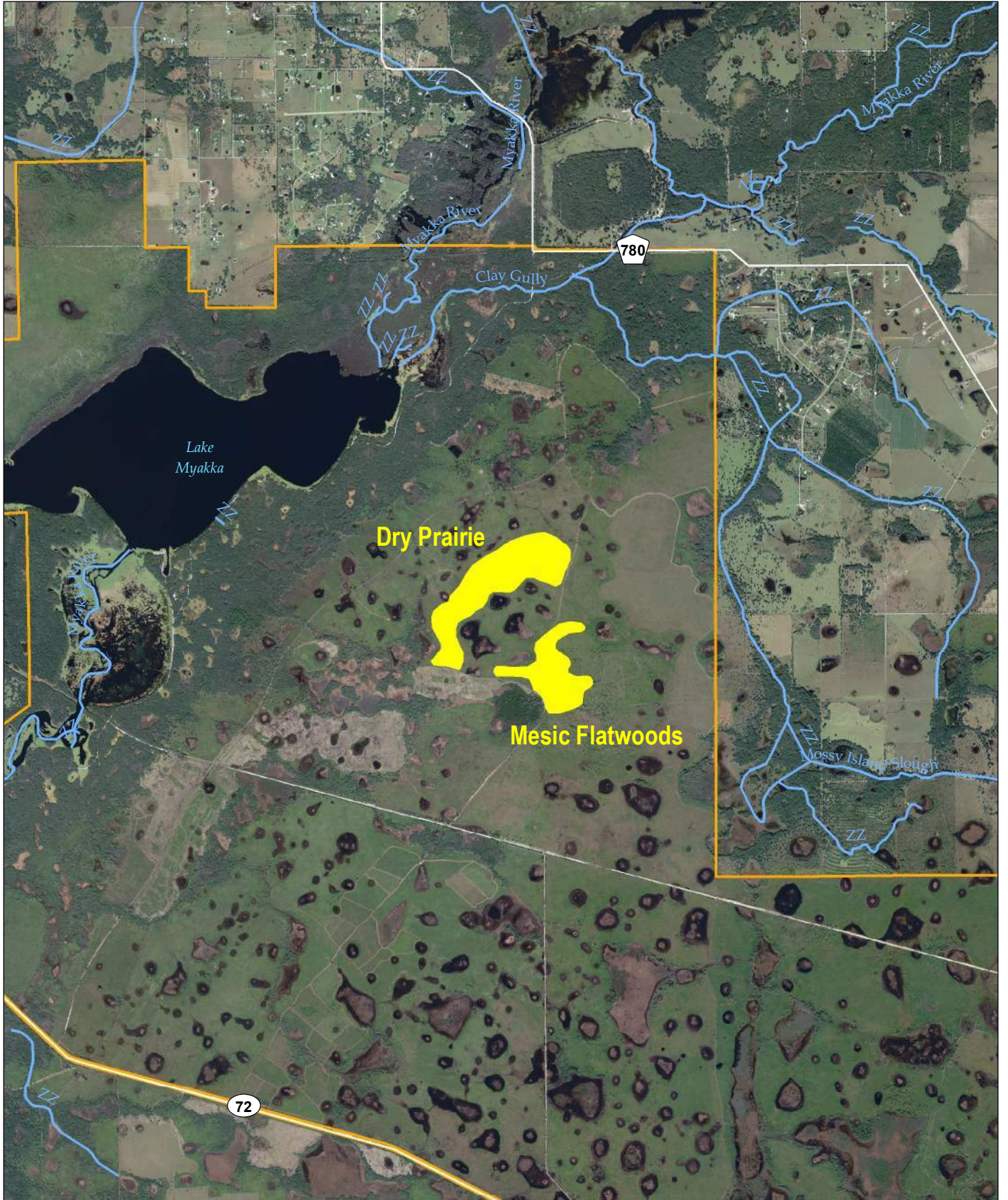
Metric	2009 Average Reference Site Value	2015 Average Reference Site Value	Recommended Range for Mesic Flatwoods
Basal Area of Pine (sq ft per acre)	19.7	13.7	10-50
Pine Regeneration (stems within 7 m radius)	0.1	0.2	>0
Bare Ground (%)	2.5	2.2	<10
Herb Cover (%)	17.4	20.8	>15
Wiry Graminoid Cover (%)	13.8	8.1	>10
Exotic Plant Cover (%)	0	0	0
Weedy Species Cover (%)	0.5	0.1	<2
Average Maximum Serenoa Height (ft)	2.7	2.3	<3
Serenoa Cover (%)	28.8	27.0	10-25
Serenoa Petiole Density >3 ft	0	0	0
Average Maximum Shrub Height (ft)	2.1	2.3	<2
Shrub Cover (%)	11.1	9.8	<25
Shrub Stem Density >3 ft	2.1	2.7	<1
Maximum Shrub DBH (in)	0	0	<0.5
Non-Pine Stem Density (stems within 7 m radius)	0.1	0	0
Subcanopy (average stems per quadrat)	0	0	0

The Reference Natural Community project, including the identification and quantification of high quality reference sites comprising geographical and plant community variations of ten actively managed natural community types, is funded by the Florida Fish and Wildlife Conservation Commission.

For more information, contact:



Florida Natural Areas Inventory
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**Location Map - Mesic Flatwoods
Myakka River State Park**

Latitude 27.254552 Longitude -82.251945
Sarasota County, Florida

-  Reference Area
-  Myakka River State Park

0 0.25 0.5 1 1.5 2 Miles





OVERVIEW

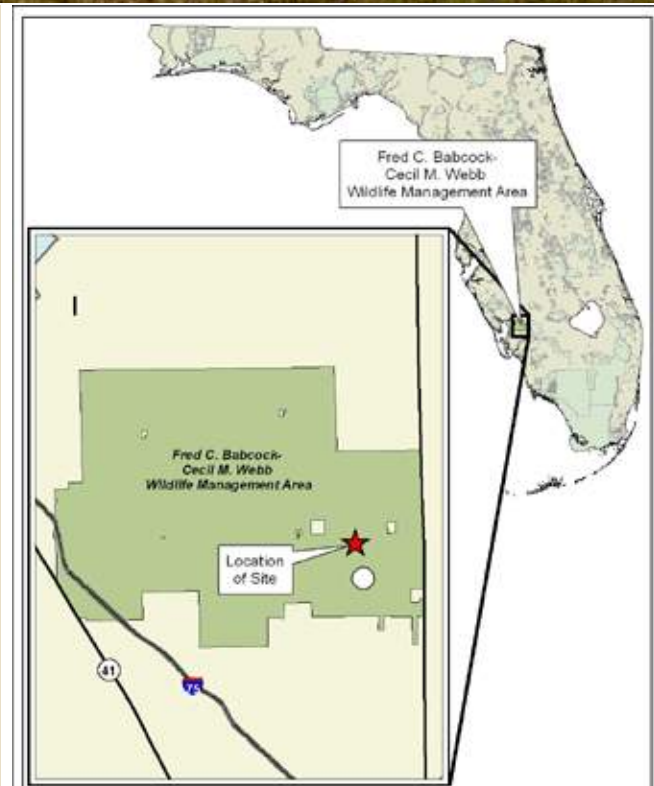
LOCATION

Charlotte County

Latitude 26° 51' 04.5" N, Longitude 81° 47' 57.7" W

COMMUNITY DESCRIPTION

Babcock-Webb Wildlife Management Area (WMA) is within the De Soto Slope Province of the Southwestern Flatwoods District characterized as a broad plain of prairies, flatwoods and swamps. The WMA is an extensive area of flatwoods, marshes, prairies and swamps. The area is frequently burned, much of it annually during the winter, to maintain habitat for quail and other wildlife. The reference wet flatwoods occurs in the western portion of the Wildlife Management Area. The site is flat with little topographic relief



and with sandy soils. It occupies a very shallow “trough” through mesic flatwoods that connects two basin marshes.

The wet flatwoods reference site has a canopy of scattered south Florida slash pine (*Pinus elliottii* var. *densa*). Larger trees are 18 inches dbh and 60 feet tall; a few flat-topped trees are present. A few young pines represent the subcanopy. The shrub cover is all mostly less than 3 feet tall and generally as small to large discrete patches of saw palmetto (*Serenoa repens*) and dwarf live oak (*Quercus minima*). A few scattered individuals of netted pawpaw (*Asimina reticulata*), roundpod St. John’s wort (*Hypericum cistifolium*), peelbark St. John’s wort (*Hypericum fasciculatum*), myrtle-leaf St. John’s wort (*Hypericum myrtifolium*), gallberry (*Ilex glabra*), and wax myrtle (*Myrica cerifera*) are present in an otherwise herb-dominated community. The herbaceous cover is generally greater than 60 percent and is dominated by wiregrass (*Aristida stricta* var. *beyrichiana*). Other dominant species are narrowfruit horned beaksedge (*Rhynchospora inundata*), tenangle pipewort (*Eriocaulon decangulare*), netted nutrush (*Scleria reticularis*), low nutrush (*Scleria verticillata*), and blue maidencane (*Amphicarpum muhlenbergianum*). Common herbaceous species include lovegrass (*Eragrostis* sp.), Florida tickseed (*Coreopsis floridana*), bluejoint panicum (*Panicum tenerum*), queensdelight (*Stillingia sylvatica*), chalky bluestem (*Andropogon virginicus* var. *glaucus*), yellow hatpins (*Syngonanthus flavidulus*), bog white violet (*Viola lanceolata*), savannah yellow-eyed grass (*Xyris flabelliformis*), spadeleaf (*Centella asiatica*), pineland rayless goldenrod (*Bigelowia nudata*), dwarf sundew (*Drosera brevifolia*), vanillaleaf (*Carphephorus odoratissimus*), pineland daisy (*Chaptalia tomentosa*), rosy camphorweed (*Pluchea rosea*), pineland heliotrope (*Heliotropium polyphyllum*), early whitetop fleabane (*Erigeron vernus*), branched hedgehyssop (*Gratiola ramosa*), hairawn muhly (*Muhlenbergia capillaris*), bretonica peluda (*Melochia spicata*), axilflower (*Mecardonia acuminata*), whitehead bogbutton (*Lachnocaulon anceps*), combleaf mermaidweed (*Proserpinaca pectinata*), starrush whitetop (*Rhynchospora colorata*). Many other herbaceous species are present.

The area is frequently burned, much of it annually during the winter, to maintain habitat for quail and other wildlife. There is less pine regeneration at this site than found in a typical wet flatwoods in good condition. This seems to be the result of very frequent burning, but may be representative of a natural cycle in wet flatwoods, which tend to have a sparse tree cover. This site has some light disturbance from cattle and an ORV trail, but is otherwise an exceptional natural site. Data were collected at this site during January 2009.

Notable Species Management Considerations

The structure and composition of this reference site is within recommended state guidelines for red-cockaded woodpecker (*Picoides borealis*). See the Florida Fish and Wildlife Conservation Commission’s *Florida Wildlife Conservation Guide*: http://myfwc.com/docs/FWCG/red_Cockaded_Woodpecker_Final.pdf.

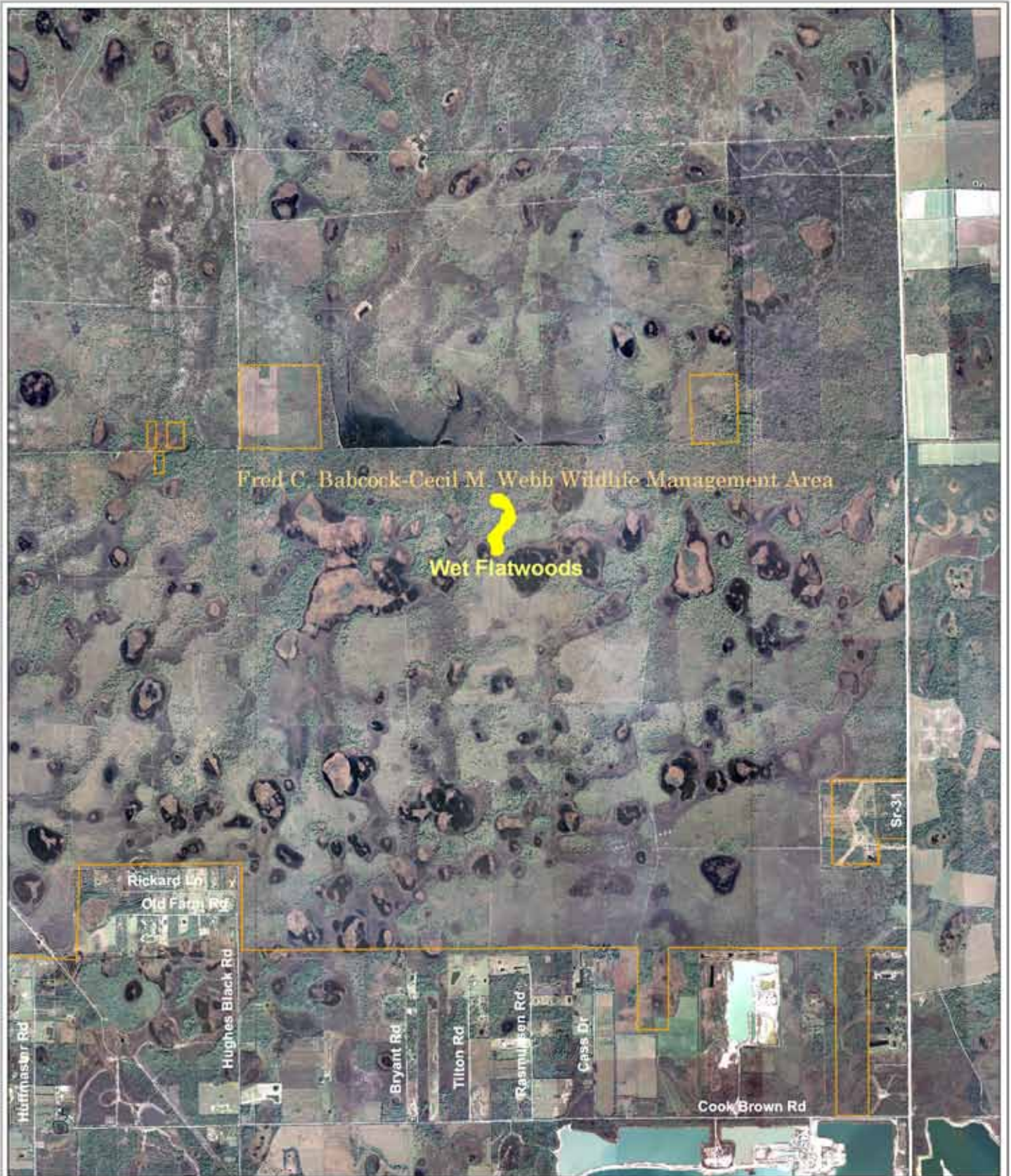
STATISTICAL SUMMARY

Metric	Average Reference Site Value	FNAI Recommended Range for Wet Flatwoods
Basal Area of Pine (sq ft per acre)	32.0	10-50
Pine Regeneration (stems within 7 m radius)	0.2	>0
Bare Ground (%)	13.8	<2
Herb Cover (%)	49.2	>25
Wiry Graminoid Cover (%)	26.1	>10
Exotic Plant Cover (%)	0.0	0
Weedy Species Cover (%)	1.1	<2
Average Maximum <i>Serenoa</i> Height (ft)	0.5	<3
<i>Serenoa</i> Cover (%)	5.9	<10
<i>Serenoa</i> Petiole Density > 3 ft	0.0	0
Average Maximum Shrub Height (ft)	0.8	<3
Shrub Cover (%)	1.8	<10
Shrub Stem Density > 3 ft	0.2	<0.5
Maximum Shrub DBH (in)	0.0	<0.5
Non-Pine Stem Density (stems within 7 m radius)	0.0	0
Subcanopy (stems within 7 m radius)	0.0	<1

The first phase of the Reference Natural Community project, including the identification and quantification of 44 reference sites comprising geographical and plant community variations of ten actively managed natural community types, was funded by the **Florida Fish and Wildlife Conservation Commission**, 2007-2009.

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Fred C. Babcock-Cecil M. Webb Wildlife Management Area

Wet Flatwoods

Rickard Ln
Old Farm Rd

Hurrmaser Rd

Hughes Black Rd

Bryant Rd

Tilton Rd

Kasimulien Rd



Cass Dr

Cook Brown Rd

Sr-31

**Location Map - Wet Flatwoods
Babcock Webb Wildlife Management Area**

Latitude 26.851243 Longitude -81.799348
Charlotte County, Florida

-  Reference Area
-  Babcock Webb Wildlife Management Area

0 0.25 0.5 1 1.5 2 Miles





OVERVIEW

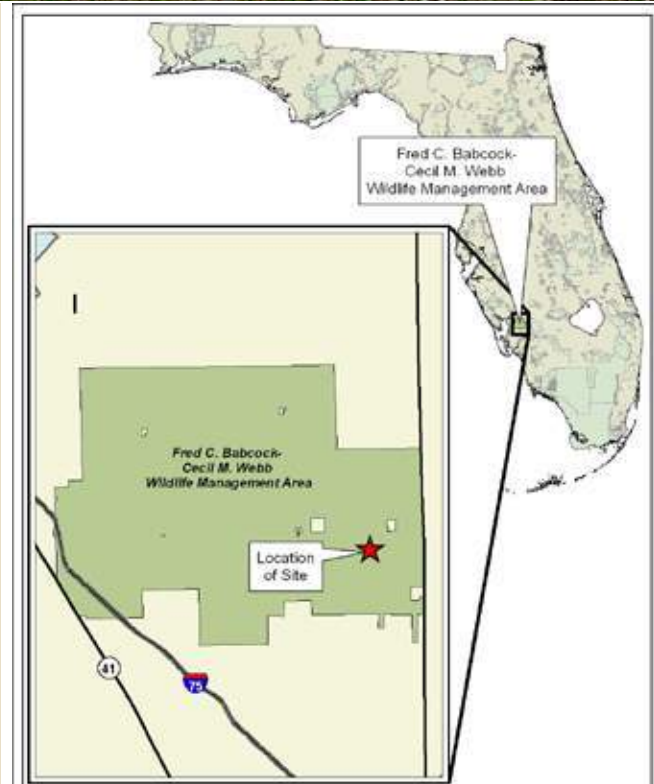
LOCATION

Charlotte County

Latitude 26° 50' 52.2" N, Longitude 81° 47' 38.7" W

COMMUNITY DESCRIPTION

Babcock-Webb Wildlife Management Area (WMA) is within the De Soto Slope Province of the Southwestern Flatwoods District which is characterized as a broad plain of prairies, flatwoods and swamps. The reference basin marsh at Babcock-Webb WMA is part of a large three-lobed basin, each lobe with a deep central area surrounded by shallow marsh. The marsh is mostly surrounded by mesic and wet flatwoods. A small area of dry prairie lies to the southwest.



There is an incomplete band of woody vegetation around the perimeter composed of coastalplain willow (*Salix caroliniana*) and common buttonbush (*Cephalanthus occidentalis*). Patches of sand cordgrass (*Spartina bakeri*) and hairawn muhly (*Muhlenbergia capillaris*) are also present in this outer transition to the marsh. There is a narrow to broad shallow marsh zone with a few willow and buttonbush and a moderately dense cover of herbaceous species growing in sandy soil through mats of periphyton. Peelbark St. John's wort (*Hypericum fasciculatum*) is occasional in this zone. Dominant herbaceous species are lemon bacopa (*Bacopa caroliniana*), pineland spade-leaf (*Centella asiatica*), combleaf mermaidweed (*Proserpinaca pectinata*), longleaf threeawn (*Aristida palustris*), southern umbrellasedge (*Fuirena scirpoidea*), narrowfruit horned beaksedge (*Rhynchospora inundata*), Tracy's beaksedge (*Rhynchospora tracyi*), tenangle pipewort (*Eriocaulon decangulare*), flattened pipewort (*Eriocaulon compressum*), axilflower (*Mecardonia acuminata*), pineland heliotrope (*Heliotropium polyphyllum*), dwarf sundew (*Drosera brevifolia*), and rosy camphorweed (*Pluchea rosea*). Deep areas of the marsh had organic soils protected from oxidation by nearly continuous saturation. Herbaceous vegetation in these deep areas is very dense (generally approaching 100%). Dominant species are maidencane (*Panicum hemitomon*), bulltongue arrowhead (*Sagittaria lancifolia*), and pickerelweed (*Pontederia cordata*). Dense patches of sawgrass (*Cladium jamaicense*) also are present. A few small patches of coastalplain willow are also present in the deep marsh.

Portions of the outer edge of the marsh have been trampled by cattle and rooted by feral hogs, which may affect the passage of fire from the surrounding uplands into the marsh. This, and the fact that most of the prescribed burns are conducted during the dormant season, might explain the extent of the woody perimeter. Despite these perimeter disturbances the core marsh remains in good condition. Data were collected at this site during January 2009.

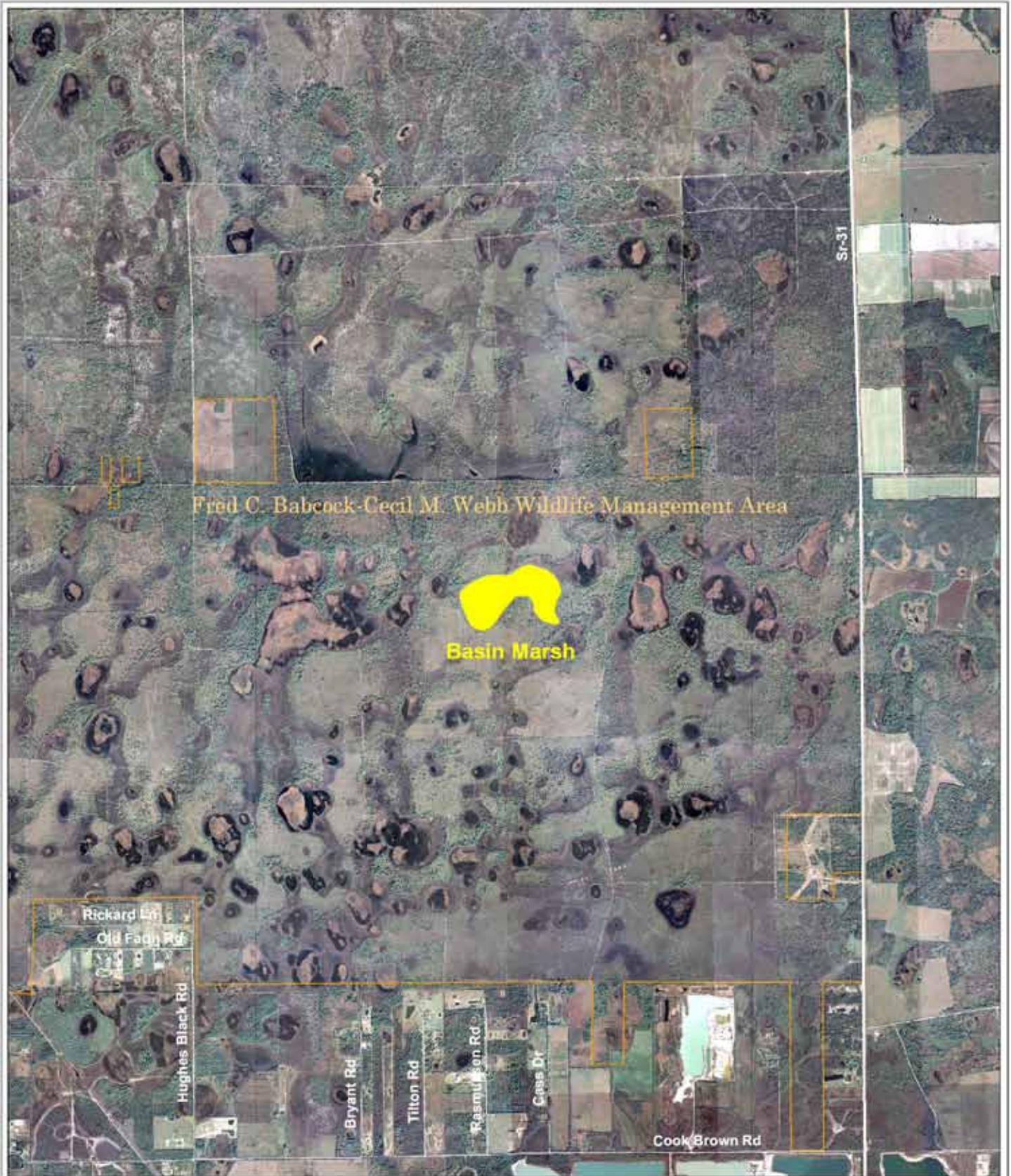
STATISTICAL SUMMARY

Metric	Average Reference Site Value	FNAI Recommended Range for Basin Marsh
Basal Area of Pine (sq ft per acre)	0.0	0
Pine Regeneration (stems within 7 m radius)	0.0	0
Bare Ground (%)	46.3	n/a
Herb Cover (%)	13.8	>25
Wiry Graminoid Cover (%)	0.1	0
Exotic Plant Cover (%)	0.0	0
Weedy Species Cover (%)	0.0	<2
Average Maximum <i>Serenoa</i> Height (ft)	0.0	0
<i>Serenoa</i> Cover (%)	0.0	0
<i>Serenoa</i> Petiole Density > 3 ft	0.0	0
Average Maximum Shrub Height (ft)	0.7	<3
Shrub Cover (%)	1.2	<5
Shrub Stem Density > 3 ft	0.6	1-5
Maximum Shrub DBH (in)	0.0	<0.5
Non-Pine Stem Density (stems within 7 m radius)	0.0	0
Subcanopy (stems within 7 m radius)	0.0	<1

The first phase of the Reference Natural Community project, including the identification and quantification of 44 reference sites comprising geographical and plant community variations of ten actively managed natural community types, was funded by the **Florida Fish and Wildlife Conservation Commission**, 2007-2009.

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Fred C. Babcock-Cecil M. Webb Wildlife Management Area

Basin Marsh

Rickard Ln
Old Faith Rd

Hughes Black Rd

Bryant Rd

Tilton Rd

Rasmussen Rd

Cross Dr

Cook Brown Rd

**Location Map - Basin Marsh
Babcock Webb Wildlife Management Area**

Latitude 26.84784 Longitude -81.794075
Charlotte County, Florida

-  Reference Area
-  Babcock Webb Wildlife Management Area





Triple N Ranch Wildlife Management Area (Osceola County)

Photo by Ann F. Johnson

Depression Marsh

Description: Depression marsh is characterized as a shallow, usually rounded depression in sand substrate with herbaceous vegetation or subshrubs, often in concentric bands. Depression marshes typically occur in landscapes occupied by fire-maintained matrix communities such as mesic flatwoods, dry prairie, or sandhill. The concentric zones or bands of vegetation are related to length of the hydroperiod and depth of flooding. The outer, or driest, zone is often occupied by sparse herbaceous vegetation consisting of longleaf threeawn (*Aristida palustris*), beaksedges (*Rhynchospora microcarpa*, *R. cephalantha*, *R. tracyi*, *R. filifolia*, etc.), Elliott's yellow-eyed grass (*Xyris elliotii*), the subshrub, myrtleleaf St. John's wort (*Hypericum myrtifolium*), and patches of blue maidencane (*Amphicarpum muhlenbergianum*) or sand cordgrass (*Spartina bakeri*). This sparse zone may be followed downslope by a sparse to dense zone of peelbark St. John's wort (*Hypericum fasciculatum*), water toothleaf (*Stillingia aquatica*) and scattered herbs, such as fringed yellow-eyed grass (*Xyris fimbriata*), pipeworts (*Eriocaulon compressum* and *E. decangulare*), narrowfruit horned beaksedge (*Rhynchospora inundata*), and Baldwin's spikerush (*Eleocharis baldwinii*). The innermost, deepest zone is occupied by maidencane (*Panicum hemitomon*), pickerelweed (*Pontederia cordata*), bulltongue arrowhead (*Sagittaria lancifolia*), or sawgrass (*Cladium jamaicense*). Floating-leaved plants, such as white waterlily (*Nymphaea odorata*), may be found in open water portions of the marsh. Depending on depth and configuration, depression marshes can have varying combinations of these zones and species within

each zone. Depression marshes within xeric communities such as sandhill or scrub may have outer borders dominated by bluestem grasses, such as *Andropogon brachystachyus*, *A. glomeratus*, or *A. virginicus* var. *glauca*, or tall herbs such as falsefennel (*Eupatorium leptophyllum*). Where stands of these species are sparse, small rosette plants, such as witchgrass (*Dichanthelium* spp.), Small's bogbutton (*Lachnocaulon minus*), and yellow hatpins (*Syngonanthus flavidulus*), may occupy the spaces between them.

Depression marshes form the characteristic pockmarked landscape seen on aerial photographs of the flat landscapes of the Florida peninsula. They form when the overlying sands slump into depressions dissolved in underlying limestone. These marshes also frequently form an outer rim around swamp communities such as dome swamps. Depression marshes often burn with the surrounding landscape and are seasonally inundated. The deepest zones (dominated by pickerelweed, bulltongue arrowhead or sawgrass) may have a peat substrate and a continuous layer of sphagnum moss, while shallower zones (dominated by peelbark St. John's wort) have a sandy substrate. Maidencane may occur on either sand or peat (Winchester et al. 1985). Common soil types include depressional phases of Basinger, Pompano, and Myakka fine sand (Abrahamson et al. 1984).

Characteristic Set of Species: longleaf threeawn, sand cordgrass, peelbark St. John's wort, maidencane, sawgrass, pickerelweed, blue maidencane

Rare Species: Rare plant species found in depression marshes include: Elliott's croton (*Croton elliotii*) in the northern Florida Panhandle; karst pond xyris (*Xyris longisepala*), small-flowered meadowbeauty (*Rhexia parviflora*), panhandle meadowbeauty (*Rhexia salicifolia*), and St. Marks yellow-eyed grass (*Xyris panacea*), all endemic to the Panhandle; pondspice (*Litsea aestivalis*), found on edges of depression marshes in northern and western Florida; Curtiss' sandgrass (*Calamovilfa curtissii*), endemic to the western Panhandle with a disjunct occurrence on Merritt Island in Brevard County; piedmont jointgrass (*Coelorachis tuberculosa*) in northwest and Central Florida, and Edison's ascyrum (*Hypericum edisonianum*) and cutthroat grass (*Panicum abscissum*), both endemic to the southern Lake Wales Ridge and vicinity.

Rare animal species include several amphibians, particularly those that require breeding sites that are free of predatory fishes (Moler and Franz 1987); these include the frosted flatwoods salamander (*Ambystoma cingulatum*), reticulated flatwoods salamander (*A. bishopi*), tiger salamander (*Ambystoma tigrinum*), striped newt (*Notophthalmus perstriatus*), and gopher frog (*Rana capito*). More than a dozen other species of frogs and salamanders also breed regularly in depression marshes, and these constitute an important part of the food supply of wading birds and snakes, including the rare eastern indigo snake (*Drymarchon couperi*) and southern hognose snake (*Heterodon simus*; Moler and Franz 1987). Other rare species using this habitat include the Florida sandhill crane (*Grus canadensis pratensis*) and round-tailed muskrat (*Neofiber alleni*). Wading birds, in addition to feeding in depression marshes, use clumps of willows or other trees in the center for roosting or nesting (NeSmith, pers. comm. 2008).

Range: Depression marshes occur throughout Florida, but are uncommon in the Panhandle and in extreme South Florida where marshes (e.g., glades marsh, marl prairie) become the matrix communities and uplands are the included communities.

Natural Processes: Depression marshes are generally thought to be maintained as herbaceous communities against woody invasion by hydrologic fluctuations or by fire or by both (Kirkman et al. 2000; Casey and Ewel 2006). The frequency of fire in depression marshes is a function of the fire frequency in the surrounding matrix community, as well as the fire-carrying characteristics of the marsh vegetation. The very sparse outer zone of some marshes may act as a natural firebreak. There is little data on natural fire frequency in depression marshes. A lack of fire may lead to an increase in shrubs at the expense of herbaceous species. Peroni and Abrahamson (1986), using 1943 and 1981 aerial photography, documented expansion of bordering shrub communities into two depression marshes at Archbold Biological Station during a period of fire exclusion.

Peelbark St. John's wort is killed by fire but germinates readily from seed (Winchester et al. 1985; LaClaire 1995). It is also killed by prolonged inundation (Winchester et al. 1985). Thus its prominence in any given depression marsh may fluctuate considerably over relatively short time periods, depending on past rainfall history and time since fire. Long-term sampling of permanent transects would be useful to determine how much depression marsh vegetation fluctuates naturally over time. During periodic droughts, upland species, such as slash pine (*Pinus elliottii*) and dogfennel (*Eupatorium capillifolium*), colonize depression marshes, but are killed during subsequent intervals of prolonged high water (Lowe 1986; Abrahamson 1991).

Community Variations: Depression marshes on the southern end of the Lake Wales Ridge are distinguished by having the endemic cutthroat grass and Edison's ascyrum as dominants. Sawgrass tends to dominate depression marshes near the coast or where limestone is near the surface. Some depression marshes found on the Panacea Unit of St. Marks National Wildlife Refuge have floating islands of soil and vegetation in the center, surrounded by open water with water lilies, and grassy zones of emergent vegetation toward the shores. The floating islands are home to the recently described St. Marks yellow-eyed grass (Anderson and Kral 2008).

Associated Communities: Depression marsh is distinguished from wetlands dominated by woody species (shrub bog, dome swamp, basin swamp) by its predominantly herbaceous and concentric zone pattern of vegetation. Depression marsh is distinguished from other herbaceous wetlands (basin marsh, wet prairie, seepage slope) primarily by its occurrence as isolated depressions within fire-maintained matrix communities. It is distinguished from wet prairie, which often borders its upper edges, by its concentric zones of vegetation, and its lack of wiregrass (*Aristida stricta* var. *beyrichiana*). Depression marsh is similar to the upper margins of sandhill upland lakes ("karst ponds") found in Bay and Washington counties; however, the lakes rarely dry completely, and have a unique flora with several endemic species, including the dominant smoothbark St. John's wort (*Hypericum lissophloeus*).

Management Considerations: Fires in surrounding communities should be allowed to burn into depression marshes and extinguish naturally or burn through them. Encroachment of shrubs such as coastalplain willow (*Salix caroliniana*), common buttonbush (*Cephalanthus occidentalis*), groundsel tree (*Baccharis halimifolia*), and wax myrtle (*Myrica cerifera*) are typical signs of lack of fire in depression marshes (Huffman and Blanchard 1991).

Physical disturbance, particularly from hog rooting, livestock, or vehicles (e.g., “mud bogging”) can cause serious damage in many marshes; these activities can destroy native species and churn the soil which is often then colonized by pure stands of Carolina redroot (*Lachnanthes caroliana*) and other weedy species. Such physical disturbances can allow invasive exotic plants to get a foothold, including torpedo grass (*Panicum repens*), Peruvian primrosewillow (*Ludwigia peruviana*), common water hyacinth (*Eichhornia crassipes*), and Brazilian pepper (*Schinus terebinthifolius*).

Drying of the marsh, either through artificial drainage or drawn-down of the water table by wells, perhaps also aided by cattle trampling, can allow pasture grasses to invade depression marshes, especially where the surrounding community has been converted to pasture (Winchester et al. 1985). These include centipede grass (*Eremochloa ophiuroides*), big carpetgrass (*Axonopus furcatus*), bahiagrass (*Paspalum notatum*), and the invasive exotic West Indian marsh grass (*Hymenachne amplexicaulis*).

Exemplary Sites: Munson Sandhills Bike Trail in Apalachicola National Forest (Leon County), Triple N Ranch Wildlife Management Area (Osceola County), Three Lakes Wildlife Management Area (Osceola County), Archbold Biological Station (Highlands County), Fred C. Babcock-Cecil M. Webb Wildlife Management Area (Charlotte County)

Global and State Rank: G4/S4

Crosswalk and Synonyms:

Kuchler	112/Southern Mixed Forest
Davis	13/Grasslands of Prairie Type
SCS	25/Freshwater Marsh and Ponds
Myers and Ewel	Freshwater Marshes - basin or depression marshes
SAF	N/A
FLUCCS	641/Freshwater Marshes 644/Emergent Aquatic Vegetation

Other synonyms: seasonal pond (Abrahamson et al. 1984), temporary pond (LaClaire 1995), flatwoods marsh (Kushlan 1990), isolated ephemeral pond (LaClaire and Franz 1991)

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Goethe State Forest (Levy County)

Photo by Paul Russo



St. Marks National Wildlife Refuge (Panacea Unit; Wakulla County).

Photo by Ann F. Johnson



Appendix B

SAMPLE MONITORING FORM



MONITORING DATA SHEET

HABITAT TYPE :

Station #

Hydrologic data			
Vegetative data	Species Type	Percent Coverage	Hydrological Indicator

Success Criteria

Discussion

Management Recommendations

Wildlife observations

Photos

Received
Electronically

Aug 6, 2020
South District



August 5,
2020



Bond Farm Hydrological Enhancement Impoundment (HEI) Project

Ready to Advertise
Operations & Maintenance Manual and Annual
Cost Estimate

4600003010-WO12R4. Task 3.4



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1 INTRODUCTION

The Bond Farm Hydrological Enhancement Impoundment (HEI, Impoundment) Project located on the 669-acre former Bond Farm property stores up to 4 feet of excess surface water from the Babcock/Webb Wildlife Management Area (WMA) in order to restore seasonal high-water levels and wetland hydroperiods in portions of the Babcock/Webb WMA. The Impoundment utilizes the property's existing discharge south to the headwaters of Powell Creek and Gator Slough Canal via Prairie Pines Preserve. This phase of the Project does not include the southwest discharge to the 15,246-acre Yucca Pens Unit State Wildlife Management Area (WMA).

1.1 Purpose of the Manual

The purpose of this Operations and Maintenance (O&M) Manual is to assist the Florida Fish and Wildlife Conservation Commission (FWC) in carrying out its operations and maintenance responsibilities for the Bond Farm HEI Project. This O&M Manual prescribes operations, maintenance, inspection, and record keeping procedures to obtain the intended purposes of this hydrological restoration project, as outlined in the Drawings, Technical Specifications and Design Report. The manual is to be utilized by FWC personnel for day-to-day use in water management and upkeep for conditions affecting the Project. Further development of the manual involves an iterative process that will continue throughout the life of the facility. As permits are issued, the post-construction permit requirements will be added to the manual. During construction the manual will be updated with specific maintenance requirements for the actual equipment and materials installed on site. Refinements to the operating criteria in the manual will be made as more data, operational experience and information is gained after construction. It is also anticipated that once the manual is completed and the long term operations and maintenance phase is underway, it may be necessary to revise the manual based on operational experience and additional scientific information gained during monitoring and management. The manual will be further modified when the southwest discharge structure for the Project is in-place and brought on-line.

1.2 Project Description

The Project as shown in **Figure 1** is a 538-acre Impoundment capable of storing 2,150 ac-ft of water, 4 feet deep on average, with approximately 8 foot high perimeter berm with a 12 foot wide crest with a 12 foot wide exterior toe road. Excess surface water flows from the Babcock/Webb WMA via a stop log drop box, two sets of 36-inch diameter culverts, and the Babcock/Webb Canal into the Impoundment perimeter seepage canal and to the 12,500 gpm pump station. The Impoundment waters discharge through a fixed crest auxiliary overflow spillway and a manually operated 4 foot wide by 3 foot high slide gate with a discharge box and two 36-inch diameter culverts. The water levels in the approximately 4.5 mile long perimeter seepage canals are controlled by four sets of flashboard risers, each with a pair of 48-inch diameter culverts. A 5,000 gpm stormwater lift station with a stop log drop box on the inlet pipe to the wet well and a back-up pump with a generator, provides existing drainage service for adjacent properties to the north.

1.3 Project Goals and Objectives

The restoration success for this phase of the Bond Farm HEI Project results from reduced seasonal high water levels and shortened hydroperiods in the south and southwest areas of Babcock/Webb WMA. Peak seasonal high water level target reductions range from 0.1 ft to 1.0 ft. The shortened/more historic hydroperiods are the direct benefit of the Bond Farm HEI operation and target goal. The reduced water levels, approximating natural levels, allow vegetative communities to transition and revert to historic (natural) conditions.

1.4 Project Location

The Project is south of Punta Gorda, Florida. From US 41 (Tamiami Trail) turn east onto Oil Well Road (part paved road, part dirt road) for approximately 3.5 miles to the intersection of Oil Well Road and Jack Road to the north and SAL Grade Road (dirt road) to the south. Turn south onto SAL Grade Road for approximately 1,400 feet to the entrance gate for the Project. The property is located in Sections 22, 27, and 34 of Township 42 South and Range 24 East in Charlotte County, Florida. The approximate central coordinates are 26° 47' 38.93" north latitude and 81° 53' 50.68" west longitude.

1.5 Project Components Summary

The Impoundment as shown in **Figure 1** includes a Perimeter Berm that is approximately 4.5 miles long and 8 foot high from an average existing ground surface at elevation (EL) 24.0 feet (ft) NAVD88. The top of the Perimeter Berm at EL 32.0 ft NAVD88 has a 12 foot wide crest width with 3:1 (Horizontal:Vertical) slopes with a 12 foot wide exterior Perimeter Berm Road at EL 27.0 ft NAVD88. Excess surface water flows from Babcock/Webb WMA are collected in the Babcock/Webb Canal along the boundary between the Bond Farm property and the Babcock/Webb WMA. The Babcock/Webb Canal provides water to the Bond Farm HEI Pump Station via the North Seepage Canal. Water from three pumps controlled with automatic float switches discharge into the Impoundment for a maximum water level elevation of 28.0 ft NAVD88. The East Seepage Canal intersects with the North Seepage Canal via a flashboard riser crossing at the south end of the North Seepage Canal. The West Seepage Canal connects to the North Seepage Canal at the entrance to the site at the Seaboard Air Line Railway (SAL) Grade Road.

The SAL Grade Road Pump Station pumps existing drainage flows from approximately 80 acres of privately owned properties to the north into the North Seepage Canal to provide these properties with the same level of existing drainage service currently provided by the Bond Farm property. The North, West, and East Seepage Canals continuously surround the Perimeter Berm with the West and East seepage canals discharging into the existing Sandy Hartman's Canal (SHC). A fixed crest auxiliary overflow spillway set at EL 28.0 ft NAVD88 allows Impoundment water to discharge into the SHC. A manually operated gate with invert EL 23.0 ft NAVD88 allows controlled discharges from the HEI to the SHC. The current outflow direction of the SHC south under Interstate 75 (I-75) to the headwaters of Powell Creek and Gator Slough Canal via Prairie Pines Preserve is unchanged by the Project. **Table 1** provides a list of Project features.

1.6 Project Flowpath

The flowpath through the Project is shown in **Figure 2**. The primary water source enters the Project site from the Babcock/Webb WMA on the east side of the Project through the Babcock/Webb Stop Log Structure, Canal and Intake Structure into the North Seepage Canal. A minimal secondary water source from the SAL Grade Road East Ditch is pumped from the SAL Grade Road East Ditch Intake Stop Log Structure into the North Seepage Canal by means of the SAL Grade Road Pump Station, operated with automatic float switches. If the Bond Farm HEI Pump Station is operating, based on automatic float switches, the water from the North Seepage Canal is pumped into the Impoundment Interior. If the Impoundment is full, which means the pumps are not operating, then water collects in the North Seepage Canal until it overtops the North and East Seepage Canals Flashboard Riser into the East Seepage Canal or overtops the North and West Seepage Canals Flashboard Riser into the West Seepage Canal. This way the water bypasses the Impoundment when the Impoundment is full (EL 28.0 ft NAVD88) and the Bond Farm HEI Pump Station is not operating. Then, water in the East and West Seepage Canals overtops the East Seepage Canal Flashboard Riser and the West Seepage Canal Flashboard Riser, respectively, and discharges into the SHC and eventually into the Prairie Pines Preserve. Staff gauges and piezometers (**Figure 3**) are installed around the site to monitor both surface and groundwater levels.

Project features are described in more detail in the following sections. Each feature is discussed in the order starting in the northwest corner of the Project and proceeding clockwise.

2 PROJECT FEATURES

2.1 SAL Grade Road East Ditch Intake Structure

The SAL Grade Road East Ditch Intake Structure is drop box inlet with stop logs that provides the inlet flow from the East Ditch to the SAL Grade Road Pump Station in order to provide the same level of drainage service for the approximately 80 acres to the north. The stop log on the Intake Structure is set at EL 24.5 ft NAVD88 to replicate the pre-construction bottom elevation of the East Ditch on the Bond Farm property. The stop logs can be adjusted from EL 24.0 ft NAVD88 to 26.5 ft NAVD88 during operations as needed but is not anticipated since the boards are to be set to provide the same level of existing drainage service.

SAL Grade Road East Ditch Intake Structure

- Purpose – Provides inflows to the SAL Grade Road Pump Station
- Inlet – Concrete drop box with stop logs and grate on top
- Number of Drop Box/Stop Log Structures – 1
- Number of Logs – 5 Logs
- Material – Treated wood
- Log Invert – EL 24.5 ft NAVD88 to approximate the existing ditch bottom elevation on the pre-construction Bond Farm property
- Log Lowest Elevation – EL 24.0 ft NAVD88 (no logs installed)
- Log Highest Elevation – EL 26.5 ft NAVD88 (5 boards installed)

2.2 SAL Grade Road Pump Station

The purpose of the SAL Grade Road Pump Station is to provide the same pre-project level of existing drainage service to approximately 80 acres of properties to the north that currently discharge into the SAL Grade Road East Ditch. The pump station is located at the end of the East Ditch at the northwest corner of the Project. The pump station configuration is a culvert from the SAL Grade Road East Ditch Intake Structure to a wet well with two pumps (one primary and one backup, each 5,000 gpm) discharging through a culvert to the North Seepage Canal. The pump station is a low head electric duplex pump system with a standby diesel generator. The stop log on the Intake Structure is set at EL 24.5 ft NAVD88 to replicate the existing level of drainage service and discharges through the culvert into the pump station wet well. An automated float switch located in the wet well has an initial setting of “pump on” at EL 22.6 ft NAVD88 and “pump off” at EL 11.5 ft NAVD88. The float switch triggers can be adjusted during operations as needed, however the “pump off” elevation shall not be lower than EL 11.5 for submergence requirements. Staff gauges are installed in the East Ditch (SG-1) and the North Seepage Canal (SG-2). A piezometer (P-1) is located near the pump station adjacent to the Maintenance Road. It is not unusual for the 80 acres of properties to the north to have standing water; this pump station is not intended to prevent the properties from flooding.

SAL Grade Road Pump Station

- Purpose – Provide existing level of drainage service, not flood protection
- Pump Type – Electric duplex pump system
- Number of Pumps – 1 duplex system (duplex system includes two pumps, a primary pump and a backup pump)
- Pump Capacity – 5,000 gpm
- Total Dynamic Head – 24 ft
- Pump Manufacturer – MWI Pumps
- Horsepower – 50 hp
- Power Type – 3-phase electric
- Generator Type – Diesel
- Generator Manufacturer – Kohler
- Diesel Fuel Tank Size – 550 gallons, tank permit not required
- Generator Operating Time – 24 hours continuously with full fuel tank
- Automatic Float Switch Pump On - EL 22.6 ft NAVD88
- Automatic Float Switch Pump Off - EL 11.5 ft NAVD88
- Flap Gate on Discharge Pipe - Yes

2.3 North and West Seepage Canals Culvert

The North and West Seepage Canals Culvert connects the North Seepage Canal and the West Seepage Canal. The culvert routes under the new SAL Grade Road at the entrance to the Project in the northwest corner. Based on the hydraulic analysis the culvert flow for the design storm event is 52.53 cfs. The invert of the culvert is EL 18.0 ft NAVD88. Staff gauges are installed in the North Seepage Canal (SG-2) and the West Seepage Canal (SG-12).

North and West Seepage Canals Culvert

- Purpose – Connect North Seepage Canal and West Seepage Canal
- Number of Culverts – 2
- Culvert Diameter – 48 in
- Culvert Length – 171 ft
- Culvert Design Storm Event Max Flow – 52.53 cfs
- Culvert Design Storm Event Max Velocity – 2.09 fps
- Culvert Invert – EL 18.0 ft NAVD88
- Culvert Slope – 0.6%
- Culvert Flow Direction – Either direction
- Culvert Material – Corrugated Aluminum Pipe (CAP)
- Culvert North End – Flashboard riser
- Culvert South End – Open pipe, submerged

2.4 North and West Seepage Canals Flashboard Riser

The North and West Seepage Canals Flashboard Riser is installed on the north side of the North and West Seepage Canals Culvert in the North Seepage Canal. The primary purpose of this flashboard riser is to stage up water in the North Seepage Canal for the inflow to the Bond Farm HEI Pump Station. Access to the top of the riser is by means of a metal platform. The initial top board setting is EL 26.0 ft NAVD88 for promoting water to stage in the North Seepage Canal for the initial fill of the Impoundment during the beginning of the wet season. The riser is a dual channel design using two columns of boards to restrict the flow through the culvert. Each pressure treated board is 3 ½ ft long and 6 inches tall. The same size board is used for all four of the flashboard risers for the Project. The flashboard riser flow for the design storm event is 52.53 cfs. Once the impoundment is full and the water levels in the West Seepage Canal increase due to seepage from the impoundment, boards can be removed from the flashboard riser to allow the Bond Farm HEI Pump Station to capture the seepage flows.

North and West Seepage Canals Flashboard Riser

- Purpose – Stage water in the North Seepage Canal
- Number of Risers – 2
- Riser Material - CAP
- Number of Boards – 8 per riser, 16 boards total
- Board Material – Treated Wood
- Riser Lowest Elevation – EL 22.0 ft NAVD88 (no boards installed)
- Riser Highest Elevation – EL 26.0 ft NAVD88 (16 boards installed)
- Riser Design Storm Event Max Flow – 52.53 cfs
- Riser Design Storm Event Max Velocity – 4.38 fps

2.5 North Seepage Canal

The North Seepage Canal is approximately 3,600 ft long from the northwest corner of the Project to the North and East Seepage Canals Flashboard Riser on the east side of the Project. The North Seepage Canal receives water from the SAL Grade Road Pump Station, from the Babcock/Webb Intake Structure and from seepage from the Impoundment. The North Seepage Canal provides water to the inflow of the Bond Farm HEI Pump Station located in the northeast corner of the Project site. The canal top width is constant at 113 ft except at the forebay to the Bond Farm HEI Pump Station in the northeast corner of the site where the canal top width is slightly wider. The canal bottom elevation varies with the top elevation of the limestone layer from EL 10.0 ft NAVD88 to EL 19.0 ft NAVD88. The slopes of the seepage canal are protected with sod.

North Seepage Canal

- Purpose – Provide water to Bond Farm HEI Pump Station; collect Impoundment seepage
- Canal Length – 3,600 ft
- Canal Design Storm Event Max Flow – 73.7 cfs
- Canal Design Storm Event Max Velocity – 0.08 fps
- Canal Slope Protection – Sod
- Canal Slope Adjacent Boundary Maintenance Road – 3:1
- Canal Slope Adjacent Perimeter Berm – 3:1 below EL 22.0 ft NAVD88, 4.5:1 above EL 22.0 ft NAVD88
- Canal Bottom – EL 10.0 ft NAVD88 to EL 19.0 ft NAVD88, varies to match top of limestone

2.6 Bond Farm HEI Pump Station

The purpose of the Bond Farm HEI Pump Station is to provide water from the Babcock/Webb WMA via the North Seepage Canal to the Impoundment. The Bond Farm HEI Pump Station has three pumps in total with a combined capacity of 12,500 gpm (27.85 cfs); two 5,000 gpm pumps and one 2,500 gpm pump. The pumps are 3-phase electric line-shaft belt-drive pumps. The pump heads are submerged in the North Seepage Canal at EL 19.5 ft NAVD88. The discharge pipe for each pump is routed overtop of the typical prism of the Perimeter Berm with the discharge pipe invert at EL 32.0 ft NAVD88. A concrete headwall supports the end of the discharge pipes with a concrete apron and riprap protecting the Perimeter Berm interior slope from erosion during discharge. There is no redundant pump capacity or generator.

The pump station will operate based on automated float switches located in the North Seepage Canal and in the Impoundment. Since typical ground surface is at EL 24.0 ft NAVD88, the float switch in the North Seepage Canal for the smallest pump, which will operate first, will trigger the “pump on” at EL 25.0 ft NAVD88 and “pump off” at EL 24.5 ft NAVD88. The float switch for the first 5,000 gpm pump will trigger “pump on” at EL 25.5 ft NAVD88 and “pump off” at EL 25.0 ft NAVD88. The float switch for the second 5,000 gpm pump will trigger “pump on” at EL 26.0 ft NAVD88 and “pump off” at EL 25.5 ft NAVD88. Another float switch within Impoundment will turn all pumps off when the Impoundment is full at EL 28.0 ft NAVD88. Staff gauges are installed in the North Seepage Canal (SG-3) and the Impoundment (SG-4) to monitor water levels. A piezometer (P-2) is located near the pump station adjacent to the Maintenance Road.

Bond Farm HEI Pump Station

- Purpose – Provide water to the Bond Farm Hydrological Enhancement Impoundment
- Pump Type – Electric line-shaft belt-drive
- Number of Pumps – 3
- Pump Capacity – One 2,500 gpm and two 5,000 gpm, total of 12,500 gpm
- Pump Lift – 12.5 ft total, from EL 19.5 ft NAVD88 to EL 32.0 ft NAVD88
- Total Dynamic Head, Pump 1 – 12 ft
- Total Dynamic Head, Pump 2 – 11 ft
- Total Dynamic Head, Pump 2 – 10.5 ft
- Pump Manufacturer – MWI
- Horsepower, Pump 1 – 15 hp
- Horsepower, Pump 2 and 3 - 30 hp each
- Power Type – 3-phase electric
- Automatic Float Switch Pump On, 2,500 gpm, Pump 1 – EL 25.0 ft NAVD88
- Automatic Float Switch Pump Off, 2,500 gpm, Pump 1 – EL 24.5 ft NAVD88
- Automatic Float Switch Pump On, 5,000 gpm, Pump 2 – EL 25.5 ft NAVD88
- Automatic Float Switch Pump Off, 5,000 gpm, Pump 2 – EL 25.0 ft NAVD88
- Automatic Float Switch Pump On, 5,000 gpm, Pump 3 – EL 26.0 ft NAVD88
- Automatic Float Switch Pump Off, 5,000 gpm, Pump 3 – EL 25.5 ft NAVD88
- Discharge Pipe Material - Steel
- Discharge Pipe Invert – EL 32.0 ft NAVD88
- Flap Gate on Discharge Pipes – Yes

2.7 Babcock/Webb Stop Log Structure

The Babcock/Webb Stop Log Structure crosses under an existing dirt road from Oil Well Road Extension on the Babcock/Webb WMA running parallel to the eastern Bond Farm property boundary. This feature is the primary collection point of excess surface water flows from Babcock/Webb WMA. The eastern side of the culvert is equipped with a concrete drop box for flow overtop with the top elevation adjustable with stop logs in order to only capture excess surface water and to not adversely impact existing wetland areas on Babcock/Webb WMA. Access to the top of the stop logs is from the top of the concrete box. Since the average existing ground elevation is 24.0 ft NAVD88, the stop logs will initially be set at EL 25.0 ft NAVD88. The maximum total overflow rate is approximately 100 cfs depending on the head conditions and how much water is on Babcock/Webb WMA. The height of the stop logs can be lowered if insufficient water is flowing over top of the logs or raised if the wetlands on Babcock/Webb WMA appear to be stressed and require more water. A staff gauge (SG-5) is located at the Project inlet in Babcock/Webb WMA.

Babcock/Webb Stop Log Structure

- Purpose – Allow water to flow from Babcock/Webb WMA to the Project
- Number of Culverts – 2
- Culvert Diameter – 36 in
- Culvert Length – 108 ft

- Culvert Capacity – approximately 100 cfs total depending on water levels on Babcock/Webb WMA
- Culvert Flow Direction – To the west toward Babcock/Webb Canal
- Culvert Invert – EL 19.6 ft NAVD88, at Inlet Box
- Culvert Material – Corrugated high-density polyethylene (HDPE)
- Culvert East End – Concrete drop box with stop logs and grate on top
- Culvert West End – Mitered end section with grate
- Number of Drop Box/Stop Log Structures – 2
- Number of Logs – 10 Logs
- Material – Treated wood
- Log Lowest Elevation – EL 23.5 ft NAVD88 (no logs installed)
- Log Highest Elevation – EL 26.0 ft NAVD88 (10 boards installed)

2.8 Babcock/Webb Intake Structure

The Babcock/Webb Intake Structure connects the Babcock/Webb Canal to the North Seepage Canal in order to provide flow from the Babcock/Webb WMA to the Bond Farm HEI Pump Station. The structure consists of two 36-inch diameter culverts for a minimum total capacity of approximately 100 cfs with an upstream invert at EL 19.5 ft NAVD88. The culverts slope towards the North Seepage Canal. A staff gauge (SG-6) is located in the North Seepage Canal downstream of the Intake Structure.

Babcock/Webb Intake Structure

- Purpose – Provide flow from Babcock/Webb Canal to North Seepage Canal
- Number of Culverts – 2
- Culvert Diameter – 36 in
- Culvert Length – 80 ft
- Culvert Capacity – approximately 100 cfs total depending on water levels
- Culvert Slope – 1.9% towards the west
- Culvert Invert – EL 19.5 ft NAVD88
- Culvert Material – Corrugated HDPE Pipe
- Culvert East End – Mitered end section with grate
- Culvert West End – Mitered end section with grate

2.9 Babcock/Webb Canal

The Babcock/Webb Canal is approximately 2,400 feet long with bottom EL 20.0 ft NAVD88. In addition to infiltrated sheetflow, water also enters the Canal from the Babcock/Webb Stop Log Structure and discharges into the Project through the Babcock/Webb Intake Structure. For maintenance, the east side of the Canal will be accessed from an existing road off of the Oil Well Road Extension within Babcock/Webb WMA. The west side of the Canal can be accessed from the Boundary Maintenance Road.

Babcock/Webb Canal

- Purpose – Provide water to Babcock/Webb Intake Structure
- Canal Length – 2,400 ft

- Canal Slope Protection – Sod
- Canal Slope – 3:1
- Canal Bottom – EL 20.0 ft NAVD88

2.10 North and East Seepage Canals Flashboard Riser

The North and East Seepage Canals Flashboard Riser is a culvert crossing that connects the North Seepage Canal to the East Seepage Canal. The crossing is located just south of the inflow from the Babcock/Webb Intake Structure in the North Seepage Canal. The crossing allows for access from the Toe Road across the seepage canals to the area between the seepage canals and the Babcock/Webb Canal which can be accessed from the existing Oil Well Road Extension on Babcock/Webb. The North and East Seepage Canals Flashboard Riser allows water from the Babcock/Webb Intake Structure in the North Seepage Canal to stage up in the North Seepage Canal for the inflow to the Bond Farm HEI Pump Station. The flashboard allows water to overtop the boards during a storm event to discharge through the East Seepage Canal and out to the SHC. Access to the top of the riser is by means of a metal platform. The top board is initially at EL 26.0 ft NAVD88 for promoting water to stage in the North Seepage Canal for the initial fill of the Impoundment during the beginning of the wet season. The riser is a dual channel design using two columns of boards to restrict the flow through the culvert. Each pressure treated board is 3 ½ ft long and 6 inches tall. The same size board is used for all four of the flashboard risers for the Project. The culvert and flashboard riser flow for the design storm event is 55.31 cfs. Once the impoundment is full and the water levels in the East Seepage Canal increase due to seepage from the Impoundment, boards can be removed from the flashboard riser to allow the Bond Farm HEI Pump Station to capture the seepage flows. Conversely, the North and East Seepage Canals Flashboard Riser can be adjusted to allow more water to bypass the Impoundment and flow south. Staff gauges are installed in the North Seepage Canal (SG-6) and the East Seepage Canal (SG-7).

North and East Seepage Canals Flashboard Riser

- Purpose – Stage water in the North Seepage Canal
- Number of Culverts – 2
- Culvert Diameter – 48 in
- Culvert Length – 54 ft
- Culvert Design Storm Event Max Flow – 55.31 cfs
- Culvert Design Storm Event Max Velocity – 2.2 fps
- Culvert Flow Direction – Either direction
- Culvert Invert – EL 18.0 ft NAVD88 upstream, 17.0 ft NAVD88 downstream
- Culvert Material – CAP
- Culvert North End – Flashboard Riser
- Culvert South End – Open pipe, submerged
- Number of Risers – 2
- Riser Material - CAP
- Number of Boards – 8 per riser, 16 boards total
- Board Material – Treated Wood
- Riser Lowest Elevation – EL 22.0 ft NAVD88 (no boards installed)

- Riser Highest Elevation – EL 26.0 ft NAVD88 (16 boards installed)
- Riser Design Storm Event Max Flow – 55.31 cfs
- Riser Design Storm Event Max Velocity – 4.61 fps

2.11 East Seepage Canal

The East Seepage Canal is approximately 8,900 ft long from the North and East Seepage Canals Flashboard Riser on the east side of the Project towards the north to the SHC near the southeast corner of the Project. The East Seepage Canal receives water from the North Seepage Canal via the North and East Seepage Canals Flashboard Riser and from seepage from the Impoundment. The canal also provides a bypass for the Project to allow excess water not required by the Bond Farm HEI Pump Station and from storm events to bypass the Impoundment and discharge into the SHC. The canal top width is constant at 113 ft. The East Seepage Canal Flashboard Riser is located within the southern end of the canal about 200 feet from where the canal discharges into the SHC. The canal bottom elevation varies with the top elevation of the limestone layer from EL 12.0 ft NAVD88 to EL 17.0 ft NAVD88. The slopes of the seepage canal are protected with sod.

East Seepage Canal

- Purpose – Collect Impoundment seepage; Provide bypass around Impoundment
- Canal Length – 8,900 ft
- Canal Design Storm Event Max Flow – 72.55 cfs
- Canal Design Storm Event Max Velocity – 0.09 fps
- Canal Slope Protection – Sod
- Canal Slope Adjacent Boundary Maintenance Road – 3:1
- Canal Slope Adjacent Perimeter Berm – 3:1 below EL 22.0 ft NAVD88, 4.5:1 above EL 22.0 ft NAVD88
- Canal Bottom – EL 12.0 ft NAVD88 to EL 17.0 ft NAVD88, varies to match top of limestone

2.12 East Seepage Canal Flashboard Riser

At the crossing of the Boundary Maintenance Road of the East Seepage Canal to the ramp up to the Toe Road, the East Seepage Canal Flashboard Riser is located approximately 200 feet upstream of the East Seepage Canal discharge into the SHC. The East Seepage Canal Flashboard Riser allows seepage water from the Impoundment to stage up in the East Seepage Canal and flow north to the Bond Farm HEI Pump Station when the flashboard risers at the North and East Seepage Canals Flashboard Riser are lowered. Access to the top of the riser is by means of a metal platform. Initially the top board is at EL 24.0 ft NAVD88. The riser is a dual channel design using two columns of boards to restrict the flow through the culvert. Each pressure treated board is 3 ½ ft long and 6 inches tall. The same size board is used for all four of the flashboard risers for the Project. The culvert and flashboard riser flow for the design storm event is 70.1 cfs. If the water level in the SHC is above EL 24.0 ft NAVD88 it will overflow the top board into the East Seepage Canal. If there is a storm event water will overflow from the East Seepage Canal into the SHC. If towards the end of the wet season and the beginning of the dry but before the Primary Discharge Structure gate is opened to empty the Impoundment, there is a potential for more seepage water from the Impoundment being lost downstream than

desired. In that case, the East Seepage Canal Flashboard Riser elevation can be raised to stage up water in the East Seepage Canal and eventually the North Seepage Canal for the Bond Farm HEI Pump Station to return the seepage waters to the Impoundment. A staff gauges is installed in the East Seepage Canal (SG-8) upstream of the flashboard riser. A piezometer (P-3) is located adjacent to the Maintenance Road in the southeast corner of the Project.

East Seepage Canal Flashboard Riser

- Purpose – Retain Impoundment seepage as desired
- Number of Culverts – 2
- Culvert Diameter – 48 in
- Culvert Length – 60 ft
- Culvert Design Storm Event Max Flow – 70.1 cfs
- Culvert Design Storm Event Max Velocity – 2.79 fps
- Culvert Flow Direction – South
- Culvert Invert – 18.0 ft NAVD88 upstream, 17.0 ft NAVD88 downstream
- Culvert Material – CAP
- Culvert North End – Flashboard Riser
- Culvert South End – Opened pipe, submerged
- Number of Risers – 2
- Riser Material - CASP
- Number of Boards – 8 per riser, 16 boards total
- Board Material – Treated Wood
- Riser Lowest Elevation – EL 22.0 ft NAVD88 (no boards installed)
- Riser Highest Elevation – EL 26.0 ft NAVD88 (16 boards installed)
- Riser Design Storm Event Max Flow – 70.1 cfs
- Riser Design Storm Event Max Velocity – 3.73 fps

2.13 Sandy Hartman’s Canal

The SHC is a manmade canal constructed in the right of way when I-75 was initially constructed. The typical section of the SHC has a 50 foot bottom width with 2:1 side slopes. The canal is a sump with the bottom elevation set at EL 11.9 ft NAVD88 while the upstream and downstream end of the canal limits are at approximately EL 21.9 ft NAVD88. The SHC serves as the discharge basin for the East Seepage Canal, the Auxiliary Overflow Spillway, the Primary Discharge Structure and the West Seepage Canal. The SHC as a flow capacity of 1,000 cfs. The canal is approximately 1,300 feet long starting at the discharge from the West Seepage Canal passing under two I-75 bridges and ending essentially at the southern right-of-way for I-75. The total flow during the design storm event is 340 cfs. A staff gauge (SG-10) is located in the SHC near the discharge of the Primary Discharge Structure.

Sandy Hartman’s Canal

- Purpose – Discharge basin/canal for Project
- Canal Length – 1,300 ft
- Canal Capacity – 1,000 cfs

- Canal Slope Protection – Sod, riprap at Project features discharges down to the existing native limestone
- Canal Slope – 2:1
- Canal Bottom – EL 11.9 ft NAVD88

2.14 Auxiliary Overflow Spillway

In order to allow the Impoundment to automatically discharge flows during a storm event, a fixed crest Auxiliary Overflow Spillway is located within the Perimeter Berm adjacent to the SHC. The fixed crest of articulated concrete block mattress (ACBM) at EL 28.0 ft NAVD88 provides both protection of and access across the top of the Perimeter Berm. Turnaround areas are provided on both sides of the spillway for when water is flowing over the spillway and it is not suitable for vehicles to cross over the crest. The spillway is 100 feet long by 36 feet wide at the overflow elevation with 40 foot long ramps on each side transitioning back to the top of the Perimeter Berm at 12 feet wide.

Auxiliary Overflow Spillway

- Purpose – Uncontrolled storm releases from Impoundment
- Crest Elevation – 28.0 ft NAVD88
- Crest Width – 36 ft
- Crest Length – 100 ft
- Location – Perimeter Berm centerline
- Material - ACBM

2.15 Primary Discharge Structure

The Primary Discharge Structure is a single manually operated gate discharge for the Impoundment. It consists of a depressed inflow basin with bottom EL 20 ft NAVD88 in front of two 36 inch diameter sloped culverts with one sluice gate covering the opening of both culverts. The HDPE culverts are routed under the Impoundment prism with invert varying from 21.0 ft NAVD88 to 20.0 ft NAVD88. As the gate is raised flow will discharge by head from the Impoundment equally through both culverts and discharge in the SHC. The gate opening discharge flow curve is provided in **Figure 4**. The maximum flow rate of the gate is 109.9 cfs which would empty the Impoundment in approximately 18 days with a continuous discharge. The number of days to drain based on the gate opening is provided in **Figure 5**.

Although the SHC may have elevations higher than the average Impoundment bottom EL 24.0 ft NAVD88 in the wet season, SHC levels typically drop below ground level in the dry season, the same as the upstream Bond Farm property, which will allow the Impoundment to discharge by head during the early part of the dry season. If the waters in the seepage canals drop below EL 23.5 ft NAVD88 with the Impoundment full at elevation 28.0 ft NAVD88, the Primary Discharge Structure gate is required to be opened to lower the water in the Impoundment and operate in the blue area of the curve provided in **Figure 6**. The anticipated operations are to partially open the gate to release water slowly to the south during the initial part of the dry season when the levels in the SHC are decreasing and when there is no excess sheetflow from Babcock/Webb WMA to be captured by the Impoundment. The goal is to have the Impoundment emptied prior

to the next season's start of excess sheetflow from Babcock/Webb WMA. The location of the Primary Discharge Structure provides access to the electrical conduits buried for future use within the Perimeter Berm for potential future installation of lights and automation of the gate. A staff gauge (SG-9) is located upstream of the gate in the Impoundment.

Primary Discharge Structure

- Purpose – Controlled release of flows from Impoundment
- Number of Gates – 1
- Gate Size – 4 ft wide and 3 ft tall
- Gate Operation – Manual, open from bottom, mounted on face of concrete box
- Number of Culverts – 2
- Culvert Diameter – 36 in
- Culvert Length – 172 ft
- Culvert Capacity with Impoundment Full – 134.58 cfs total
- Culvert Velocity with Impoundment Full – 9.52 fps
- Culvert Flow Direction – South
- Culvert Invert – 21.0 ft NAVD88 upstream, 20.0 ft NAVD88 downstream
- Culvert Material – HDPE
- Culvert North End – Gate with riprap lined inflow basin at EL 23.0 ft NAVD88
- Culvert South End – Open pipe, submerged

2.16 West Seepage Canal Flashboard Riser

At the crossing of the Boundary Maintenance Road of the West Seepage Canal to the ramp up to the Toe Road, the West Seepage Canal Flashboard Riser is located on the north side of the crossing and discharge through culverts into the SHC. The West Seepage Canal Flashboard Riser allows seepage water from the Impoundment to stage up in the West Seepage Canal and flow north to the Bond Farm HEI Pump Station when the flashboard risers at the North and West Seepage Canals Flashboard Riser are lowered. Access to the top of the riser is by means of a metal platform. Initially the top board is set at EL 24.0 ft NAVD88. The riser is a dual channel design using two columns of boards to restrict the flow through the culvert. Each pressure treated board is 3 ½ ft long and 6 inches tall. The same size board is used for all four of the flashboard risers for the Project. The culvert and flashboard riser flow for the design storm event is 69.1 cfs. If the water level in the SHC is above this EL 24.0 ft NAVD88 it will overflow the top board into the West Seepage Canal. If there is a storm event water will overflow from the West Seepage Canal into the SHC. If towards the end of the wet season and the beginning of the dry but before the Primary Discharge Structure is opened to empty the Impoundment, there is a potential for more seepage water from the Impoundment being lost downstream than desired. In that case, the West Seepage Canal Flashboard Riser elevation can be raised to stage up water in the West Seepage Canal and eventually the North Seepage Canal for the Bond Farm HEI Pump Station to return the seepage waters to the Impoundment. A staff gauge (SG-11) is installed upstream of the flashboard riser in the West Seepage Canal.

West Seepage Canal Flashboard Riser

- Purpose – Retain Impoundment seepage as desired
- Number of Culverts – 2
- Culvert Diameter – 48 in
- Culvert Length – 161 ft
- Culvert Design Storm Event Max Flow – 69.1 cfs
- Culvert Design Storm Event Max Velocity – 2.75 fps
- Culvert Flow Direction – Southeast
- Culvert Invert – 18.0 ft NAVD88 upstream, 17.0 ft NAVD88 downstream
- Culvert Material – CAP
- Culvert North End – Flashboard Riser
- Culvert South End – Open pipe, submerged, no grate
- Number of Risers – 2
- Riser Material - CAP
- Number of Boards – 8 per riser, 16 boards total
- Board Material – Treated Wood
- Riser Lowest Elevation – EL 22.0 ft NAVD88 (no boards installed)
- Riser Highest Elevation – EL 26.0 ft NAVD88 (16 boards installed)
- Riser Design Storm Event Max Flow – 69.1 cfs
- Riser Design Storm Event Max Velocity – 3.62 fps

2.17 West Seepage Canal

The West Seepage Canal is approximately 8,250 ft long from the North and West Seepage Canals Culvert at the northwest corner of the Project to the beginning of the SHC near the southeast corner of the Project. The West Seepage Canal receives water from the North Seepage Canal via the North and West Seepage Canals Flashboard Riser and from seepage from the Impoundment. The canal also provides a bypass for the Project to allow excess water not required by the Bond Farm HEI Pump Station and from storm events to bypass the Impoundment and discharge into the SHC. The canal top width is constant at 113 ft. The West Seepage Canal Flashboard Riser is located at the southern end of the canal where the Boundary Maintenance Road crosses to ramp up to the Toe Road. The West Seepage Canal through the West Seepage Canal Flashboard Riser discharges into the SHC. The canal bottom elevation varies with the top elevation of the limestone layer from EL 10.0 ft NAVD88 to EL 18.0 ft NAVD88. The slopes of the seepage canal are protected with sod. A piezometer (P-4) is located adjacent of the Maintenance Road west of the West Seepage Canal in the southwest corner of the Project.

West Seepage Canal

- Purpose – Collect Impoundment seepage, Provide bypass around Impoundment
- Canal Length – 8,250 ft
- Canal Design Storm Event Max Flow – 72.48 cfs
- Canal Design Storm Event Max Velocity – 0.09 fps
- Canal Slope Protection – Sod

- Canal Slope Adjacent Boundary Maintenance Road – 3:1
- Canal Slope Adjacent Perimeter Berm – 3:1 below EL 22.0 ft NAVD88, 4.5:1 above EL 22.0 ft NAVD88
- Canal Bottom – EL 10.0 ft NAVD88 to EL 18.0 ft NAVD88, varies to match top of limestone

3 PROJECT OPERATIONS

The Project is designed as an automatic, flexible facility. For normal operations, the only manual operation is to open the Primary Discharge Structure gate once a year to initiate Impoundment discharge and then to close the gate once a year when the Impoundment is empty. For flexibility, both pump stations have adjustable automatic floats, inflow from the SAL Grade Road East Ditch has an adjustable stop log, all four seepage canals culverts have adjustable flashboard risers, and the Project inflow from Babcock/Webb WMA has an adjustable stop log. All float switches, boards, logs and gate can to changed and operated by one person without any special tooling or equipment.

Crucial operational and maintenance items to be performed by FWC staff are listed throughout the document and summarized below.

- Open the Primary Discharge Structure gate within 48 hours after receipt of alarm notification of an unacceptable differential head condition between the Impoundment and the seepage canals.
 - Inspect affected seepage canal slope adjacent to the Perimeter Berm and repair if necessary.
- Inspect non-operational SAL Grade Road Pump Station pump within 48 hours of alarm notification.
 - If FWC cannot resolve issue with the pump within 48 hours, call the service representative for the pump to be repaired within 48 hours.
- Upon alarm notification of no power at site, fuel level in tank, and SAL Grade Road Pump Station generator is operating,
 - Immediately contact Lee County Electric Cooperative (LCEC) for status on power failure and restoration time.
 - Order a fuel delivery within the next 24 hours.
 - Inspect pump station within 24 hours and address any issues.
- Remove any sediment depths of 12-inches or greater in all of the seepage canals.

3.1 Normal Operations

The normal operations for the Bond Farm HEI Project will be described based on a water year since the Impoundment will be filled and emptied on an annual basis. The months listed below are for a general reference. The actual indicator for operations will be water levels around and within the Project. Staff gauges are installed throughout the Project along with piezometers (**Figure 3**).

3.1.1 Transition from Dry Season to Wet Season

During the middle to end of the dry season (approximately February through May) and for the first initial fill for the Project, the Impoundment is empty. The automatic float switches for the

pump stations, the board elevations for the flashboard risers, the stop log elevations and the Primary Discharge Structure gate shall be set in accordance with **Table 2** and as shown in **Figure 7**. Water elevations on the Babcock/Webb WMA at SG-5 would typically be at or below ground surface EL 24.0 ft NAVD88, the same as most staff gauges on-site including SG-1 in the SAL Grade East Ditch. No adjustments to these settings in **Table 2** are anticipated. If sufficient water would flow into the Project during a storm event, the pump stations would operate automatically based on the float switch settings.

3.1.2 Wet Season

All settings remain the same as provided in **Table 2** and **Figure 7**. As rainfall increases (roughly between May and November) to produce excess sheetflow from Babcock-Webb WMA, water will flow into the Project over the Babcock/Webb Stop Logs, through the Babcock/Webb Road Culverts, into the Babcock/Webb Canal along with water infiltrating into the Canal from the WMA, through the Babcock/Webb Intake Structure, into the North Seepage Canal and to the inflow of the Bond Farm HEI Pump Station to be pumped into the Impoundment. This flowpath is shown on **Figure 8**.

The three electric pumps at the Bond Farm HEI Pump Station operate automatically based on the float switch settings listed in **Table 2**. All pumps shut off when the Impoundment is at EL 28.0 ft NAVD88. **Figure 9** provides the pump curve for Pump 1, the 2,500 gpm pump; **Figure 10** provides the pump curve for Pump 2 (5,000 gpm); **Figure 11** provides the pump curve for Pump 3 (5,000 gpm). As water levels drop in the Impoundment from evaporation and seepage into the seepage canals, the pumps will automatically refill the Impoundment when water is available based on the float switch settings. If the Impoundment is full, any rainfall on the Impoundment will automatically discharge over the Auxiliary Overflow Spillway with a fixed crest at EL 28.0 ft NAVD88. The spillway discharges into the SHC. The Impoundment may not necessarily be filled every year since the ability to fill the Impoundment is based on the amount of excess sheetflow from Babcock/Webb WMA that is available to be pumped into the Impoundment.

There is no generator for back-up power or back-up pumps for the Bond Farm HEI Pump Station. If one or more pumps are not operational, any excess water in the North Seepage Canal that cannot be pumped by the remaining operational pumps will stage up, flow over the North and East Seepage Canals Flashboard Riser to the East Seepage Canal and flow over the North and West Seepage Canals Flashboard Riser through the North and West Seepage Canals Culvert into the West Seepage Canal. If water levels are high enough, the water from the East Seepage Canal will flow over the East Seepage Canal Flashboard Riser to the SHC, essentially bypassing the Project. Similarly for the water in the West Seepage Canal water will flow over the West Seepage Canal Flashboard Riser to the SHC. **Figure 2** shows these flowpaths through the seepage canals around the Impoundment.

If the Bond Farm HEI Pump Station is operating, the four flashboard risers in the seepage canals can be adjusted to retain more water in the seepage canal to allow the Pump Station to capture and return the seepage waters from the Impoundment, particularly towards the end of the wet season/beginning of the dry season when water inflows from Babcock/Webb WMA have

reduced. If a storm event would occur, the excess water in the seepage canals would overflow the flashboard risers and discharge into the SHC and downstream. Water within the Impoundment is either released over the fixed crest Auxiliary Overflow Spillway during storm events or a controlled release through the gated Primary Discharge Structure. Both the Spillway and Discharge Structure discharge into the SHC.

The SAL Grade Road Pump Station turns on automatically based on the float switch setting listed in **Table 2**. The pump curve is provided in **Figure 12**. The SAL Grade Road Pump Station pumps drainage flows from the northern properties and discharges this water into the North Seepage Canal. The operation of the SAL Grade Road Pump Station is independent of the water level in the Impoundment and operates based on the water level in the SAL Grade Road East Ditch. This pump station is a duplex pump station. If a pump is not operational, the second integral pump automatically starts operations and an alarm notification of the pumps status is telephoned to the designated FWC representative(s). If electrical power is not available the generator will automatically start to operate the pump station and an alarm notification of the power status is telephoned to the designated FWC representative(s). A full diesel fuel tank for the generator allows for 24 hours continuous operation of the pump station.

3.1.3 Transition from Wet Season to Dry Season

At the transition from the wet season to the Dry Season (typically October through February), the Impoundment level will be maintained at EL 28.0 ft NAVD88 by the Bond Farm HEI Pump Station. Any excess flows within the Project will either bypass the Impoundment through the seepage canals to the SHC or discharge over the spillway into the SHC. All settings remain the same as provided in **Table 2** and **Figure 7**.

3.1.4 Dry Season

The Impoundment is to initiate discharges through the Primary Discharge Structure manually-operated gate at the start of the dry season (typically December through February). All settings remain the same as in **Table 2** and **Figure 7** except for the Primary Discharge Structure gate. Controlled discharges from the Impoundment can initiate when all of the following conditions have been met:

- No water overtopping the Babcock/Webb Stop Logs and entering the Project
- Water levels in seepage canals below EL 24.5 ft NAVD88
- SHC water level below EL 24.0 ft NAVD88

Figure 13 provides the drawdown curve for the Primary Discharge Structure gate that indicates the changes in the Impoundment water level elevation with time for a full open gate. **Figure 4** provides the discharge flow rate through the Primary Discharge Structure based on different gate openings. **Figure 5** provides the number of days to empty the Impoundment for different gate settings. **Figure 6** provides the allowed operating range for the Impoundment water levels based on the water levels in the seepage canals. The goal is to release all of the water from the Impoundment before transitioning from the dry season into the next wet season. Once all water has been discharged from the Impoundment, the Primary Discharge Structure gate is closed. If any of the above three conditions are no longer valid during the lowering of the Impoundment

water levels the gate is to be closed and re-opened when the three conditions are satisfied. **Table 3** summarizes the requirements for the Primary Discharge Structure gate operations.

Per **Figure 6**, if the water level drops in any of the seepage canals below the curve shown for the corresponding Impoundment water level, the Primary Discharge Structure gate must be opened to reduce the Impoundment water level in order for the facility to be operating in the acceptable operating range as indicated by the curve to insure slope stability of the seepage canals. An automatic alarm notification when surface water elevations decrease below EL 23.5 will be telephoned to the designated FWC representative(s). Since this represents the most conservative operating condition, the FWC representative who will go to the site shall reference the graph in **Figure 6** and determine if the conditions are outside of the acceptable operating range. If they are out of the acceptable operating range, the FWC representative shall open the Primary Discharge Structure gate within 48 hours after receipt of notification along and perform an inspection of the affected seepage canal slope adjacent to the Perimeter Berm.

3.2 Adjustments and Adaptive Management

Table 4 provides several situations that may occur and the actions that FWC may take to modify the operational settings of the Project based on surrounding water level conditions.

Table 2 provides the adjustment range for each feature.

3.3 Storm Conditions

During rainfall events with the Impoundment full at EL 28.0 ft NAVD88, water will discharge over the Auxiliary Overflow Spillway which has a capacity of 400 cfs. There are no requirements to open the Primary Discharge Structure gate before or during a storm event. The settings for the Project features can remain the same as indicated in **Table 2**.

During a significant storm event with the Project features at the setting indicated in **Table 2**, the Maintenance Road and Toe Road only on the north side of the Project may be under water and may not be traversable. Project access can be maintained around the entire site by means of the road on top of the Perimeter Berm which can be accessed from the SAL Grade Road south of Oil Well Road. There is no requirement for the Bond Farm HEI to operate during a storm event. Since the SAL Grade Road Pump Station provides existing level of drainage service to the northern properties it is equipped with a back-up pump and generator for continuous operation.

3.4 Design Storm Event

Based on modeling for the 100-year 72-hour design storm event the amount of discharge from an initially full Impoundment is 270 cfs and from all of the seepage canals is 70 cfs. The peak stage at the three seepage canals for this event was determined to be:

	<u>Peak Stage for Design Storm</u>
• North Seepage Canal	EL 27.53 ft NAVD88
• East Seepage Canal	EL 26.36 ft NAVD88
• West Seepage Canal	EL 26.51 ft NAVD88

The design storm peak stage is above the elevation of the Maintenance Road (EL 26.0 ft NAVD88). The berm between the Maintenance Road and the adjacent properties at the East and West Seepage Canals is at EL 27.0 ft NAVD88 minimum. The berm between the Maintenance Road and the adjacent properties on north side of the Project is at L 28.0 ft NAVD88 minimum.

During the design storm event the water level on the north side of the Project will be over the Boundary Maintenance Road (EL 26.0 ft NAVD88) and the Toe Road (EL 27.0 ft NAVD88). The site can be accessed on the north by the road on top of the Perimeter Berm. The SAL Grade Road will be approximately 0.28 feet higher than the peak design storm stage in the northwest corner of the site.

3.5 Drought Operations

During a drought it would be expected that there would be no excess sheetflow from the Babcock/Webb WMA. The conditions would be such that water would not be flowing into the Project and the Bond Farm HEI Pump Station would not be operating. The settings for the Project features remain the same as indicated in **Table 2**.

3.6 Emergency Conditions

Prior to completion of Project construction, it is recommended to collect data for a more inclusive representation of topography of the areas surrounding the site utilizing existing sources and the results of new specific purpose surveys. This enhanced topography data would allow a more refined analysis of the probable impacts including duration of inundation to the surrounding areas if a breach were to occur. This information would assist the FWC in the creation of a process with preplanned actions and notifications to supplement this manual in case such an incident would occur.

A due diligence evaluation with a simulated breach of the Impoundment adjacent to the Correctional facility was performed. This evaluation indicates that the water from the Impoundment if a breach were to occur would inundate the existing surrounding low lying areas with minimal to no modeled impacts to the roads, buildings and structures of the Correctional facility given the elevation of these facilities. Based on available topography, resulting water levels after the breach did not exceed EL 28.0 ft NAVD88. The available topography does not include the existing culverts under I-75 and other features that would allow the routing of this water away from both the Correctional Facility and I-75 to other low lying, uninhabited areas. It is reasonable to assume no appreciable impacts to I-75 with a road elevation typically at EL 29 ft NAVD88 to EL 30 ft NAVD88.

4 MONITORING

Both surface and ground water levels are to be monitored on Site in addition to environmental monitoring. The staff gauge and piezometer locations for the Project are shown on **Figure 3**.

4.1 Staff Gauges

Staff gauges are located at each pump station, flashboard riser, stop log structure, and Impoundment discharge structure. The staff gauges are utilized by on-site FWC staff to assist in making determinations to adjust float switch settings, to install or remove boards and stop logs, and to open or close the Primary Discharge Structure gate in accordance with the operations listed previously. For the first year of operation, the FWC staff when on-site will record the levels of all staff gauges. This data will be compared to the daily recorded data from the four piezometers to establish a correlation between surface water levels and ground water levels for the site.

4.2 Piezometers

The four piezometers on-site (**Figure 3**) include the use of a pressure transducer installed in each well. The transducer collects long-term level data on a user-specified interval; the collection interval for this site is one level reading per day. The readings are relative to a reference elevation in NAVD88; this reference elevation is to be specified when the wells are installed. The data will be downloaded from each well location in the field every one to two months. Once downloaded the data will be converted to level elevations in NAVD88 based on the reference elevation and utilized in the determination if changes in the Project operational settings (**Table 2**) are warranted and in the modeling for the future design of the Project's southwest discharge.

4.3 Environmental Monitoring Plan

To determine if the Project is meeting its restoration goals for the Babcock/Webb WMA there is an Environmental Monitoring Plan provided in **Appendix A**. This plan utilizes the piezometers on the Bond Farm HEI Project as well as piezometers and a rain gauge on the Babcock/Webb WMA. This plan also has its own data recording, documentation and reporting requirements.

5 INSPECTIONS

This section describes inspections of the impoundment, structures and pump stations. Inspections are to be performed by FWC staff with the objective to

- identify, document, and correct any visual degradations or problems associated with any Project feature
- plan and schedule activities to prevent or predict failures and keep features operating within design specifications

5.1 General Inspection Guidelines

Periodic inspections will reveal trends that can indicate whether more serious problems are developing. Some problems arise suddenly after extreme storm events where high velocity releases can cause problems. Because some mechanical equipment is used very infrequently, regular inspections must be performed to ensure that the equipment is operational when needed. The inspection and maintenance program for the Bond Farm HEI Project is based primarily on visual inspections and manufacturer's recommendations once received during

construction. Due to the seasonal nature of rainfall patterns in south Florida and the seasonal operation of the Impoundment, both wet and dry season inspections should be performed. Visits under different conditions can provide a comprehensive understanding of a feature's physical condition and performance.

Prior to an inspection, the previous inspection reports should be reviewed to determine what type of problems were noted previously for a particular feature. Trends in the behavior and deterioration of specific pieces of equipment can be ascertained by reading through the previous inspection reports. If significant problems are noted during an inspection, an experienced and qualified Engineer may be required to make a special inspection. Special inspections are also recommended after floods, hurricanes, or other unusual events.

Inspectors should take a core set of documentation photographs of components being inspected. In addition, specific problem areas should be photo documented. A recommended set of core photographs include:

- Vehicle access points and roads
- Upstream face and downstream face of Impoundment
- Each pump station inlet and discharge
- Pump station wet well
- Overview of spillway structure in operation
- Discharge gate
- Each flashboard riser and stop log structure

Photos should be repeated as necessary at subsequent inspections to document trends in the condition of the Project features.

Inspection results should be documented to indicate whether or not a particular issue with a Project feature requires no further action, maintenance, monitoring, monitoring at a greater frequency, or if an engineer should be consulted and a special inspection initiated. The issue should be adequately described and photographed.

5.2 Impoundment Inspections

Visual inspections are a key component for monitoring the performance of an embankment or slope. Visual inspections fall into three major categories: 1) Routine, 2) Annual, and 3) Special inspections. All inspections will include general observations of the embankment such as vegetation (areas of thin sod or bare areas, unwanted vegetation in the slope), erosion, any holes or depressed areas, and any miscellaneous observations. A visual inspection of the downstream slope is to be performed, including the Toe Road, ramps, seepage canal slopes and Maintenance Road. In addition to the slope, the inspection of the upstream slope includes the Wave Benches, the toe of the slope when the Impoundment is empty and boat ramps. The crest inspection includes the entire crest road, turnout areas and all travel areas. The area near the pump station where the pipes cross the embankment is inspected for any settlement or erosion.

5.2.1 Routine Inspections

Routine inspections will be performed on a monthly basis for the first year of operation to insure sufficient grow-in of all vegetation. Once vegetation is firmly established the routine inspections should coincide with the quarterly mowing operations so conditions are visible and not covered by vegetation overgrowth.

5.2.2 Annual Inspection

If required by a permit condition, the purpose of the annual inspection is to allow a registered Professional Engineer in Florida who has experience in evaluating facilities of this type to document the physical condition of the impoundment to identify conditions that require routine maintenance, near-term repair, or immediate action.

5.2.3 Special Inspections

Special inspections will be conducted whenever conditions are identified in the routine or annual inspections that require further evaluation.

5.3 Seepage Canals Inspections

Based on the geotechnical report, some sediment build-up should be expected in the seepage canals, particularly when the impoundment is empty with antecedent groundwater levels in the seepage canals. It is recommended for the first year of operations the amount of sediment build-up in the bottom of the seepage canals be measured quarterly with a graduated pole from a boat to determine the typical build-up of sediment in the canal bottom. To determine the depth of sediment, the as-built condition of the canal bottom is required from the Record Drawings along with the water elevation in the seepage canal obtained from the staff gauges. Measure the sediment depth every 500 feet and in areas where water velocities would decrease allowing for sediment to settle out of the water column and not encouraging the sediment to be reintroduced into the water column. After the first year, determine the frequency of inspections based on the previous amount measured and the timing between measurements with the acknowledgement that the sediment depths of 12-inches or greater are required to be removed to minimize the potential for off-site seepage impacts when the impoundment is full.

All canals and features within those canals shall be inspected for debris that could interfere with the operation of the pumps, flashboard, stop logs, gates and grates at the stop log structure. This inspection should occur coincident with the quarterly mowing with special attention that grass clippings can be a major source of debris in the canals and on structures.

Per **Figure 6**, if the water level drops in any of the seepage canals below the curve shown for the corresponding Impoundment water level, the affected seepage canal slope adjacent to the Perimeter Berm shall be inspected when the Primary Discharge Structure gate is opened.

5.4 Concrete Inspections

Concrete is susceptible to cracking, surface defects such as voids or from impact, deterioration from cavitation, erosion evidenced by pitting and missing aggregate, and leaking joints; the Project features' concrete should be inspected for these conditions. Concrete surfaces are recommended to be visually inspected annually. If a major new crack is observed, or one

whose characteristics have changed drastically from the previous inspection, a qualified engineer should make an assessment of the crack as soon as possible.

5.5 Mechanical Inspections

Corrosion (rust, galvanic action) is progressive deterioration resulting from exposure to moisture, acid, and other corrosive agents, or electrolysis, and usually is marked by scaling or flaking, pitting, and color changes. Corrosion should be documented to record the amount, location and progression of corrosion to determine if a repair is required per manufacturer's requirements. Frequency of inspections shall be based on manufacturer's requirements. Pumps, gates, flashboard risers, culverts, grates, fuel tanks and any other feature of a mechanical nature shall be inspected in accordance with manufacturer's requirements.

5.6 Electrical Inspections

All electrical hardware, including grounding and generator, shall be inspected per manufacturer's recommendations. The generator shall be operated for maintenance based on manufacturer's recommendations.

6 MAINTENANCE/REPAIR

Appropriate maintenance schedules, procedures and repairs for all electrical and mechanical equipment shall be based on manufacturers' recommendations provided in the equipment's O&M instruction manuals to be provided in accordance with the technical specifications by the construction contractor.

6.1 Grass Maintenance/Repair

Grass maintenance and repair includes the following:

- Water as necessary to maintain all grass on site; fertilize in accordance with FWC guidelines and permit requirements.
- Replant bare areas; water and fertilize as necessary for establishment.
- Mow the entire site including but not limited to grass roads, canal banks, Impoundment slopes, Wave Benches, and flat areas, approximately four (4) times per year.
- Maintain a grass height no higher than 12 inches.
- Weed and trim as necessary in order to maintain a vegetation height no higher than 12 inches; utilize only appropriate herbicides, insecticides or other chemicals in accordance with FWC guidelines and permit requirements.
- Remove all tress and woody vegetation from all slopes and areas adjacent to slopes.

A satisfactory section of grass that has:

- No bare spots larger than 3 square feet.
- Not more than 5 percent of total area with bare spots larger than 6 inches.
- Not more than 10 percent of total area with bare spots larger than 2 inches square.

Do not mow areas that FWC has designated as wetland areas as part of the environmental monitoring (**Appendix A**).

6.2 Road Maintenance

All shellrock areas are to be inspected based on the amount of traffic and rainfall. It is anticipated these areas would be inspected quarterly and graded as needed. All roads on site shall be maintained in a drivable condition for a maximum speed of 25 miles per hour. The objective of grading the roads is to maintain roads to the proper shape and surface condition to promote rideability, good drainage, and low future maintenance costs. When grading the roads, maintain the crown and drainage. Rock or debris will not be pushed off the roadway.

All equipment must be properly maintained, adjusted and operated in order to achieve a smooth road surface. The grader blades must be well maintained to ensure a smooth grading surface. All grading equipment shall be provided with safety appurtenances. Any equipment left on the roadway unattended shall be parked as far from the waters' edge as possible without blocking the roadway. All equipment will be secured in a manner that will prevent its movement by unauthorized personnel. The grader must meet the following requirements:

- Minimum blade width of 12 feet.
- Minimum horse power of 155 @ 2180 rpm.

Use the proper blade and pitch settings for the grader to prevent loss of aggregate road material. Maintain a safe, effective speed so that the grader does not bounce causing the blade to move up and down and creating a "washboard" surface.

6.3 Seepage Canals Maintenance

As stated previously, any sediment depths of 12-inches or greater in the bottom of the seepage canals is required to be removed. Any damage to the canal slopes during removal shall be repaired. Removed materials shall be placed on top of the existing berm adjacent to the Maintenance Road or in the Impoundment interior when the Impoundment is empty. Placement in the Impoundment interior shall not impact any wetland species. Similarly remove and dispose of any floating vegetation in the canals that has a potential to impact the operations of the Project.

6.4 Stilling Wells and Float Switches

Since the Impoundment will be drained annually, each year prior to the next fill of the Impoundment, the holes in the bottom of the stilling well within the Impoundment are to be cleared of any blockage. These holes allow water inside the stilling well to activate the float switch to turn off the Bond Farm HEI Pump Station pumps when the Impoundment is full.

The stilling wells which house the float switches are located either within the seepage canals or the Impoundment. The stilling wells can be accessed by boat by utilizing the boat ramp in the Impoundment or launching a boat from the 4.5:1 slope on the seepage canal. The stilling wells are mounted to a concrete piles with pole steps for access to the top of the stilling well and the float switches. Climbers shall follow safety guidelines for climbing piles with appropriate harnesses and tie-off to the provided D-rings.

6.5 Bond Farm HEI Pump Station Pump Removal

If any of the pumps are required to be removed from the Bond Farm HEI Pump Station for maintenance, the maximum crane size that is allowed is 50 tons. It is assumed that the crane will be stationed overtop of the three discharge pipes for the Pump Station that are buried within the Perimeter Berm. The crane is not allowed to be any closer to the top of slope than the location of the bollards. The crane outriggers must be placed outside of the 18 ft wide shellrock installed over top of the buried pipes. The contractor will install a placard with this requirements on one of the bollards or on a separate sign adjacent to the bollards. See **Figure 14**.

7 REPORTING

Scheduled reporting will be performed to document observations from the inspections and to evaluate data obtained from monitoring instrumentation. If required by permit, an annual report will be prepared that will summarize the inspection data and discuss any problems or concerns that were addressed over the reporting year and to discuss any current issues that may affect the Project based on the inspections. The report will include a yearly summary and analysis of all site water level data and an evaluation of the Project operations to determine if changes are required for the float switches or board and stop log elevations.

8 O&M ANNUAL COST ESTIMATE

The O&M annual cost estimate is provided in **Appendix B**. The basis of the unit costs for the estimate is Appendix F, Operations and Maintenance Cost Projects, from the SFWMD Engineering Submittal Requirements dated March 22, 2016 (SFWMD O&M Costs). Applicable excerpts from this document are provided in **Appendix B**, Attachment A. The unit costs utilized are the fiscal year 2020 (FY20) costs which is the last year provided in the SFWMD O&M Costs.

8.1 Assumptions

The O&M efforts assumed for the two pump stations are electrical service costs and general maintenance. The current estimated electrical service cost is based on the rates and demand changes provided by the LCEC. An average operation of 40 days (960 hours) per year for the Bond Farm HEI Pump Station is assumed based on the estimated flows to the Project from the hydrologic model. Given the setting of the automatic floats for the pumps it is assumed that Pump 3 runs for a third of the time that the pumps are operating, Pump 2 runs for two-thirds of the time and Pump 1 for all of the times the pumps are operational. The annual operational time for each pump is estimated as follows:

- 2,500 gallons per minute (gpm), Pump 1 – 40 days (960 hours) per year
- 5,000 gpm, Pump 2 – 26.7 days (640 hours) per year
- 5,000 gpm, Pump 3 – 13.3 days (320 hours) per year

The SAL Grade Road Pump Station is assumed to operate the same amount of time per year, 40 days (960 hours), for one 5,000 gpm pump. The general maintenance for each pump station includes maintaining instrumentation and controls including the floats, applying herbicides

annually for vegetation in among the riprap, any hand mowing, if needed, protecting/repairing rust on exposed features and any specified manufacturer's maintenance.

The SAL Grade Road Pump Station has additional costs for fuel and maintenance efforts for the generator and associated diesel fuel tank. Annual tank repairs and associated maintenance are based on SFWMD O&M Costs. The same cost was assumed for the generator since it is an integral unit to the fuel tank. It is assumed that the 258 gallon tank which is integral to the generator will be refilled once a year.

The grassed interior Perimeter Berm slope and Wave Benches are assumed to be mowed twice from the top of the berm to the toe along with 10% of the Impoundment bottom for access between the time when the Impoundment has been emptied and the initial fill for the next operational cycle. The only exceptions to this mowing effort will be as directed by the FWC managers and biologists regarding favorable wetland species on the slope, Wave Benches or Impoundment bottom that are to remain. No acreage is assumed in the cost estimate for these exceptions. The Perimeter Berm interior slope is assumed to be mowed two times per year down to elevation (EL) 28.0 feet (ft) NAVD88 when the Impoundment is full for a total of four mowings per year for the interior Perimeter Berm slope.

The Perimeter Berm exterior slope will be mowed four times a year from the top of berm to the Toe Road. It is assumed that the quarterly mowing of both seepage canal slopes will be from either the Toe Road or the Maintenance Road down to EL 23.0 ft NAVD88 which is the low range of the average groundwater elevation. Both the Toe Road and the Maintenance Road will be mowed. The slopes of the Babcock/Webb Canal are assumed to be mowed from top of bank down to EL 23.0 ft NAVD88. It is assumed that there is no mowing from the Maintenance Road to the property line and no mowing on the slopes of the SAL Grade Road from Oil Well Road to the main entrance of the Project. It is assumed that 1% of all mowed areas, excluding the Impoundment bottom, will require re-sodding/re-planting on an annual basis. Unit cost for new sod was obtained from Florida Department of Transportation (FDOT) Statewide Item Average Unit Cost Table from March 1, 2019 to February 29, 2020, page 22 of 43 (**Appendix B**, Attachment A). It is assumed that vegetation maintenance with chemicals will be required to control vegetation in the open waters of the seepage canals and the Babcock/Webb Canal once a year. This may be a conservative assumption given that the bottom of the seepage canals will be limestone which should dramatically limit the amount of aquatic vegetation in these canals.

It is assumed that the shellrock areas including the road on top of the Perimeter Berm, the ramps to the Toe Road and the SAL Grade Road from Oil Well Road to the top of the Perimeter Berm will be graded twice a year.

It is assumed that for each project feature not already covered (4 flashboard risers, 1 equalization culvert, 1 stop log structure, 1 intake culvert, 1 gate, and 1 spillway) that each structure requires an annual construction materials budget for miscellaneous materials for lumber, metal, seals and other miscellaneous items based on SFWMD O&M Costs.

The hourly rate for performing the required inspections was determined by averaging the personnel services included in the SFWMD O&M Costs and escalating by 4% per year from

2008 to 2020 (**Appendix B**, Attachment A). It was assumed that the quarterly routine inspections, mechanical inspection, electrical inspections, structural inspections, environmental monitoring, seepage canal sediment depth inspections and the piezometer download of data would occur during the same site visit event with one report written to cover all of these inspections and data processing. Additional inspections are included for power outages, post-storm events, low seepage canal alarm, and potential permit required annual inspections by a registered professional engineer.

8.2 Summary

Based on the above, the total O&M annual cost estimate is approximately **\$641k** in fiscal year 2020 dollars escalated 4% per year from 2008 costs for the majority of the items provided in the estimate (**Appendix B**). Approximately 85% of the annual cost is estimated to be electrical service fees for the two pump stations. Based on the current schedule to obtain grant money for construction with a construction period of 2 years, the first year of operation is anticipated to be 2025. As such, the O&M annual cost estimate escalated 4% per year to 2025 dollars is **\$780k**.

TABLES

Table 1: List of Bond Farm HEI Project Features

Feature	Type	Quantity	Size (if applicable)	Material (if applicable)
SAL Grade Road East Ditch Intake Structure	Conveyance	1	-	Concrete Drop Box, Wood Stop Logs
SAL Grade Road East Ditch Culvert (PS Intake)	Conveyance	1	36 in dia	HDPE
SAL Grade Road Pump Station (PS)	Electric	2 pumps, primary and back-up	5,000 gpm each	Steel Pump Can and Ductile Iron Pipes
SAL Grade Road PS Generator	Standby	1	-	-
SAL Grade Road PS Fuel Tank	Diesel	1	550 gal	Steel
North and West Seepage Canals Culvert	Conveyance, Access	2	48 in dia	CAP
North and West Seepage Canals Flashboard Riser (FBR)	Stage Water, Conveyance	2	48 in dia	CAP, Wood Boards
North Seepage Canal	Conveyance, Seepage	1	3,600 ft long	Sod Slopes
Bond Farm HEI PS	Electric	3 pumps	1 – 2,500 gpm 2 – 5,000 gpm	Steel Pipes
Babcock/Webb Road Culvert	Conveyance, Access	2	36 in dia	HDPE
Babcock/Webb Stop Logs and Top Inflow Grate	Conveyance	1	-	Concrete Drop Box, Wood Stop Logs
Babcock/Webb Intake Structure	Conveyance and Access Culvert	2	36 in dia	HDPE
Babcock/Webb Canal	Conveyance	1	2,400 ft long	Sod Slopes
North and East Seepage Canals Culvert	Conveyance and Access Culvert	2	48 in dia	CAP
North and East Seepage Canals Crossing FBR	Stage Water, Conveyance	2	48 in dia	CAP, Wood Boards
East Seepage Canal	Conveyance, Seepage	1	8,900 ft long	Sod Slopes
East Seepage Canal Culvert	Conveyance, Access	2	48 in dia	CAP
East Seepage Canal FBR	Conveyance, Stage Water	2	48 in dia	CAP, Wood Boards
Sandy Hartman's Canal	Discharge	1	1,300 ft long	Natural Vegetated Slopes
Auxiliary Overflow Spillway	Storm Discharge	1	100 ft long and 36 ft wide crest	ACBM
Primary Discharge Structure Gate	Manual	1	4 ft wide 3 ft tall	Stainless Steel
Primary Discharge Structure Discharge Box	Discharge	1	-	Concrete
Primary Discharge Structure Culvert	Discharge	2	36 in dia	HDPE
West Seepage Canal Culvert	Conveyance, Access	2	48 in dia	CAP
West Seepage Canal FBR	Conveyance, Stage Water	2	48 in dia	CAP, Wood Boards
West Seepage Canal	Conveyance, Seepage	1	10,300 ft long	Sod Slopes

Table 2: Bond Farm HEI Project Operational Settings

All Elevations in NAVD88

Pump Stations

Feature Name	Normal Operational Setting	Adjustment Range	Maximum Flow	Comments
Bond Farm HEI Pump 1	Pump On: Inflow EL 25.0 ft Pump Off: Inflow EL 24.5 ft Pump Off: Impoundment EL 28.0 ft	Inflow EL 24.5 ft to EL 26.0 ft Outflow EL 28.0 ft	5.6 cfs (2,500 gpm)	1, 2 or 3 pumps can operate at once No generator
Bond Farm HEI Pump 2	Pump On: Inflow EL 25.5 ft Pump Off: Inflow EL 25.0 ft Pump Off: Impoundment EL 28.0 ft	Inflow EL 24.5 ft to EL 26.0 ft Outflow EL 28.0 ft	11.1 cfs (5,000 gpm)	
Bond Farm HEI Pump 3	Pump On: Inflow EL 26.0 ft Pump Off: Inflow EL 25.5 ft Pump Off: Impoundment EL 28.0 ft	Inflow EL 24.5 ft to EL 26.0 ft Outflow EL 28.0 ft	11.1 cfs (5,000 gpm)	
SAL Grade Road Pump 1	Pump On: Inflow EL 22.6 ft Pump Off: Inflow EL 11.5 ft	Inflow EL 11.5 ft to EL 26.0 ft	11.1 cfs (5,000 gpm)	1 pump operates at a time
SAL Grade Road Pump 2	Pump On: Inflow EL 22.6 ft Pump Off: Inflow EL 11.5 ft	Inflow EL 11.5 ft to EL 26.0 ft	11.1 cfs (5,000 gpm)	Generator power back-up

Flashboard Risers and Stop Logs

Feature Name	Normal Operational Setting	Adjustment Range	Adjustment Increment (Stop Log/Board Height)	Rows of Stop Logs/Boards per Culvert	Culvert Diameter	No. of Culverts
SAL Grade Road East Ditch Intake Stop Log Structure	EL 24.5 ft	30 inches total EL 24.0 ft to EL 26.5 ft	6 inches	1	36 inches	1
Babcock/Webb Stop Log Structure	EL 25.0 ft	30 inches total EL 23.5 ft to EL 26.0 ft	6 inches	2	36 inches	2
North and East Seepage Canals Flashboard Riser	EL 26.0 ft	24 inches total EL 22.0 ft to EL 26.0 ft	6 inches	2	48 inches	2
East Seepage Canal Flashboard Riser	EL 24.0 ft	24 inches total EL 22.0 ft to EL 26.0 ft	6 inches	2	48 inches	2
North and West Seepage Canals Flashboard Riser	EL 26.0 ft	24 inches total EL 22.0 ft to EL 26.0 ft	6 inches	2	48 inches	2
West Seepage Canal Flashboard Riser	EL 24.0 ft	24 inches total EL 22.0 ft to EL 26.0 ft	6 inches	2	48 inches	2

Gates

Feature Name	Normal Operational Setting	Adjustment Range	Adjustment Increment	No. of Gates	Culvert Diameter	No. of Culverts
Primary Discharge Structure Gate	Closed	36 inches total EL 23.0 ft to 26.0 ft	Continuous from 0 inches to 36 inches	1	36 inches	2

Table 3: Primary Discharge Structure Gate Operation Requirements

All Elevations in NAVD88

**Condition 1: Primary Discharge Structure Gate May Be Open
When All of the Following Requirements Have Been Satisfied**

Project Feature	Required Condition	Measurement Type
Babcock/Webb Stop Log Structure	No Flow Over Top of Stop Logs SG-5 Below EL 25.0 ft	Visual
Bond Farm HEI Pump Station	No Pumps Operating	Visual
North Seepage Canal	SG-3 Below EL 24.5 ft	Visual
East Seepage Canal	SG-7 Below EL 24.5 ft	Visual
West Seepage Canal	SG-12 Below EL 24.5 ft	Visual
Sandy Hartman's Canal	SG-10 Below EL 24.0 ft	Visual

**Condition 2: Primary Discharge Structure Gate Must Be Opened Within 48 Hours of
Alarm Notification that Float Switch in North Seepage Canal at
Bond Farm HEI Pump Station Below Operating Curve Based on
Float Switch in Impoundment at Bond Farm HEI Pump Station**

Operating Curve Provided in Figure 13

Condition 1 and 2 are independent of each other.

Table 4: Adaptive Management Adjustment of Operation Settings

Issue	Issue Determinations	Project Feature to be Adjusted	Adjustment	Result	Return to Normal Operating Settings
Too much water on Babcock/Webb WMA	Visual observations of Babcock/Webb WMA wetlands stressed with too much water and little or no water flowing over stop logs	Babcock/Webb Stop Log Structure	1. Remove top of stop logs below EL 25.0 ft	Lowers water on Babcock/Webb WMA, Allows more water to flow over stop logs into Babcock/Webb Canal	When water levels on Babcock/Webb WMA decrease and wetlands no longer stressed with too much water
Too little water on Babcock/Webb WMA	Visual observations of Babcock/Webb WMA wetlands stressed with too little water and water flowing over stop logs	Babcock/Webb Stop Log Structure	1. Add top of stop logs above EL 25.0 ft	Decreases or prohibits water from discharging from Babcock/Webb WMA into Babcock/web Canal	When wetlands no longer stressed from too little water
No water flowing from Babcock/Webb WMA to Project	SG-5 level below Babcock/Webb Stop Log Structure set at EL 25.0 ft, wetlands on Babcock/Webb WMA are not stressed from lack of water and Bond Farm HEI Pump Station has non-operating pumps	Babcock/Webb Stop Log Structure	1. Remove top of stop logs below EL 25.0 ft	Allows water to flow over stop logs into Babcock/Webb Canal	When Babcock/Webb WMA wetlands become stressed from lack of water or Impoundment full
Impoundment is not full, Bond Farm HEI Pump Station has non-operating pumps, and water is discharging over the East Seepage Canal Flashboard Riser to Sandy Hartman's Canal	SG-3 level below level for automatic float switch trigger to turn on non-operating pump(s); SG-8 level above top of East Seepage Canal Flashboard Riser and water overtopping flashboard	East Seepage Canal Flashboard Riser and North and East Seepage Canals Flashboard Riser	1. Add boards to East Seepage Canal Flashboard Riser above EL 24.0 ft above SG-8 level 2. Remove boards from North and East Seepage Canals Flashboard Riser to level below East Seepage Canal Flashboard Riser	Retains water leaving the site in the East Seepage Canal to potentially flow north to North Seepage Canal and Pump Station to fill Impoundment;	When Impoundment full or when Primary Discharge Structure Gate is opened to drain Impoundment
Impoundment is not full, Bond Farm HEI Pump Station has non-operating pumps, and water is discharging over the West Seepage Canal Flashboard Riser to Sandy Hartman's Canal	SG-3 level below level for automatic float switch trigger to turn on non-operating pump(s); SG-11 level above top of West Seepage Canal Flashboard Riser and water overtopping flashboard	West Seepage Canal Flashboard Riser and North and West Seepage Canals Flashboard Riser	1. Add boards to West Seepage Canal Flashboard Riser above EL 24.0 ft above SG-11 level 2. Remove boards from North and West Seepage Canals Flashboard Riser to level below West Seepage Canal Flashboard Riser	Retains water leaving the site in the West Seepage Canal to potentially flow north to North Seepage Canal and Pump Station to fill Impoundment;	When Impoundment full or when Primary Discharge Structure Gate is opened to drain Impoundment
~80 acres to the north is being drained more than typical or is being flooded more than typical	Neighbors complain; correlate historic groundwater levels from P-1 with regional rain gauge at SR-6 to try to substantiate or refute complaint	SAL Grade Road Pump Station	1. Adjust float switch trigger to either address over drainage or flooding more than typical conditions	Either reduces pumping to prevent over drainage from typical conditions or increases pumping to prevent flooding more than typical conditions	Only when the new settings seem to cause a problem with over draining or flooding more than typical
A Bond Farm HEI Pump Station pump frequently cycling on and off	Water level at SG-3 not consistent to higher water levels for pump to run consistently	Bond Farm HEI Pump Station	1. Adjust float switch triggers to turn pump on and off at a lower level to run more consistent with the water that is available	Reduces pump cycling and potentially increased maintenance	When levels at SG-3 consistently higher to support original float switch trigger settings

FIGURES

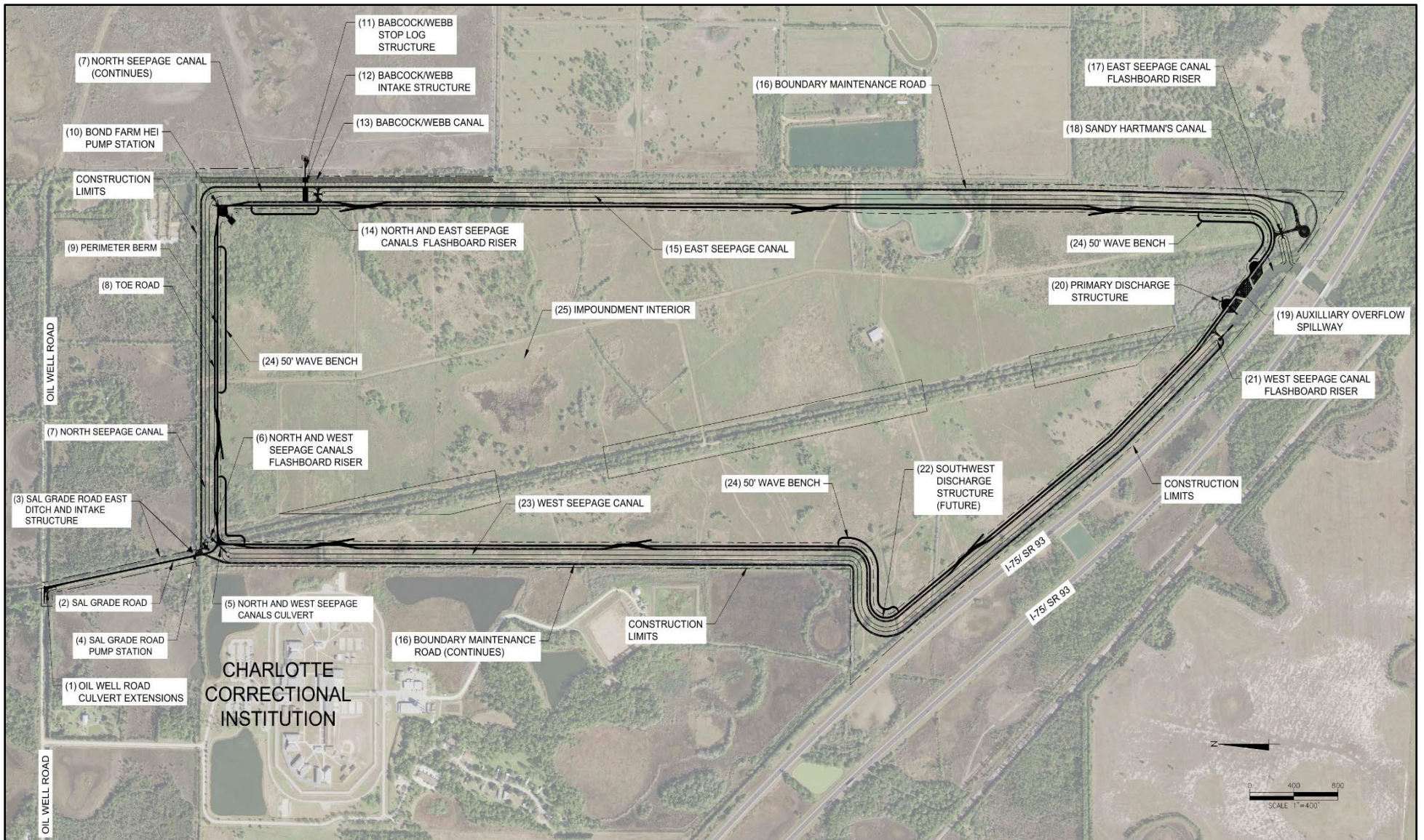


Figure 1: Bond Farm HEI Project Features

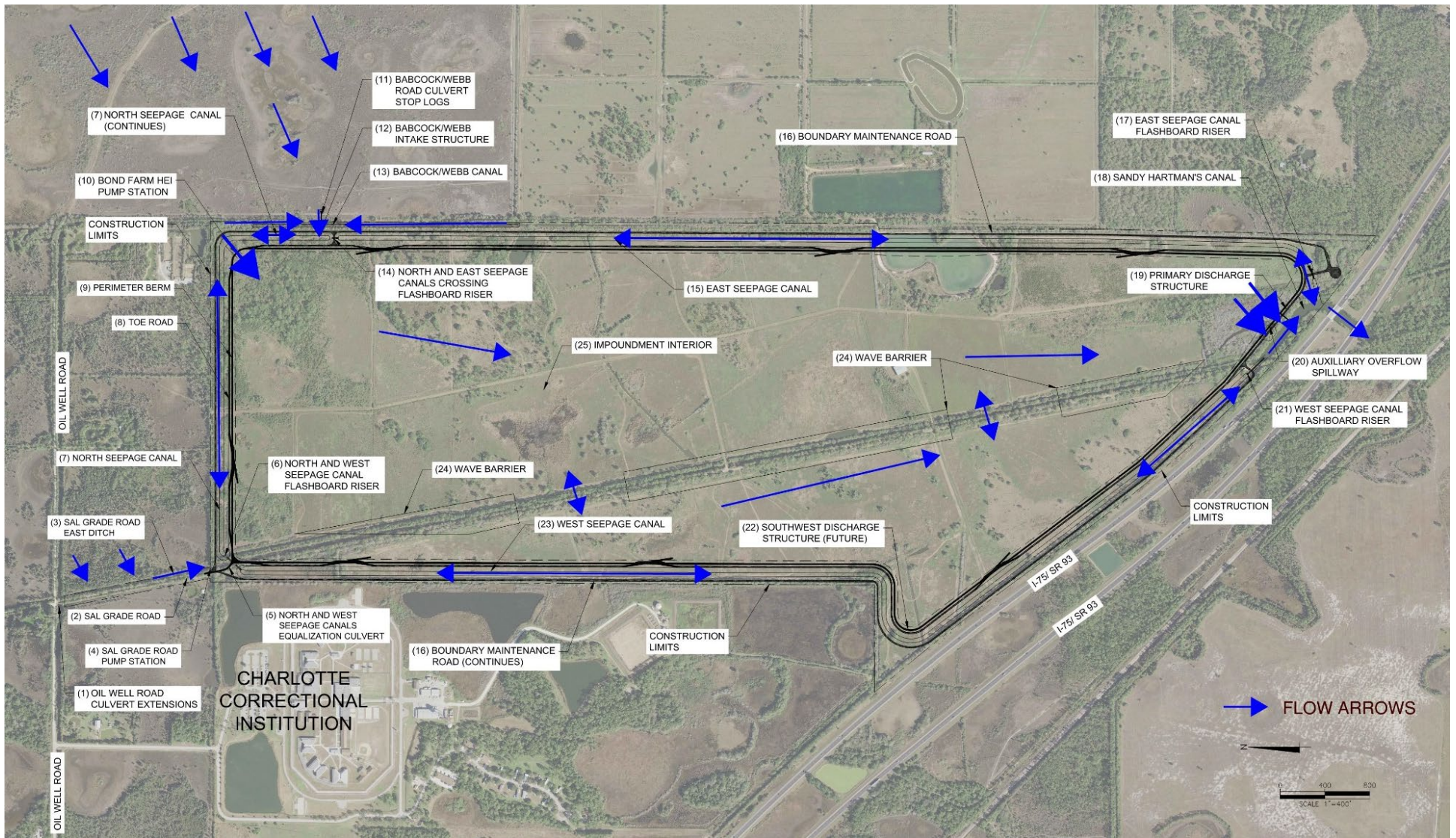


Figure 2: Bond Farm HEI Project Flow Directions

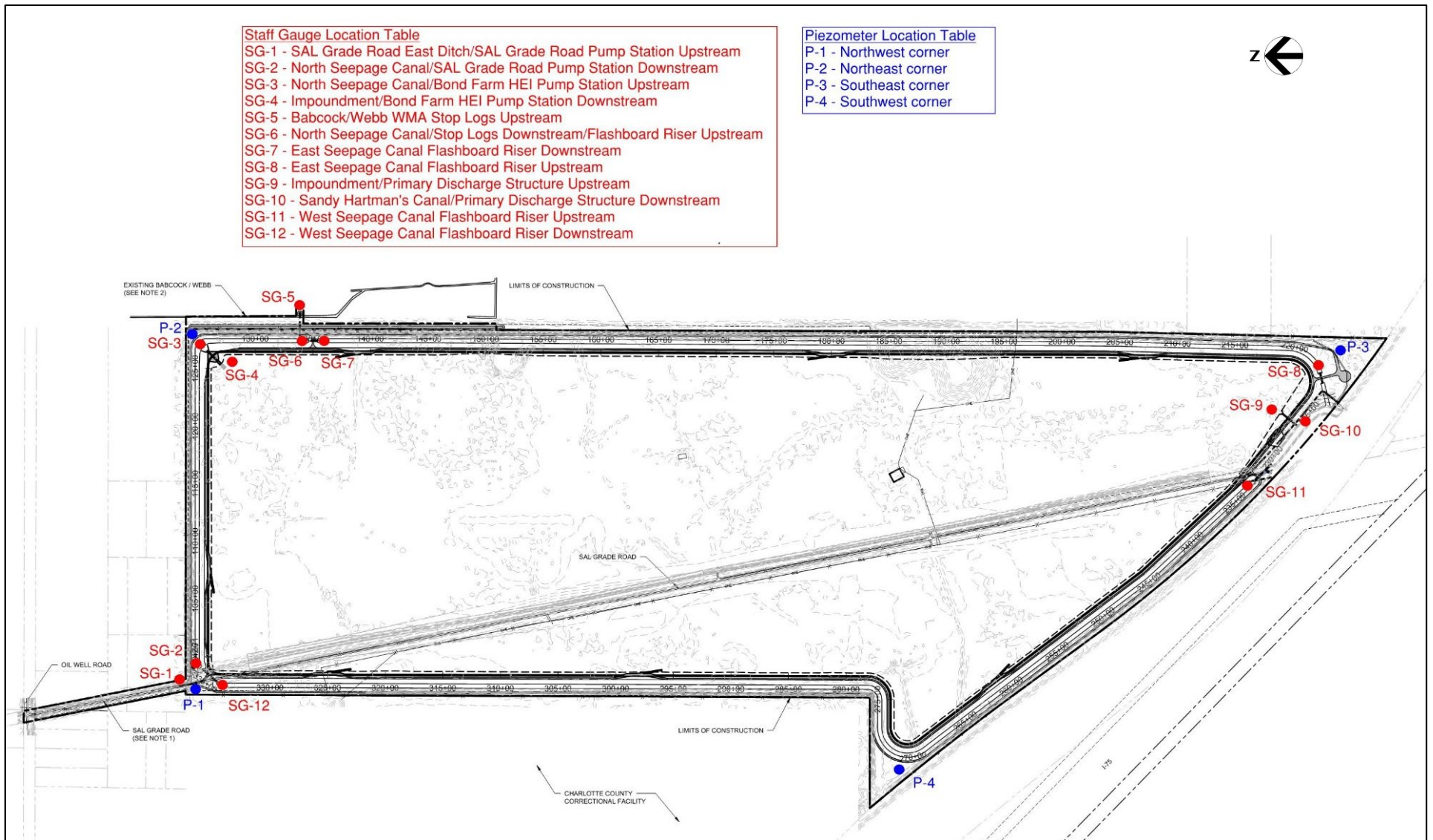


Figure 3: Staff Gauge and Piezometer Locations

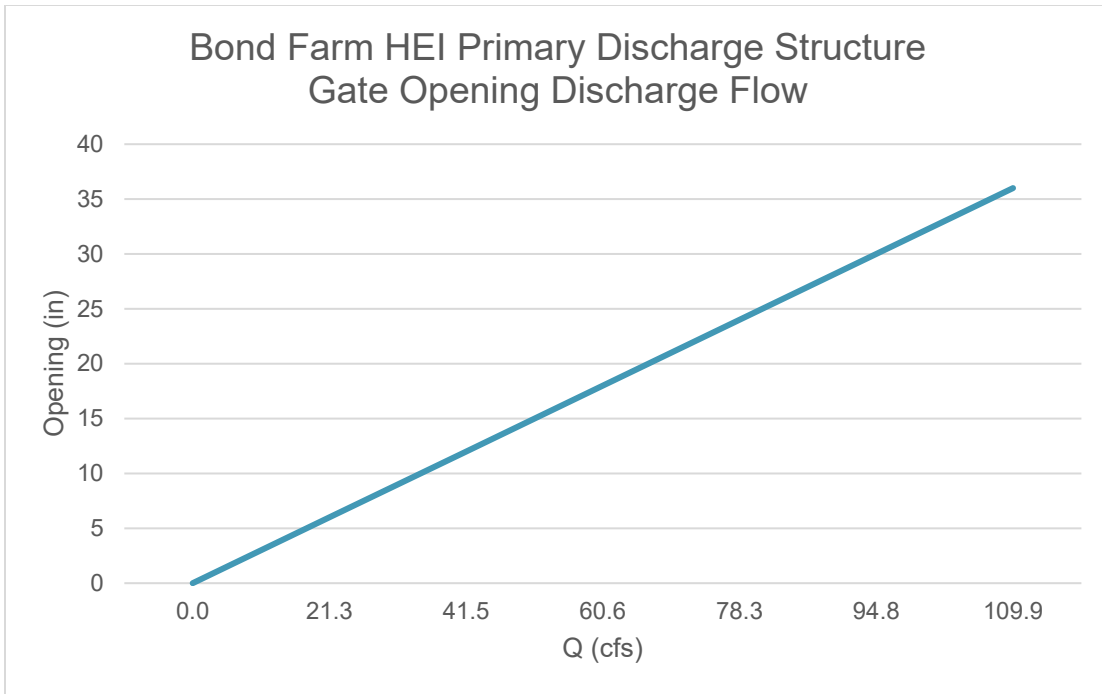


Figure 4: Bond Farm HEI Primary Discharge Structure Gate Opening Discharge Flow

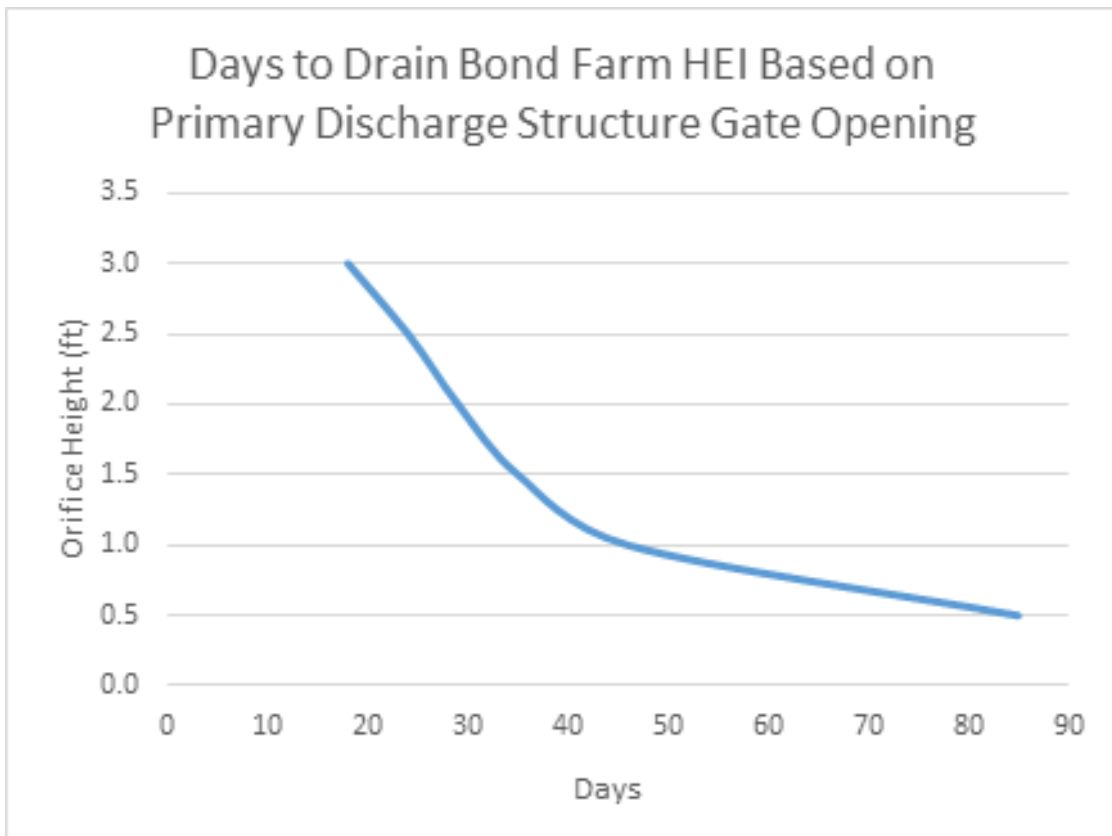


Figure 5: Days to Drain Bond Farm HEI Based on Primary Discharge Structure Gate Opening

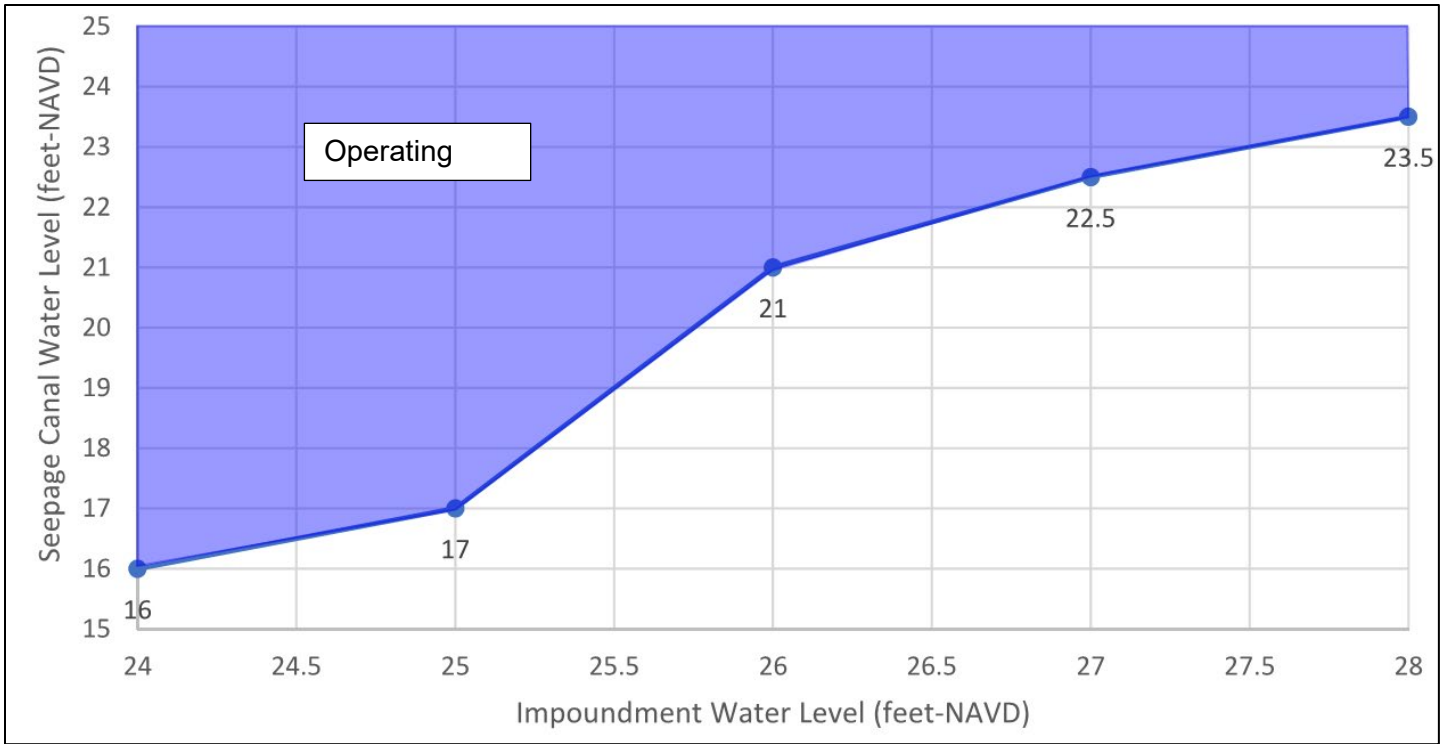


Figure 6 Minimum Seepage Canal Levels for Bond Farm HEI Levels

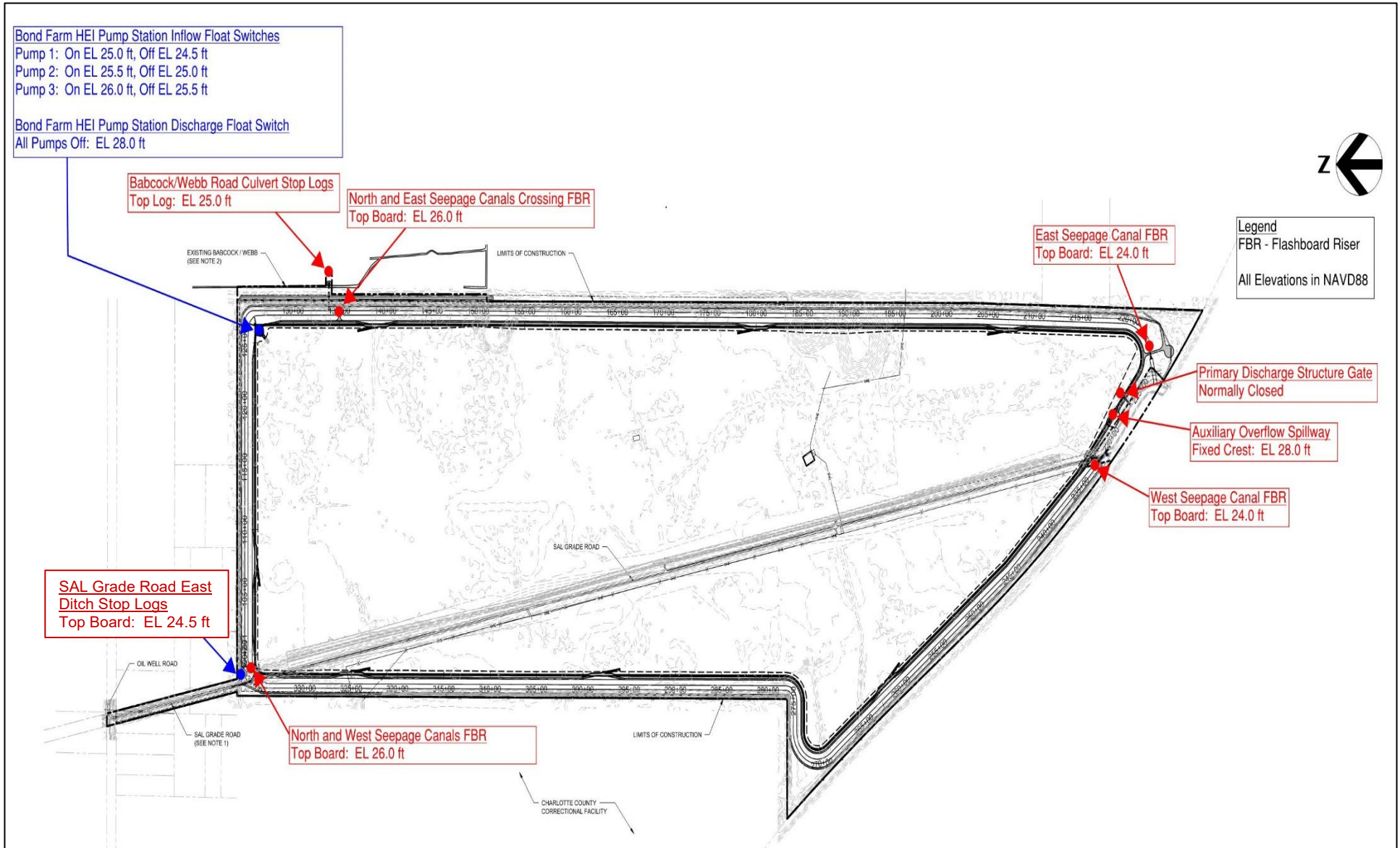


Figure 7: Operational Settings

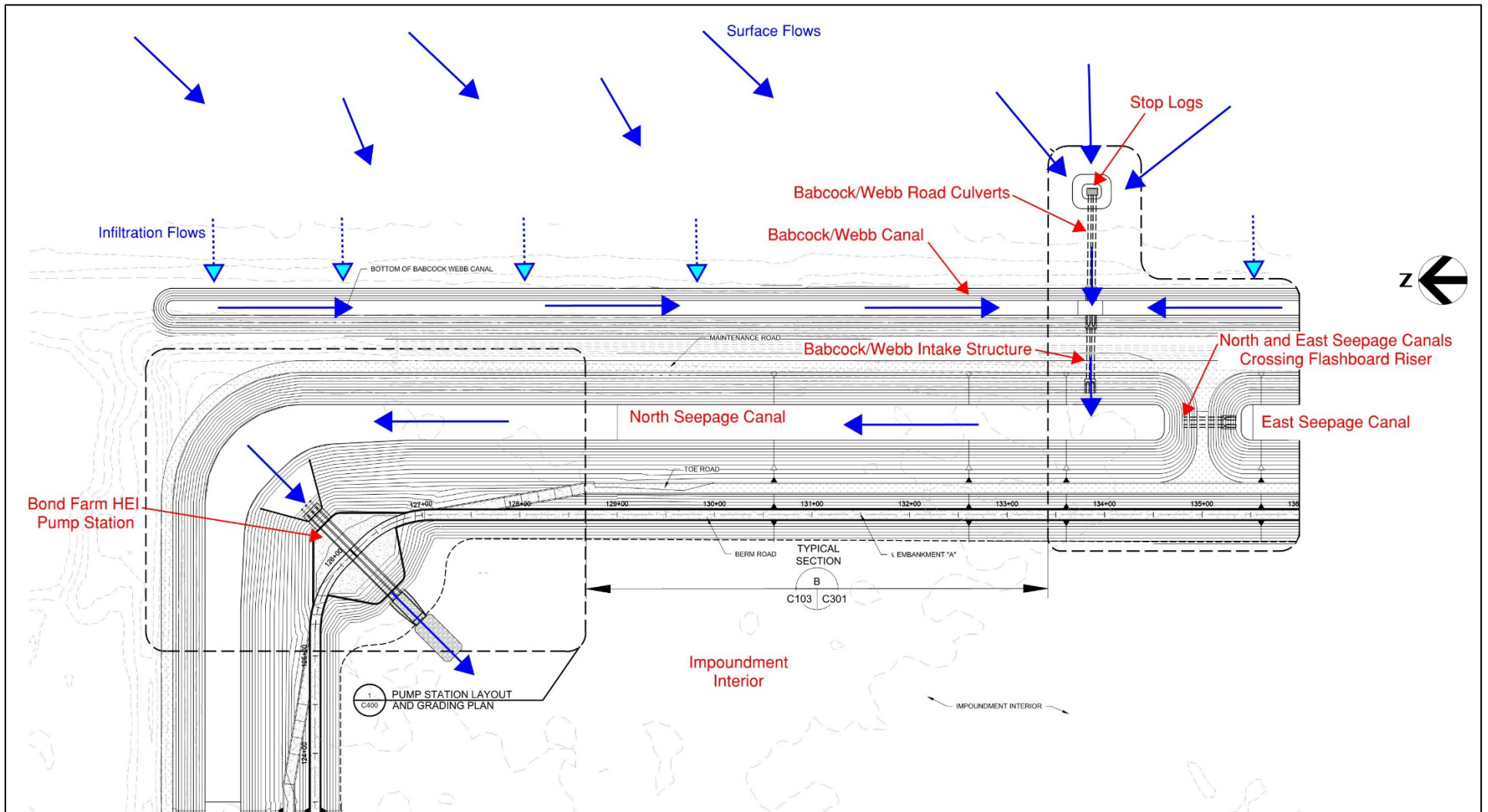


Figure 8: Bond Farm HEI Project Inflow Paths

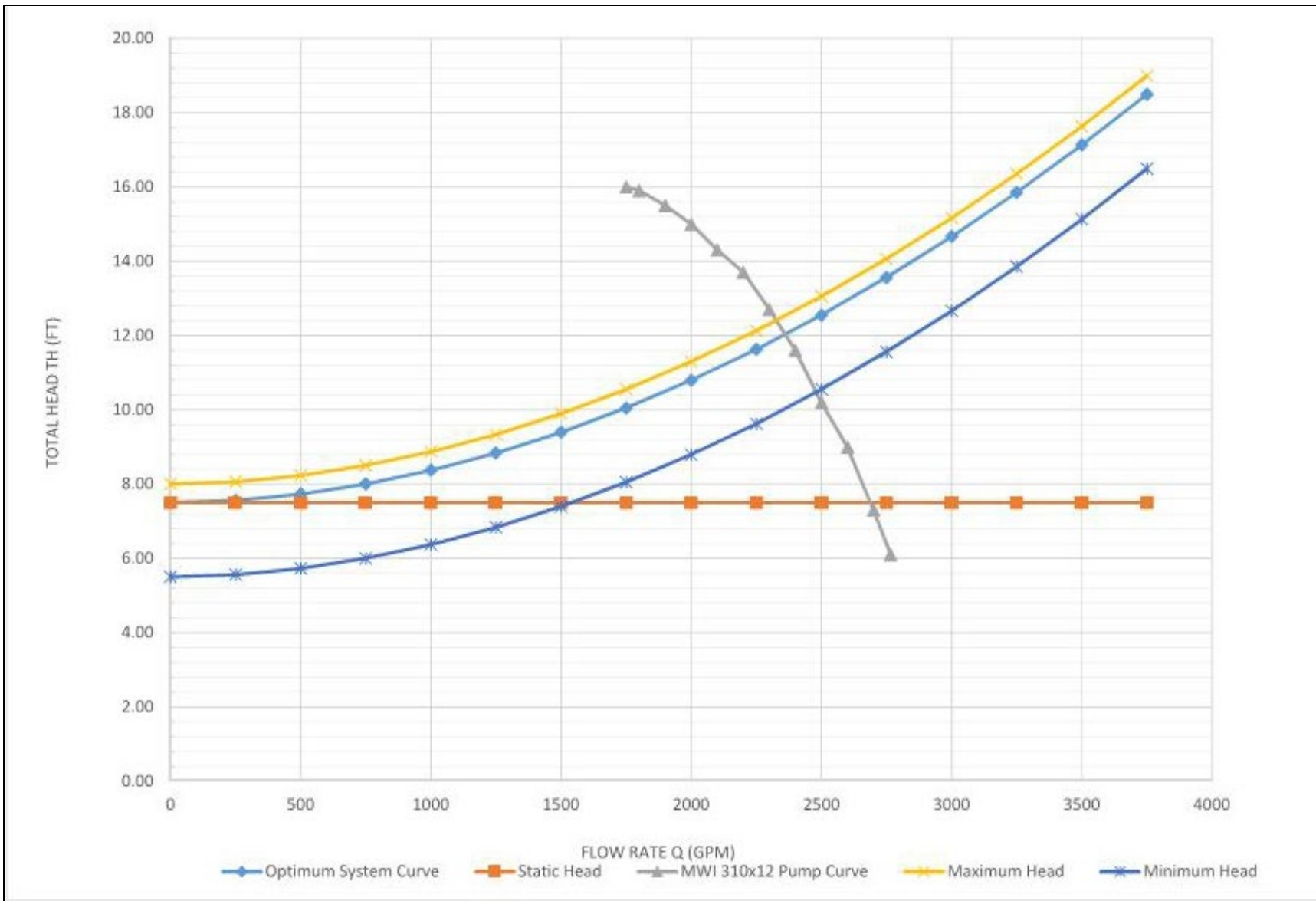
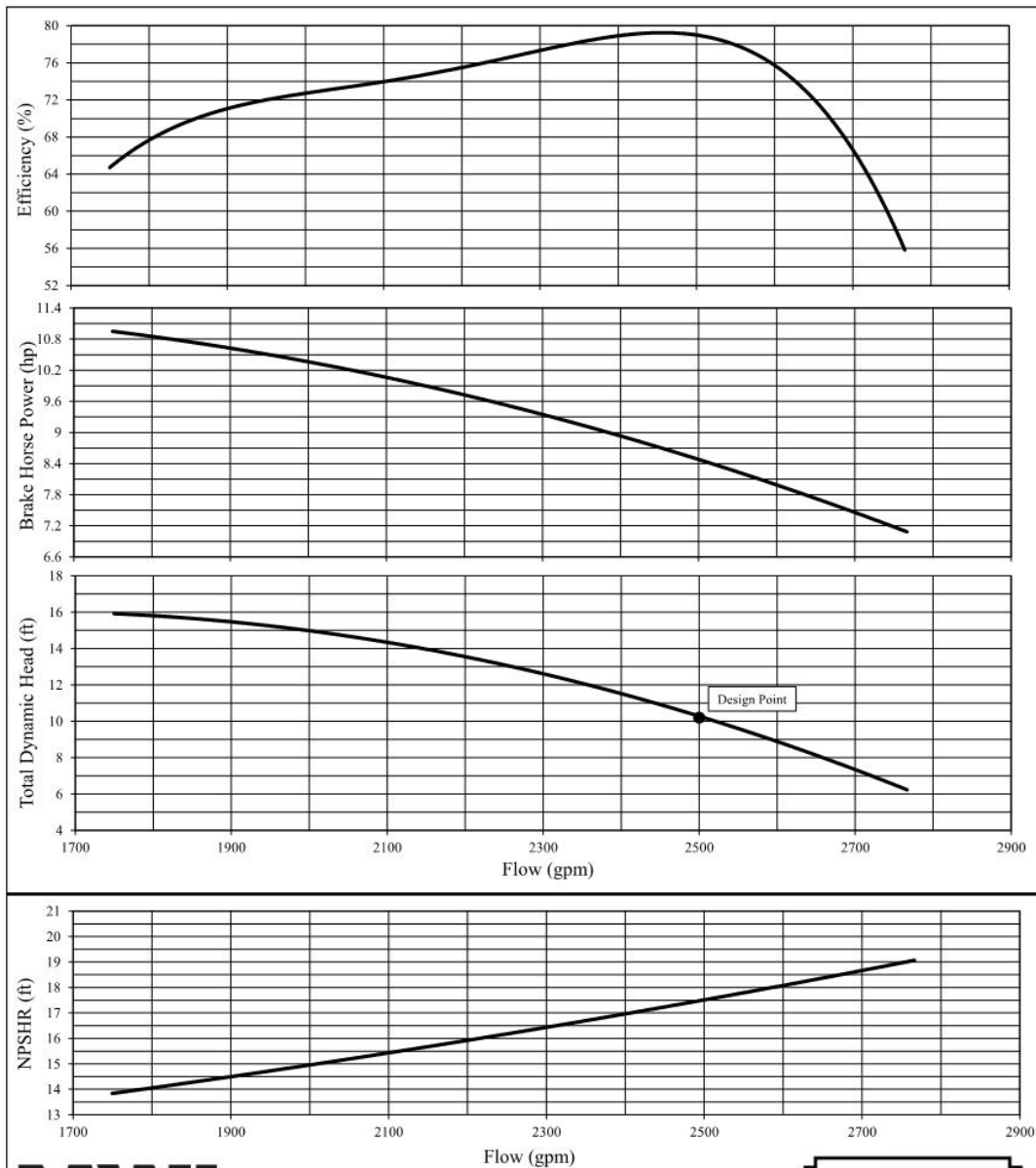


Figure 9a: Bond Farm HEI Pump Station Pump 1 (2,500 gpm) Pump Design Curve



PUMP BOWL PERFORMANCE CURVE	
Project: SFWMD Bond Farm Project	
TYPE: Axial Flow	PROPELLER DIA: 10 in
MODEL NO: NW310X12	SPEED: 1395 RPM
INTAKE DIA: 15 in	DISCHARGE DIA: 12 in
SINGLE STAGE PERFORMANCE FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0 PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 DEG F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.	

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PERFORMANCE CHARACTERISTICS OF THE MWI PUMP MODEL SHOWN AND WAS OBTAINED BY SCALE MODEL TEST AND CALCULATIONS IN ACCORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE.

MWI CORPORATION
CERTIFIED BY

MWI CORPORATION
Deerfield Beach, Florida

Figure 9b: Bond Farm HEI Pump Station Pump 1 (2,500 gpm) Pump Design Curve

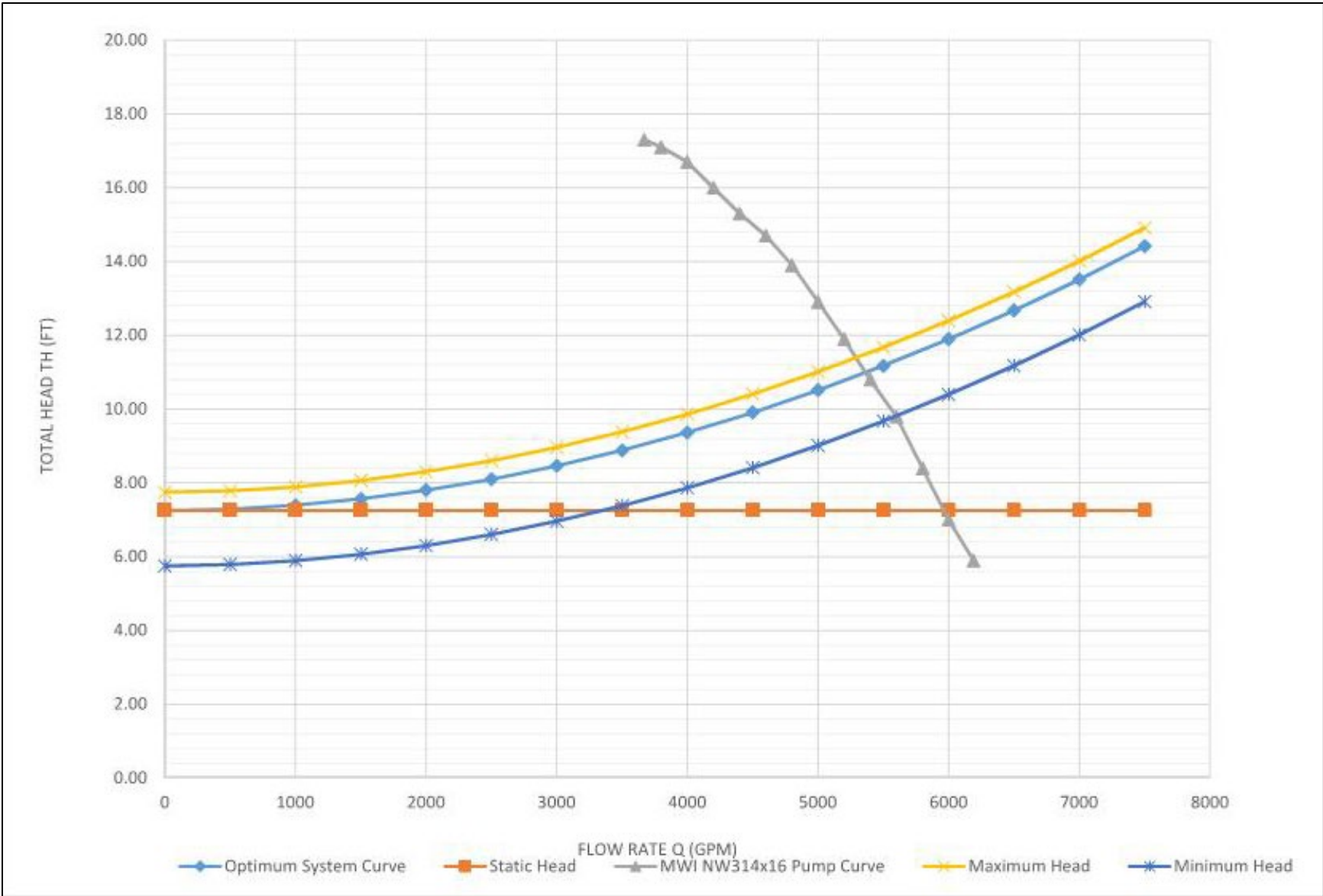
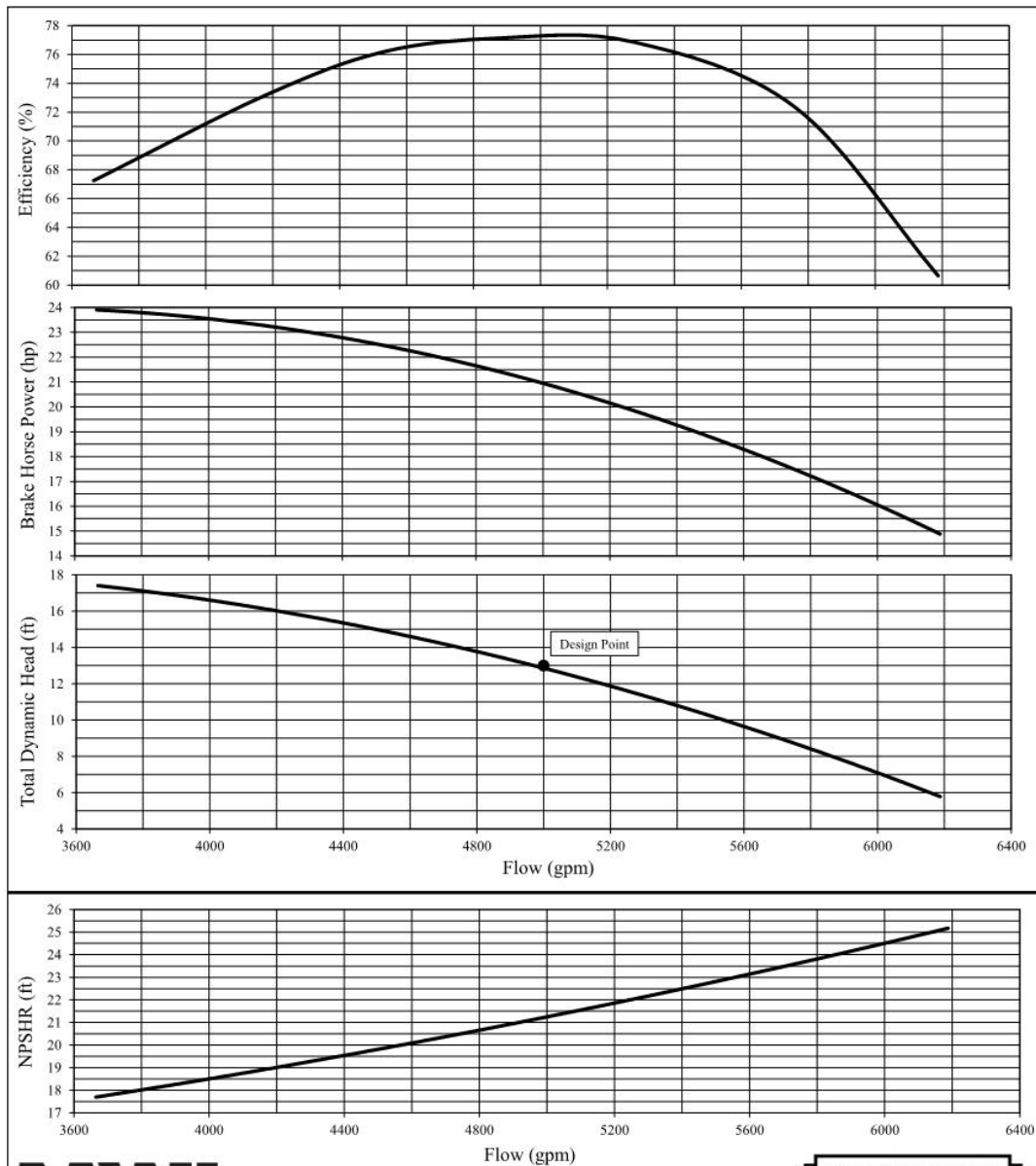


Figure 10a: Bond Farm HEI Pump Station Pump 2 (5,000 gpm) Pump Design Curve



PUMP BOWL PERFORMANCE CURVE	
Project: Bond Farms 5000 gpm	
TYPE: Axial Flow	PROPELLER DIA: 14 in
MODEL NO: NW314X16	SPEED: 1030 RPM
INTAKE DIA: 21 in	DISCHARGE DIA: 16 in
SINGLE STAGE PERFORMANCE FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0 PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 DEG F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.	

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PERFORMANCE CHARACTERISTICS OF THE MWI PUMP MODEL SHOWN AND WAS OBTAINED BY SCALE MODEL TEST AND CALCULATIONS IN ACCORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE.

MWI CORPORATION
CERTIFIED BY

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Deerfield Beach, Florida

Figure 10b: Bond Farm HEI Pump Station Pump 2 (5,000 gpm) Pump Design Curve

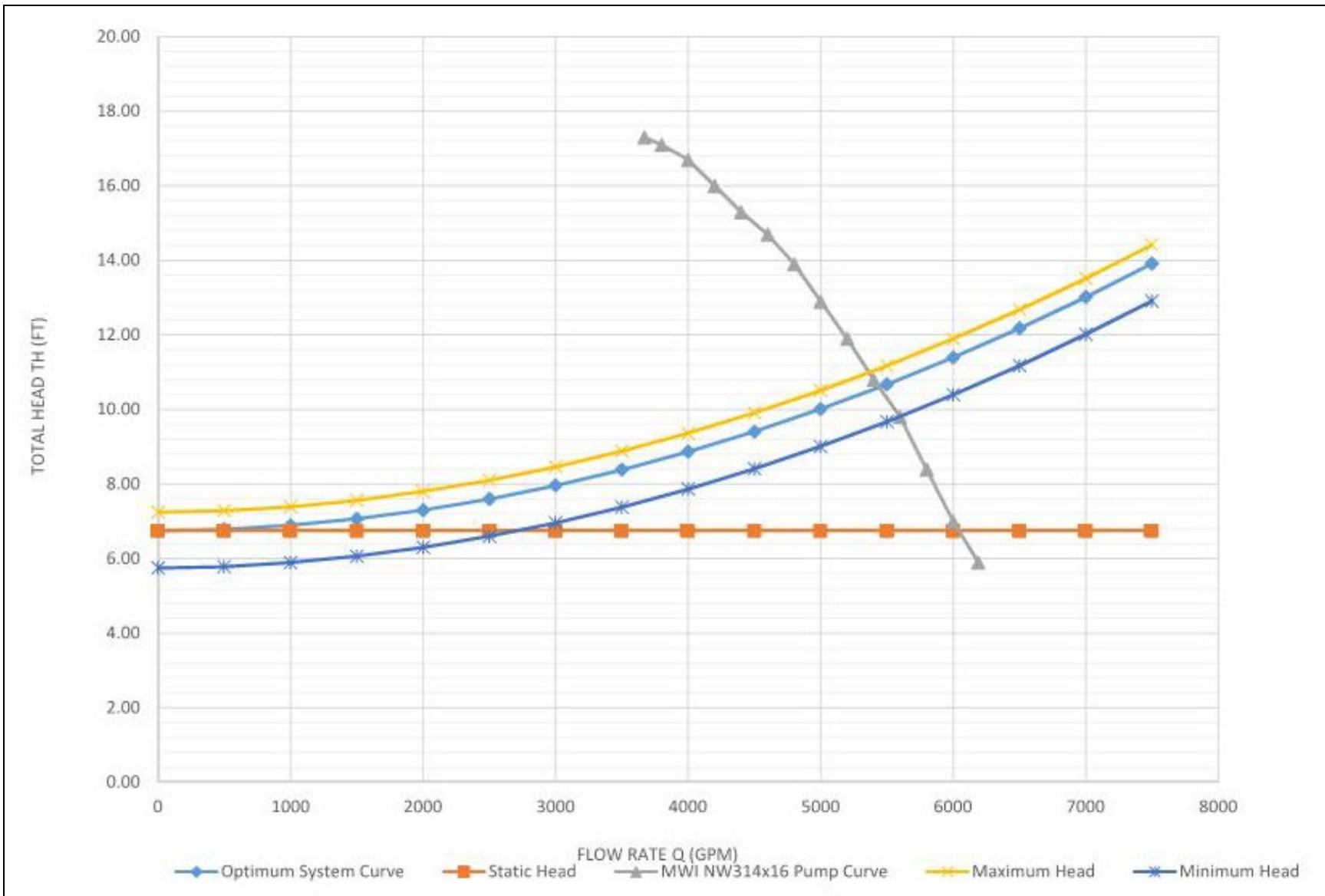


Figure 11a: Bond Farm HEI Pump Station Pump 3 (5,000 gpm) Pump Design Curve

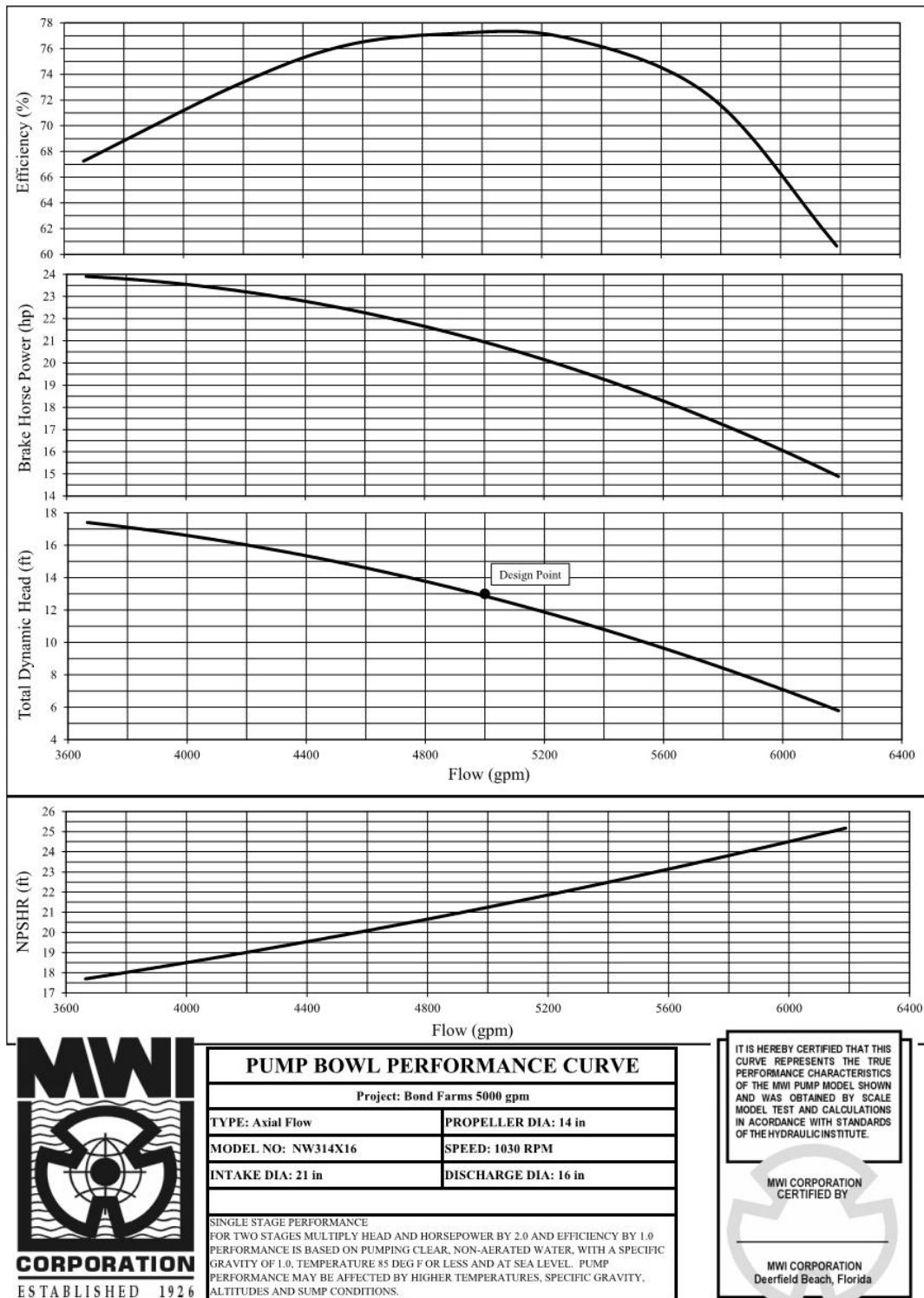


Figure 11b: Bond Farm HEI Pump Station Pump 3 (5,000 gpm) Pump Design Curve

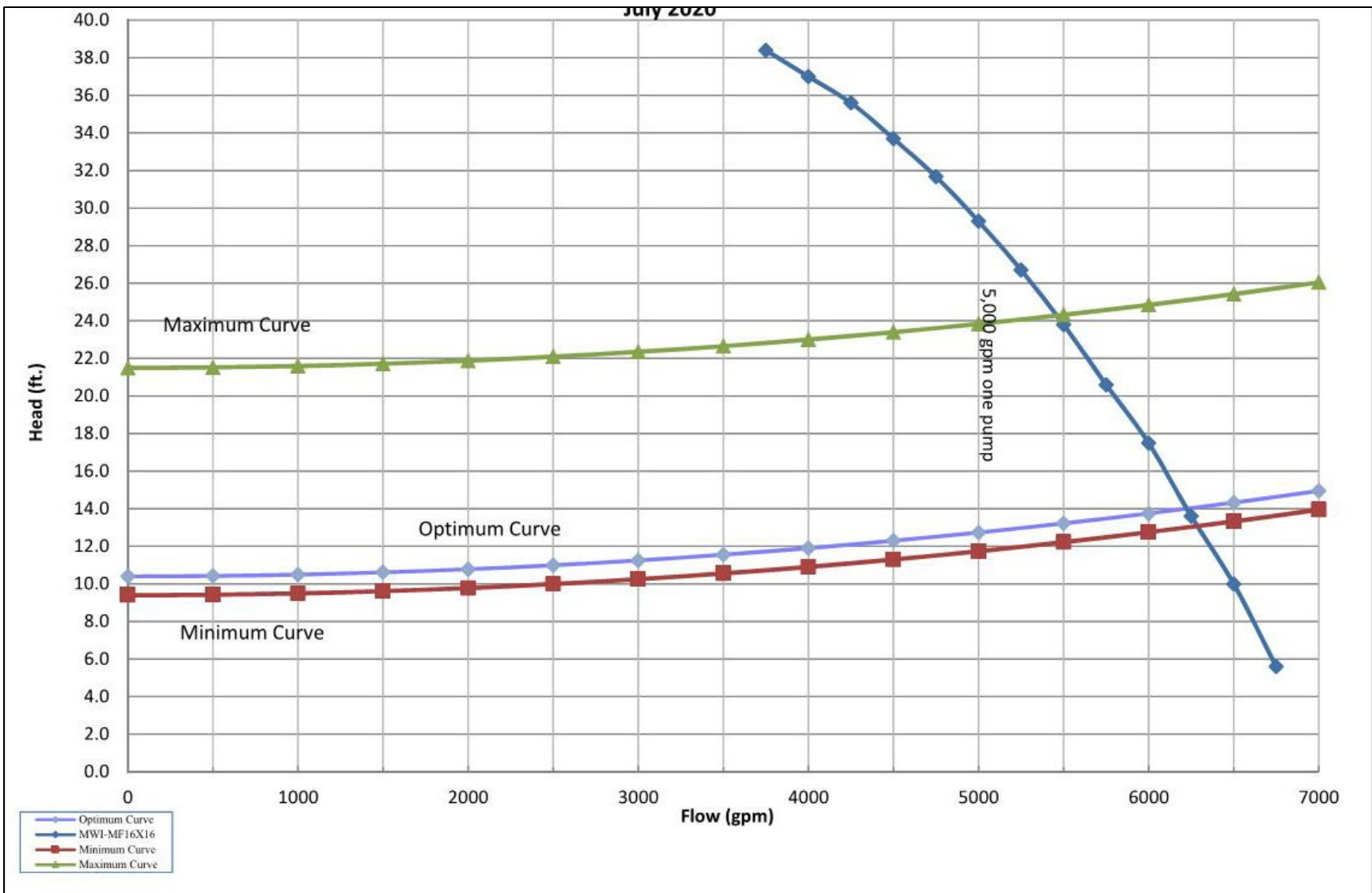


Figure 12a: SAL Grade Road Pump Station 5,000 gpm Pump Design Curve

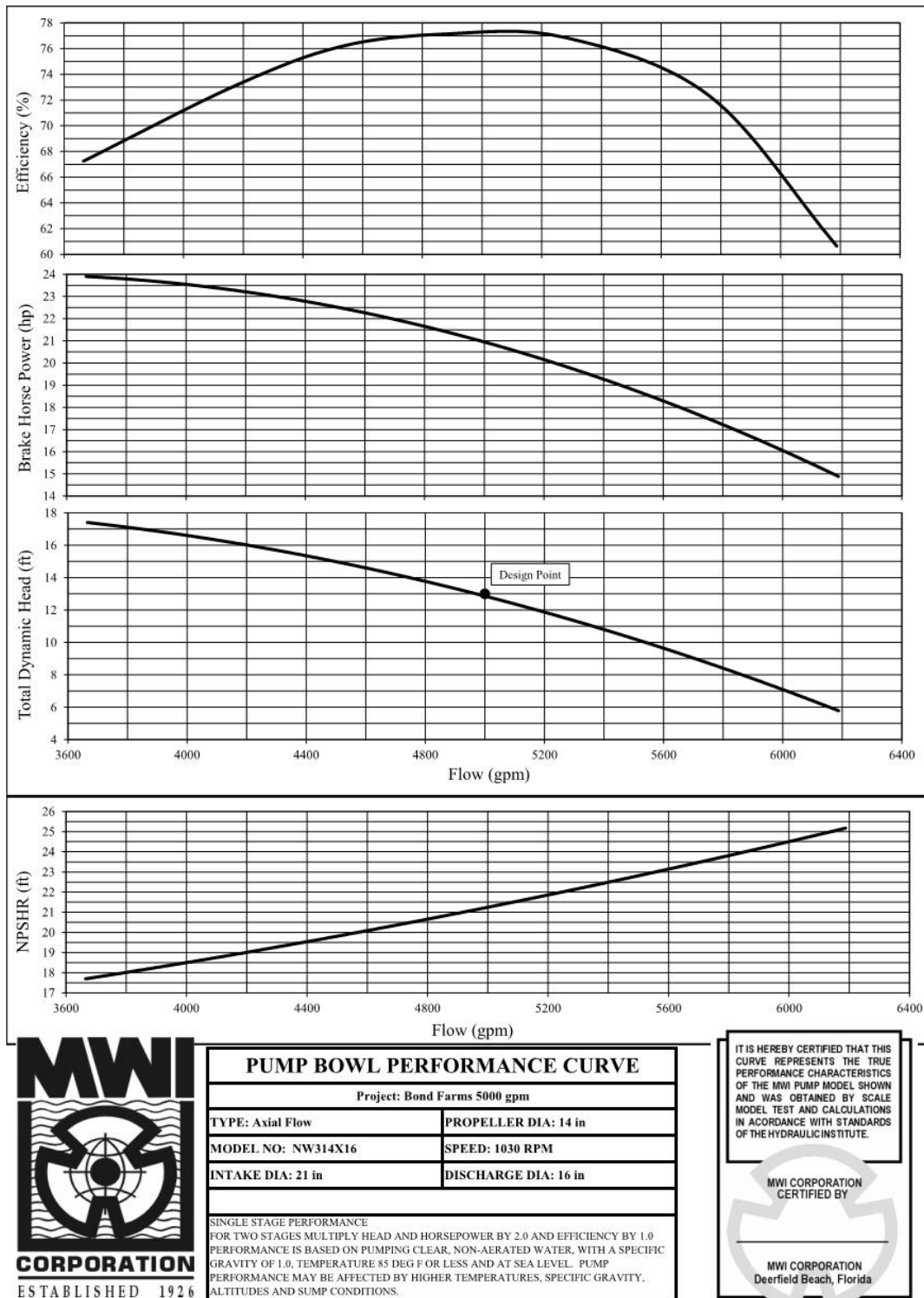


Figure 12b: SAL Grade Road Pump Station 5,000 gpm Pump Design Curve

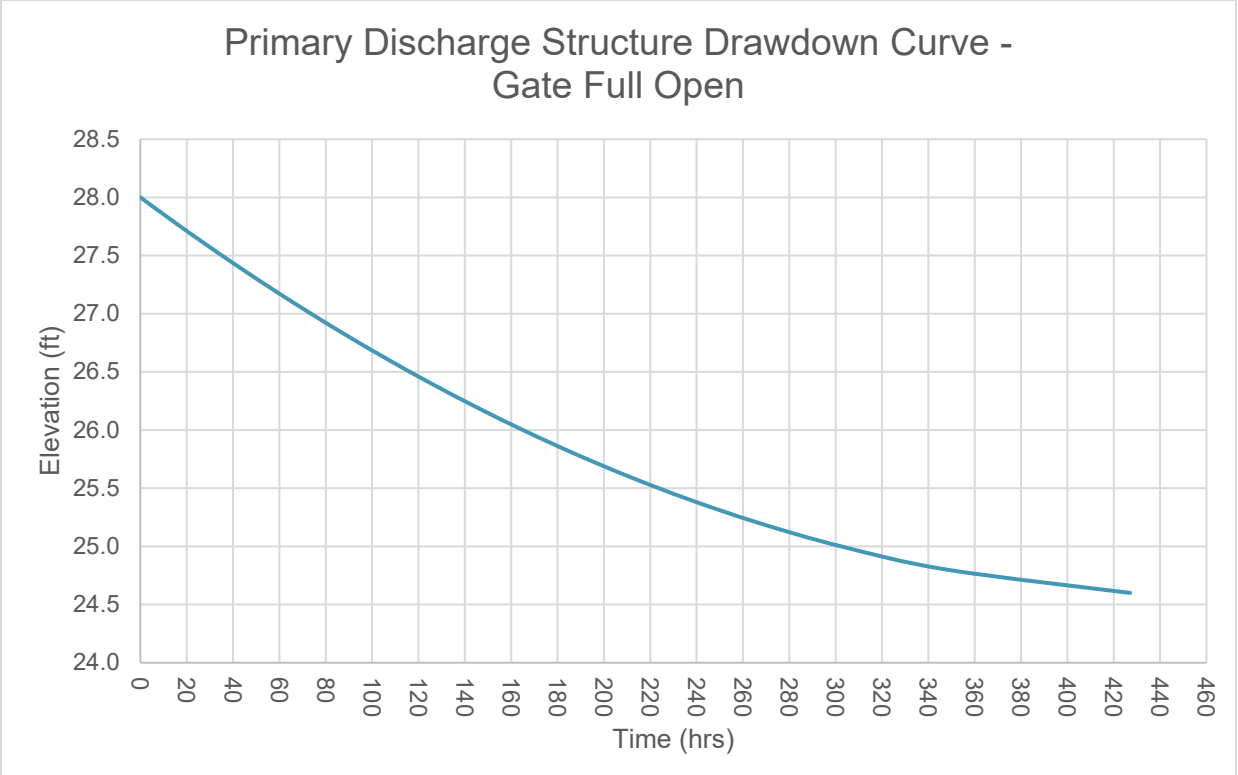


Figure 13: Primary Discharge Structure Drawdown Curve - Gate Full Open

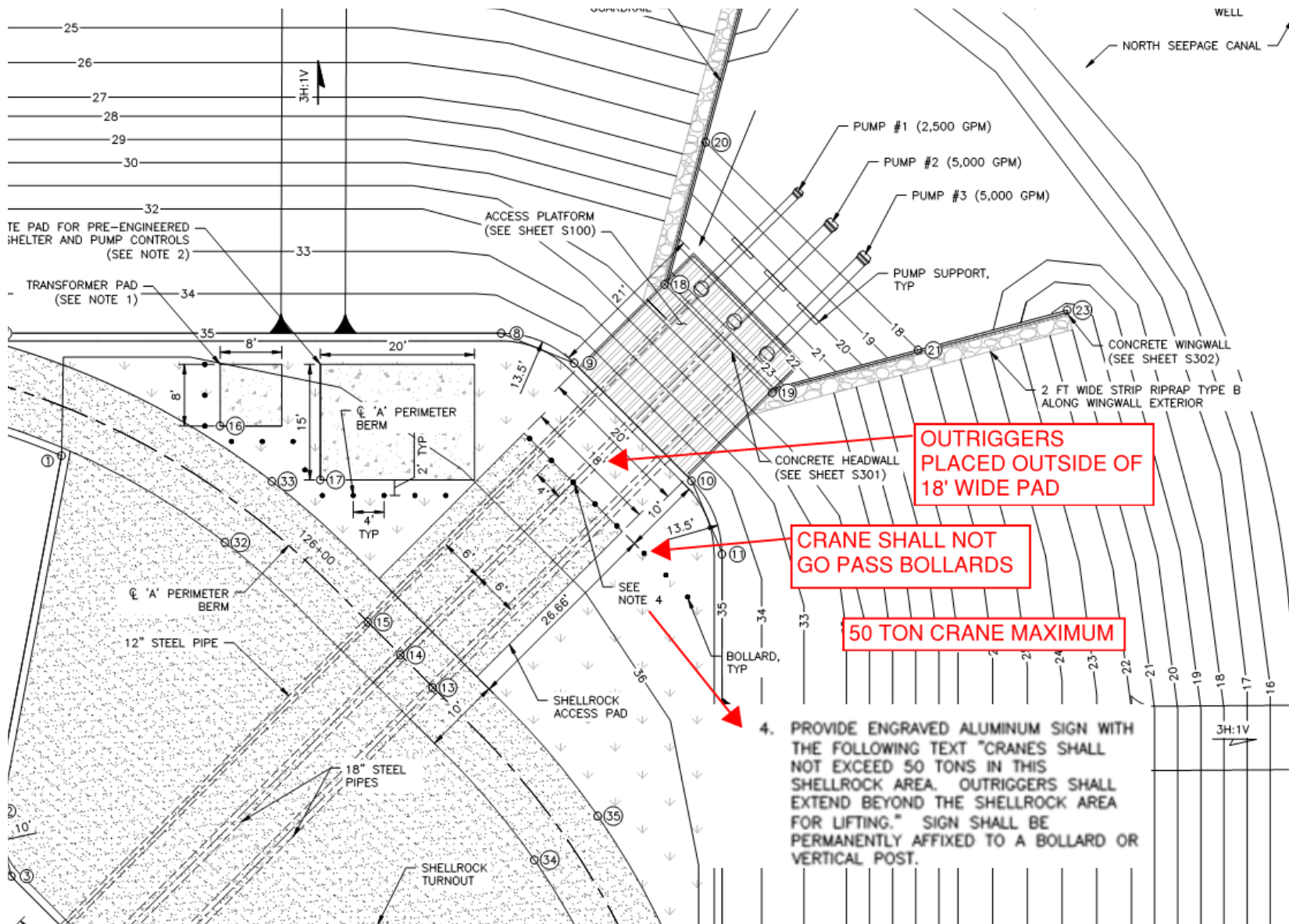







Figure 14: Crane Restrictions for Bond Farm HEI Pump Station Pump Removal



A

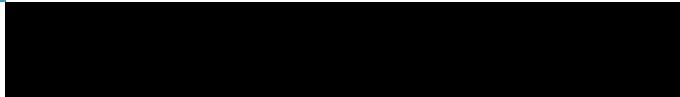
Bond Farm HEI
Environmental Monitoring
Plan – April 10, 2020





B

Bond Farm HEI Operations &
Maintenance Annual Cost
Estimate – July 14, 2020



Received
Electronically

Aug 6, 2020

South District



August 5,
2020



Bond Farm Hydrologic Enhancement Impound (HEI) Project

Ready to Advertise

Technical Specifications

Charlotte County, Florida


4600003010-WO12R4, Task 3.4




Bond Farm Hydrological Enhancement Impoundment (HEI) *Ready to Advertise*

Technical Specifications

Division 2: Site Work
Division 9: Finishes
Division 11: Equipment
Division 13: Building
Division 15: Mechanical


8/5/2020
DATE

Richard LeBlanc, P.E.
Florida License No. 74712



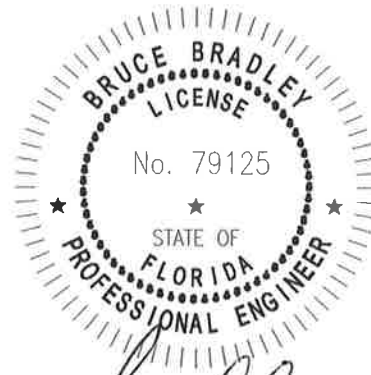
4830 W Kennedy Blvd., Suite 400
Tampa, Florida 33609
CA 4213

Bond Farm Hydrological Enhancement Impoundment (HEI) *Ready to Advertise*

Technical Specifications

Division 3: Concrete

Division 5: Metals



Bruce Bradley 7/31/2020
DATE

Bruce Bradley, P.E.
Florida License No. 79125



4830 W Kennedy Blvd., Suite 400
Tampa, Florida 33609
CA 4213

Bond Farm Hydrological Enhancement Impoundment (HEI) *Ready to Advertise*

Technical Specifications

Division 16: Electrical



DATE

Jose A. Gonzalez, P.E.
Florida License No. 58896



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Tampa, Florida 33609
CA 4213

SECTION	DESCRIPTION	PAGES
DIVISION 1: GENERAL REQUIREMENTS		
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01590	Field Offices and Sheds	3
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END OF DIRECTORY

SECTION 01010 SUMMARY OF WORK

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION summarizes the WORK of the Bond Farm Hydrological Enhancement Impoundment (HEI) Project (Project) as covered in detail in the Contract Documents. This SECTION is a general summary and is not intended to be complete and all inclusive of the required WORK items. The WORK is any and all obligations, duties, responsibilities, labor, materials, equipment, temporary facilities, utilities, and incidentals and the furnishing thereof necessary to complete the construction assigned to or undertaken by the CONTRACTOR pursuant to the Contract Documents.

1.02 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300 including submittals identified in the Contract Documents and as deemed necessary by the COMMISSION.
- B. Submittals mentioned in this SECTION
 1. 01065 Permits
 2. 01310 Construction Schedule
 3. 02200 Embankment and Slope Protection Plan

1.03 PROJECT DESCRIPTION:

- A. Description of Project: The Project is a 538-acre impoundment capable of storing 2,150 ac-ft of water, 4 feet deep on average, with an approximately 8 foot high perimeter berm, 12 foot wide crest, and a 12 foot wide exterior toe road. Excess surface water flows from the Babcock/Webb Wildlife Management Area (WMA) via a stop log drop inlet structure two sets of 36-inch diameter culverts, and the Babcock/Webb Canal into the impoundment perimeter seepage canal and to the 12,500 gpm pump station. The impoundment waters discharge through a fixed crest auxiliary overflow spillway and a manually operated 4 foot by 3 foot gate with a discharge box and two 36-inch diameter culverts. The water levels in the approximately 4.5 mile long perimeter seepage canals are controlled by four sets of flashboard risers, each with a pair of 48-inch diameter culverts. A 5,000 gpm stormwater lift station provides existing drainage service for adjacent properties.
- B. Directions: South of Punta Gorda, Florida on US 41 (Tamiami Trail) turn east onto Oil Well Road (part paved road, part dirt road) for approximately 3.5 miles to the intersection of Oil Well Road and Jack Road to the north and SAL Grade Road to the south. SAL Grade Road (dirt road) is beginning of the construction limits. Turn south onto SAL Grade Road for approximately 1,400 feet to the 669-acre former Bond Farm property.

1.04 RELATED CONTRACT ACTIVITIES:

- A. The CONTRACTOR shall provide adequate slope protection and/or stabilization to protect the WORK, the Site and the general public. The CONTRACTOR shall revegetate all slopes as they are constructed. Slopes include berms, embankments, levees, banks, and any surface that is sloped. Revegetation shall not be greater than 1500 LF behind the construction. An unvegetated slope shall be vegetated and protected immediately. The CONTRACTOR shall submit an Embankment and Slope Protection Plan for COMMISSION approval within 45 days of NTP.

1.05 WORK PERFORMED BY OTHERS:

- A. Lee County Electrical Cooperative (LCEC)
 1. Permanent electrical service will be provided to and routed through the site by LCEC as noted on the Contract Drawings.
 2. The following items will be performed by LCEC:

- a. Furnish and install all transformers.
 - b. Furnish and install all enclosures for primary power.
 - c. Furnish and install all hand holes and pull boxes for primary power.
 - d. Furnish and install all primary power cable.
 - e. Remove existing primary power lines and poles through the site.
3. The following related items shall be performed by the CONTRACTOR:
- a. Furnish and install all secondary power cables, enclosures, cabinets, hand holes, and appurtenances as shown on the Contract Drawings and in these Specifications.
 - b. Furnish and install all conduits for primary and secondary power.
 - c. Perform earthwork sufficient to allow LCEC to install primary power components.
 - d. Coordinate with LCEC per Contract Drawing and Specification requirements.

1.06 CONTRACTOR'S USE OF PREMISES:

- A. See General Terms & Conditions.
- B. During construction activities, the CONTRACTOR shall be responsible for maintaining all access roads in good condition at all times, including grading and drainage, as determined by the COMMISSION. Any damage to these roads is the responsibility of the Contractor to repair immediately. These roads include the following:
 - 1. Oil Well Road.
 - 2. SAL Grade Road.
 - 3. Portion of Babcock/Webb Road within construction limits.
 - 4. Haul roads within the Project site.
 - 5. Any road and any travel route utilized by the CONTRACTOR.
- C. The CONTRACTOR is responsible for Site safety of the CONTRACTOR, Subcontractors, the FWC, others on Site, and the general public.
- D. The CONTRACTOR is responsible for the security of the Site.

1.07 COMMISSION'S USE OF PREMISES:

- A. Partial COMMISSION Occupancy: The COMMISSION reserves the right to occupy and to place and install equipment in areas of the Project, prior to Substantial Completion provided that such occupancy does not interfere with completion of the WORK. Such placing of equipment and partial occupancy shall not constitute acceptance of the WORK.

1.08 EXISTING SITE CONDITIONS:

- A. The typical condition of the site is wet regardless of the time of year. Groundwater/surface water levels historically average 1 foot below existing ground to 2 feet above existing ground. Water levels have been higher than 2 feet above existing ground. Standing water on site is always to be expected regardless of the time of year. All earthwork activities must meet moisture and dewatering requirements. Soils will require drying, moisture conditioning, mixing, and processing before final fill placement. Refer to SECTION 02200 and SECTION 02401.
- B. The entire site has an underlying layer of limestone. The CONTRACTOR shall fully expect to encounter this limestone layer during construction. The bottoms of the seepage canals are required to be excavated to the top of the limestone layer. In order to install the culverts at the required inverts, the CONTRACTOR shall assume that excavation of the limestone layer is required in order to provide the minimum required bedding between the culvert and the limestone. There is no blasting allowed on site. The CONTRACTOR shall provide the proper equipment to be able to excavate the limestone. The limestone layer has variable and high hydraulic conductivities. The CONTRACTOR shall assume that upon contacting or breaching the limestone layer that water will immediately flood the excavation and

the CONTRACTOR shall have the proper dewatering equipment in place to address this influx of water. Refer to SECTION 02200 and SECTION 02401.

1.09 WORK SEQUENCE, COORDINATION ACTIVITIES AND SCHEDULED DATES:

- A. General: The CONTRACTOR shall coordinate its WORK with other adjacent contractors, landowners, utilities and COMMISSION activities, with specific attention to access and staging areas. The CONTRACTOR is solely responsible for this coordination. Construction sequence shall be determined by CONTRACTOR subject to the following needs for continuous access and operation by others.
1. The CONTRACTOR shall provide continuous access to the Project to the COMMISSION.
 2. Oil Well Road which is utilized to access the Project site is a Charlotte County Road and the CONTRACTOR's use of this road shall not interfere with the continuous access and operation of this road by the adjacent landowners and the general public. Oil Well Road is a partially paved and partially dirt road.
 3. The SAL Grade Road East Ditch provides drainage for approximately 80 acres of privately owned lands east of SAL Grade Road, south and west of Oil Well Road and north of the Project. The CONTRACTOR's efforts shall not interfere with the continuous level of drainage service provided by the Project site.
 4. An LCEC overhead power line crosses the Project site and provides power to property owners to the east. The CONTRACTOR's efforts shall not interfere with the continuous power service to these off-site properties.
 - a. LCEC Contact: Keith Lanman, LCEC – Distribution Design, 239-656-2413, Keith.Lanman@lcec.net.
 5. The CONTRACTOR is required to perform all coordination with LCEC for the installation of all primary power equipment, obtaining primary power to the Project site for Project purpose, and the abandonment and relocation of the existing power service on-site that serves property owners to the east. The LCEC will provide and install all required primary power pull boxes, transformers, switching cabinets and other equipment for primary power as noted in paragraph 1.05 of this SECTION. The CONTRACTOR is required to perform the earthwork operations necessary for LCEC to install the primary power equipment. Per the fixed price amount on the bid form, the CONTRACTOR shall pay LCEC for all of LCEC services associated with permanent power for the Bond Farm HEI Project and for all of LCEC services associated with the abandonment and final relocation of existing power within the Project site.
 - a. The CONTRACTOR is responsible for all temporary power equipment and appurtenances.
 - b. The CONTRACTOR is responsible to pay for all power usage during construction through Substantial Completion including the power usage for the testing of both pump stations.
- B. Suggested Construction Sequence: A suggested sequence of construction has been prepared by the Architect/Engineer and is presented below. Note that several of the construction operations could be performed simultaneously with multiple crews. The CONTRACTOR shall provide their own construction sequence in the Construction Schedule adhering to the access, coordination and operation requirements and compliance with the overall Contract Documents and Contract Period.
1. Obtain permits.
 2. Submit construction schedule.
 3. Submit list of submittals and submittals.
 4. Stake construction limits.
 5. Mobilize.
 6. Install culvert extensions and widen road at intersection of Oil Well Road and SAL Grade Road.
 7. Stake all access and haul roads for approval prior to clearing and grubbing.
 8. Establish and install dewatering system for site access.
 9. Establish and install controls for managing site surface water and maintaining existing drainage through site from the SAL Grade Road East Ditch.

10. Establish Contractor staging and laydown areas including areas to process on-site soils for construction. Stake each area for approval prior to clearing and grubbing.
11. Stake areas of construction including no-excavation area adjacent to interior impoundment toe, secondary borrow areas within the impoundment interior, and sections of SAL Grade Road to be removed.
12. Construct the North Seepage Canal including the entire cross-section for the existing property berm, Boundary Maintenance Road, North Seepage Canal, Toe Road and Perimeter Berm including Wave Bench and the installation of buried electrical conduits and pull boxes from the northwest corner of Project to the northeast corner of the Project.
13. Construct the Bond Farm HEI Pump Station.
14. Construct the West Seepage Canal including the entire cross-section for the existing property berm, Boundary Maintenance Road including the installation of buried electrical conduits and pull boxes, West Seepage Canal, Toe Road and Perimeter Berm including Wave Bench.
15. Construct the West Seepage Canal Flashboard Riser discharge to the existing Sandy Hartman's Canal.
16. Construct the Primary Discharge Structure.
17. Construct the Auxiliary Overflow Spillway.
18. South of the Babcock/Webb Canal, construct the East Seepage Canal including the entire cross-section for the existing property berm, Boundary Maintenance Road including the installation of buried electrical conduits and pull boxes, West Seepage Canal, Toe Road and Perimeter Berm including Wave Bench.
19. Construct the East Seepage Canal Flashboard Riser discharge to the existing Sandy Hartman's Canal.
20. Construct the Babcock/Webb Stop Log Structure and associated culverts.
21. Construct the northern portion of the East Seepage Canal including the entire cross-section for the Babcock/Webb Canal, the existing property berm, Boundary Maintenance Road including the installation of buried electrical conduits and pull boxes, East Seepage Canal, Toe Road and Perimeter Berm.
22. Construct the North and East Seepage Canals Flashboard Riser and associated culverts and buried electrical conduits.
23. Construct the Babcock/Webb Intake Structure.
24. Construct the remaining portion off the North Seepage Canal from the Bond Farm HEI Pump Station to the North and East Seepage Canals Flashboard Riser including the entire cross-section for the Babcock/Webb Canal, the existing property berm, Boundary Maintenance Road, North Seepage Canal, Toe Road and Perimeter Berm including Wave Bench and the installation of buried electrical conduits and pull boxes.
25. Construct the SAL Grade Road Pump Station with generator and diesel fuel tank.
26. Coordinate with LCEC for temporary power service for properties off site.
27. Complete demolition efforts within impoundment interior including the coordination with LCEC of the removal of the existing overhead power lines.
28. Demobilize staging and laydown areas within the impoundment interior.
29. Provide temporary power to the SAL Grade Road Pump Station.
30. Block the SAL Grade Road East Ditch and utilize the SAL Grade Road Pump Station to provide drainage service.
31. Complete construction of the Perimeter Berm including Wave Bench in the northwest corner of the Project.
32. Construct North and West Seepage Canals Culvert and Flashboard Riser.
33. Construct new SAL Grade Road and finish construction in the northwest corner of the Project.
34. Coordinate with LCEC for the installation of permanent power.

35. Test both pump stations and discharge gate. Demonstrate stop logs and boards can be installed and removed at all structures. Provide training.
 36. Perform final mowing of all slopes and roads. Perform final grading of Perimeter Berm shellrock road and northwest corner of the Project.
 37. Install shellrock on approximately 1,400 feet of SAL Grade Road from Oil Well Road to northwest corner of Project.
 38. Submit As-Builts, O&M Manuals, and other closeout documentation.
 39. Substantial Completion.
 40. Finish demobilization and Final Completion.
- C. Scheduled Events: Schedule the WORK to conform to the following events and dates, and to provide for coordination with the WORK performed by others.
1. N/A.

1.10 REFERENCE MATERIALS:

- A. The following reference materials are included as part of this solicitation. These materials are for reference only, are provided as-is, are not Contract Documents unless stated otherwise, and do not replace the CONTRACTOR's due diligence in bid preparation. Reference documents are not guaranteed as to accuracy or completeness; they are provided for informational purposes only.
1. AutoCAD native files of Drawings.
 2. Geotechnical Engineering Report, Terracon Consultants, Inc., dated February 25, 2020.
 3. Bond Farm Property Boundary Survey, FDEP, dated January 30, 2015.
 4. Land Survey Report, McKim & Creed, dated September 1, 2017.
 5. FDEP ERP (Contract Document)
 6. USACE 404 Permit (Contract Document)
 7. Charlotte County Stormwater Permit (Contract Document)
 8. Charlotte County Special Exception (Contract Document)
 9. Dewatering Permit (Contract Document)
 10. FDOT I-75 SFWMD Permit Mod 08-00155-P, October 20, 2014
 11. Phase I Environmental Site Assessment, October 2014
 12. Phase II Environmental Site Assessment, November 3, 2014
 13. Pre-Demolition Asbestos Survey, March 20, 2020
 14. Septic Tank Closeout Documentation, January 30, 2020
 15. LCEC Cost Estimate, May 5, 2020
 16. Dewatering Considerations Technical Memorandum, August 3, 2020

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01015 DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.01 SCOPE:

A. Definitions:

1. A substantial amount of the Technical Specification (specification) language constitutes definitions for terms found in other areas of the Contract Documents including the Drawings, which must be recognized as diagrammatic in nature and not completely descriptive of all requirements necessary.
2. Certain terms used in the Contract Documents are defined in the General Terms & Conditions. Definitions and explanations are not necessarily either complete or exclusive but are general for the WORK.
3. The terms "COMMISSION", "FWC", and "OWNER", as defined in the General Terms & Conditions and used in these specifications, is further defined as the Florida Fish and Wildlife Conservation Commission, Florida Wildlife Commission, and the COMMISSION's authorized representative, which may include, but is not limited to, the Architect/Engineer, Design Engineer, Project Manager, Construction Representative, Construction Manager and any representatives of these entities.
4. The term "WORK" is any and all obligations, duties, responsibilities, labor, materials, equipment, temporary facilities, utilities, and incidentals and the furnishing thereof necessary to complete the construction assigned to or undertaken by the CONTRACTOR pursuant to the Contract Documents.
5. The terms "levee", "berm", "embankment", "bank" and "slope" are used interchangeably within the Contract Documents and all have the same meaning and requirements.
6. The terms "fill" and "backfill" are used interchangeably within the Contract Documents and have the same meaning and requirements.

- B. General Requirements: General requirements are the provisions or requirements of Division 1 SECTIONs which apply to the entire WORK of the Contract.

1.02 FORMAT AND SPECIFICATION EXPLANATIONS:

- A. Format Explanation: The format of principal portions of these specifications can be described as follows, although other portions may not fully comply and no particular significance will be attached to such compliance or noncompliance.

1. SECTIONs and DIVISIONs: For convenience, the basic unit of the specification text is a "SECTION", each unit of which is named and numbered. These are organized into related families of sections, and various families of sections are organized into "DIVISIONs", which are recognized as the present industry consensus on uniform organization and sequencing of specifications. The SECTION title is not intended to limit meaning or content of SECTION, nor to be fully descriptive of requirements specified therein, nor to be an integral part of the text.
2. SECTION Numbering: Used for identification and to facilitate cross-references in the Contract Documents. SECTIONs are placed in numeric sequence; however, the numbering is not sequential, and listing of SECTIONs in Table of Contents at the beginning of the Technical Specifications must be consulted to determine numbers and names of specification SECTIONs in these Contract Documents.
3. Page Numbering: Numbered independently for each SECTION. The SECTION number is shown with the page number at bottom of each page to facilitate location of the text.

4. Parts: Each SECTION of these specifications generally has been subdivided into three (3) basic parts for uniformity and convenience (Part 1 "General", Part 2 "Products", and Part 3 "Execution"). These parts do not limit the meaning of the text within. Some SECTIONS may not contain all three parts when not applicable, or may contain more than three parts to add clarity to organization of the SECTION.
 5. Imperative Language: Used generally in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the CONTRACTOR. For clarity of reading, at certain locations contrasting subjective language is used to describe responsibilities which must be fulfilled by the CONTRACTOR or, when so noted, by others.
 6. Specialists Assignments: In certain instances, specification text requires that specific work be assigned to specialists or expert entities who must be engaged for performance of those units of work. These must be recognized as special requirements over which the CONTRACTOR has no choice or option. These assignments must not be confused with, and are not intended to interfere with, normal application of regulations, union jurisdictions and similar conventions. Nevertheless final responsibility for fulfillment of the entire set of requirements remains with the CONTRACTOR.
 7. Trades: Except as otherwise specified or indicated, the use of titles such as "carpentry" in specification text, implies neither that the work must be performed by an accredited or unionized tradesperson of corresponding generic name (such as "carpenter"), nor that the specified requirements apply exclusively to work by tradespersons of that corresponding generic name.
- B. Specification Content: Because of methods by which this Project specification has been produced, certain general characteristics of contents and conventions in use of language are explained as follows:
1. Specifying Methods: The techniques or methods of specifying requirements varies throughout the text, and may include "prescriptive", "compliance with standards", "performance", "proprietary", or a combination of these. The method used for specifying one unit of work has no bearing on requirements for another unit of work.
 2. Overlapping and Conflicting Requirements: Where compliance with two (2) or more industry standards or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, notify the FWC for a decision, as specified in the General Terms & Conditions.
 3. Abbreviations: Throughout the Contract Documents are abbreviations implying words and meanings which will be appropriately interpreted. Specific abbreviations have been established, principally for lengthy technical terminology, and in conjunction with coordination of specification requirements, with notations on the Drawings and in schedules. These are normally defined at first instance of use. Organizational and association names and titles of general standards are also abbreviated.

1.03 DRAWING SYMBOLS:

- A. Except as otherwise indicated, graphic symbols used on the Drawings are those symbols generally recognized in the construction industry for the purposes indicated. Refer instances of uncertainty to the FWC for clarification.

1.04 INDUSTRY STANDARDS - APPLICABILITY:

- A. Applicable standards of the construction industry have the same force and effect, and are made a part of the Contract Documents by reference, as if copied directly into the Contract Documents, or as if published copies were bound herewith. Referenced standards referenced directly in the Contract Documents or by governing regulations have precedence over non-referenced standards which are recognized in industry for applicability to work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01050 FIELD ENGINEERING AND SURVEYING

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work:

1. The CONTRACTOR shall engage a Professional Engineer of the discipline required, registered in the State of Florida, to perform engineering services for temporary facilities including the design of shoring systems, shores, earth and water retaining systems, dewatering, forms, temporary erection supports, and similar items provided by the CONTRACTOR as part of its means and methods of construction.
2. The CONTRACTOR shall engage a Professional Surveyor and Mapper licensed in the State of Florida to perform all necessary construction layout surveys, horizontal and vertical control, As-Built (Record) Surveys, and Topographic Surveys in accordance with Chapter 472.027 of the Florida Statutes and Chapter 5J-17 Florida Administrative Code (FAC) and these Specification SECTIONS.
3. The CONTRACTOR shall furnish, at his expense, the services of a Professional Surveyor and Mapper licensed in the State of Florida for the field layout of all WORK indicated or specified in the Contract Documents. The CONTRACTOR's licensed surveyor shall perform all initial Site layout and shall provide follow-up verification of all WORK underway as necessary.

B. Related Work Specified Elsewhere:

1. SECTION 01300 - Submittals
2. SECTION 01700 – Contract Closeout
3. SECTION 02200 – Earthwork
4. SECTION 02781 – Staff Gauges

1.02 SUBMITTALS:

A. Submit in accordance with SECTION 01300.

B. Submittals mentioned in this SECTION.

1. Temporary Facilities Signed and Sealed Engineering Documents
2. Name(s) and address(s) of the licensed survey firms(s)
3. Compliance Survey Plan
4. Preliminary Surveyor's Reports
5. Final Surveyor's Report

PART 2 - PRODUCTS / EXECUTION

2.01 DESCRIPTION: In connection with this WORK, the CONTRACTOR shall be responsible for:

- A. Performing all construction layout survey tasks as necessary for construction and satisfactory completion of the WORK.
- B. Verifying benchmark elevations by running a level loop between a minimum of two (2) vertical control points prior to the construction layout survey, establishing the Project elevation data, and new benchmarks where necessary.
 1. As indicated on the Drawings, there are two existing benchmarks on site which are anticipated to be disturbed by construction efforts. The Contractor shall provide a plan for replacing these benchmarks; the Contractor shall replace these benchmarks.
- C. Completing all leveling under the supervision of a Florida licensed Professional Surveyor and Mapper. The level run shall close to within 0.03 feet * $\sqrt{\text{miles}}$ (0.03 feet times the square root of the distance in miles).

- D. Performing at a minimum two (2) daily check measurements with RTK Global Positioning System (GPS) on a minimum of two (2) different Project control monuments in two (2) different satellite geometric layouts.
- E. Performing a peg test as necessary on all level equipment with needed adjustments to maintain the accuracy of the instruments.
- F. Keeping a record of all survey work in a survey field book in a clear, orderly, and neat manner consistent with standard surveying practices.

2.02 CONSTRUCTION REQUIREMENTS:

- A. The CONTRACTOR's personnel performing the construction layout survey shall work under the direct supervision of a Florida licensed Professional Surveyor and Mapper. Submit the name(s) and address(s) of the survey firms(s) responsible for the Project surveying requirements to the FWC prior to start of survey activities.
- B. The CONTRACTOR shall be solely and completely responsible for the accuracy of the line and grade of all features of the WORK. Any errors or apparent discrepancies found in previous surveys, Drawings, or specifications shall be called to the attention of the FWC by the CONTRACTOR for correction or interpretation prior to proceeding with the WORK.
- C. The CONTRACTOR shall be responsible for the placement, referencing, and preservation of all survey control points, whether set or found on the Project. All boundary corners (i.e. section corners, fractional section corners, similar Project survey monumentation) and benchmarks that may be lost, destroyed or disturbed during construction shall be carefully replaced and referenced by a Florida licensed Professional Surveyor and Mapper.
- D. The supervision of the CONTRACTOR's construction surveying personnel shall be the responsibility of the CONTRACTOR; any deficient surveying layout or construction WORK which may be the result of inaccuracies in construction layout survey operations or failure to report inaccuracies found in WORK shall be corrected at the expense of the CONTRACTOR.
- E. Station Identification: On linear elements of construction (such as levees, canals, and similar items) the CONTRACTOR shall place temporary identifying signs (stakes) at intervals no greater than 500 feet using four (4) foot sections of one (1) inch by four (4) inches lumber driven into the ground. The signs shall identify the station at that location.
- F. No Excavation Areas: The CONTRACTOR shall stake all no excavation areas identified in the Drawings. Stakes shall be clearly identified as No Excavation Area.
- G. Secondary Borrow Areas: The CONTRACTOR shall stake the secondary borrow areas within the impoundment and obtain FWC approval prior to excavating from these areas. Stakes shall be clearly identified as Secondary Borrow Area.
- H. Access Roads and Haul Roads: The CONTRACTOR shall stake areas for all access and haul roads and obtain FWC approval of the route prior to disturbing area for utilization.
- I. Staging and Laydown Areas: The CONTRACTOR shall stake areas for all staging areas, laydown areas and any other area the Contractor is going to disturb and obtain FWC approval of those areas prior to disturbing area for utilization.
- J. The CONTRACTOR shall maintain all stakes to the satisfaction of the FWC and replace damaged stakes immediately.

2.03 SURVEY STANDARDS: The CONTRACTOR shall follow the following standards to establish the vertical and horizontal data at the Project Site:

- A. Vertical Data:
 - 1. All vertical data shall be collected and displayed in North American Vertical Datum 88 (NAVD 88). All Vertical elevation control level runs shall start and end on National Geodetic Survey (NGS) Second Order or higher FWC approved vertical control monuments. The

CONTRACTOR shall use a minimum of two (2) different NGS Second Order or FWC approved published benchmarks that are a minimum of one-half mile apart. The level run(s) between monuments must close on each other. If the monuments do not close on each other the surveyor shall re-do the level runs or use another NGS monument until the two (2) monuments used in the level run close. The level run shall close to within $0.03 \text{ feet} * \sqrt{\text{miles}}$ (0.03 feet times the square root of the distance in miles).

- B. All Vertical elevation control level runs shall start and end on National Geodetic Survey (NGS) Second Order or higher FWC approved vertical control monuments.
 - 1. If elevations need to be converted to NGVD 29, use the CORPSCON 6.0.1 with the Corps of Engineers, South Atlantic Division's "vertcon 05.txt" file added to the CORPSCON 6.01 file.
- C. Horizontal Data (State Plane Coordinates):
 - 1. All horizontal data shall be collected in and based on the North American Datum (NAD 1983/2007) adjustment or higher. Horizontal coordinate control shall be established from existing NGS or FWC approved Second Order control or higher in the area by using a minimum of conventional NGS Third Order field observation procedures. All horizontal work shall be done in the same horizontal adjustment (no mixing of the adjustments). Once the horizontal datum has been established it shall not change for the life of the project.

2.04 AS-BUILT CROSS-SECTIONS

- A. Provide a certified copy, in accordance with Paragraph 2.06 below, of field measured cross-sections of the final embankments, berms, levee, slopes and canals prepared by a Professional Surveyor and Mapper licensed in the State of Florida for payment and record purposes, measured at a maximum of 200-foot intervals and at lesser intervals as needed to fully define the work. The survey information must be provided in a cross-section format. A plan view format is not acceptable.

2.05 BENCHMARKS

- A. The Bond Farm HEI Pump Station, SAL Grade Road Pump Station, Auxiliary Overflow Spillway and the Primary Discharge Structure shall require at a minimum one (1) new Site benchmark to be set in the concrete of each of these features. A survey disk (approved by the FWC) stamped with the feature designation shall be permanently grouted into the structure of the Project feature provided it is on a portion of the structure that does not have an expansion joint. The CONTRACTOR shall only stamp or engrave the benchmark identification and not the elevation. If a NGS Class "B" mark is set, the survey disk is not required and the designation shall be stamped on the benchmark cap.
- B. The two existing benchmarks to be replaced per Paragraph 2.01.B.1 of this SECTION shall be replaced in kind.
- C. A benchmark description sheet meeting established survey standards shall be completed for each benchmark established (set) for use in the Project.

2.06 RECORDS AND SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Provide FWC a copy of the designs described in Paragraph 1.01.A.1 of this SECTION signed and sealed by the Florida registered Professional Engineer in charge of the Project.
- C. Provide FWC with a Compliance Survey Plan documenting the CONTRACTOR's approach to implementing the survey requirements provided in this SECTION, documentation of the level loop performed per Paragraphs 2.01.B and C of this SECTION, documentation of the establishment of the vertical and horizontal data per Paragraph 2.03 of this SECTION, and recommendation for the location of all benchmarks required to be set for the Project.
- D. Provide FWC one (1) copy of the Preliminary Surveyor's Reports with each survey submittal for the Project, and two (2) comprehensive all-inclusive copies of the final signed, sealed and certified Final Surveyor's Report at Substantial Completion to the FWC.

1. At a minimum, each report shall include: an overall Project description, location sketches, field notes, equipment used, photographs and a horizontal data (NAD 1983/2007 state plane coordinate (RTK)) on each new bench mark (if applicable).
 2. A CD containing Surveyor's firm name and logo, Surveyor's Report, digital photographs, benchmark description sheets and any other associated data.
- E. Record/As-Built Surveys:
1. The CONTRACTOR shall provide one (1) set of conventional certified hardcopy As-Built Survey overlaid on the Drawings.
 2. The CONTRACTOR shall provide a single certified PDF file with all data attached to that file.
 3. The CONTRACTOR shall provide AutoCAD digital files for each of the certified hard copies.
 4. The As-Built Survey includes the As-Built cross-sections specified in Paragraph 2.04 and all other As-Built documentation required per the Specification SECTIONS, Drawings and Contract Documents to adequately convey the construction performed by the Contractor.
- F. Software:
1. The software and software version utilized by the CONTRACTOR shall be approved by the FWC.

END OF SECTION

SECTION 01065 PERMITS AND FEES

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work:

1. Unless otherwise specified, the CONTRACTOR shall obtain and pay for all permits and licenses related to the WORK as provided for in the General Terms & Conditions. This includes all Charlotte County required permits including but not limited to demolition, right-of-way, electrical, plumbing, and building permits and all South Florida Water Management District required permits including but not limited to dewatering permit.
2. The CONTRACTOR will be issued copies of all permits obtained by the FWC. A copy of the permits shall be posted at the Site at all times during construction. The CONTRACTOR shall be responsible for familiarizing himself with the permits and shall abide by the permit conditions at all times.
 - a. For the FWC-obtained dewatering permit for site access and mobilization and any other applicable permits, the CONTRACTOR shall be responsible for obtaining applicable permits from the Florida Department of Transportation or any other necessary agreements and permits in order to access a downstream location within the Sandy Hartman's Canal for turbidity monitoring.
3. The WORK shall be conducted, and shall result in construction of the improvements of the Project, in full accordance with the conditions of the permits granted for the Project.

1.02 SUBMITTALS:

- A. Submittals shall be provided in accordance with SECTION 01300.
- B. Submittals mentioned in this SECTION:
 1. Contractor Obtained Permits

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01071 STANDARD REFERENCES

Wherever used in the Contract Documents, the following abbreviations will have the meanings listed:

AA	Aluminum Association Incorporated 818 Connecticut Avenue, NW Washington, DC 20006
AABC	Associated Air Balance Council 1518 K Street NW Washington, DC 20005
AAMA	American Architectural Manufacturers Association 2700 River Road, Suite 118 Des Plaines, IL 60018
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, NW, Suite 225 Washington, DC 20001
ABMA	American Bearing Manufacturers Association 2025 M Street, NW Suite 800 Washington, DC 20036
ACI	American Concrete Institute 38800 Country Club Drive Farmington Hills, MI, 48331
AEIC	Association of Edison Illuminating Companies 600 18 th Street N Birmingham, Al 35203
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association 400 N. Capital Street, NW Suite 450 Washington, DC 20001
AGMA	American Gear Manufacturer's Association 500 Montgomery Street, Suite 350 Alexandria, VA 22314
AHA	American Hardboard Association 1210 West Northwest Hwy Palatine, IL 60067
AISC	American Institute of Steel Construction One East Wacker Drive, suite 700 Chicago, IL 60601
AISI	American Iron and Steel Institute 1000 16th Street, NW Washington, DC 20036

AITC	American Institute of Timber Construction 333 West Hampden Avenue Englewood, CO 80110
ALSC	American Lumber Standards Committee P. O. Box 210 Germantown, MD 20874
AMCA	Air Movement and Control Association, Inc. 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute, Inc. 25 West 43 rd Street New York NY 10036
APA	American Plywood Association P.O. Box 11700 Tacoma, WA 98411
API	American Petroleum Institute 1220 L Street, NW Washington, DC 20005
AHRI	Air-Conditioning Heating and Refrigeration Institute 1814 North Fort Myer Drive Arlington, VA 22209
ASCE	American Society of Civil Engineers 345 East 47th Street New York, NY 10017
ASCII	American Standard Code for Information Interchange United States of America Standards Institute 10 East 40th Street New York, NY 10016
ASE	American Standard Safety Code for Elevators, Dumbwaiter and Escalators American National Standards Institute/ASME A17.1/CSA B44 1430 Broadway New York, NY 10018
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers United Engineering Center 1791 Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103

AWPA	American Wood Preservers Association P.O. Box 361784 Birmingham, AL 35236
AWPB	American Wood Preservers Bureau 7962 Conell Court P. O. Box 5283 Lorton, VA 22079
AWPI	American Wood Preservers Institute 1945 Old Gallows Road, Suite 150 Vienna, VA 22182
AWI	Architectural Woodwork Institute 46179 Westlake Drive, Suite 120 Potomac Falls, VA 20165
AWS	American Welding Society 550 NW Lejune Road Miami, FL 33126
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BHMA	Builders Hardware Manufacturers Association 355 Lexington Avenue, 17 th Floor New York, NY 10017
BOCA	Building Officials and Code Administrators 17926 Halstead Homewood, IL 60430
CBMA	Certified Ballast Manufacturers Association 2120 Keith Building Cleveland, OH 44115
CMAA	Crane Manufacturers Association of America (Formerly called: Overhead Electrical Crane Institute) (OECI) 8720 Reds Oak Boulevard, Suite 201 Charlotte, NC 28217
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173
CSA	Canadian Standards Association 155 Queen Street, Suite 1300 Ottawa, Ontario, CA K1P6L1
DEMA	Diesel Engine Manufacturer's Association 122 East 42nd Street New York, NY 10017

DHI	Door Hardware Institute 14150 Newbrook Drive, Suite 200 Chantilly, VA 20151
DIS	Division of Industrial Safety California Department of Industrial Relations 2422 Arden Way Sacramento, CA 95825
EEI	Edison Electric Institute 701 Pennsylvania Avenue, NW Washington, DC 20004
EIA	Electronic Industries Alliance 2001 Eye Street, NW Washington, DC 20006
EJMA	Expansion Joint Manufacturer's Association 25 North Broadway Tarrytown, NY 10591
EPA	Environmental Protection Agency Region 4 Sam Nunn Atlanta Federal Center 61 Forsyth Street, SW Atlanta, GA 30303-3104
ESO	Electrical Safety Order, California Administrative Code, Title 8, Chap. 4, Subarticle 5 Office of Procurement, Publications Section P. O. Box 20191 8141 Elder Creek Road Sacramento, CA 95820
FAC	Florida Administrative Code
FEDSPEC	Federal Specifications General Services Administration Specification and Consumer Information Distribution Branch Washington Navy Yard, Bldg. 197 Washington, DC 20407
FEDSTDS	Federal Standards (see FEDSPECS)
FM	Factory Mutual Research 1151 Boston-Providence Turnpike Norwood, MA 02062
GANA	Glass Association of North America 800 SW Jackson Street, Suite 1500 Topeka, Kansas 66612
HEI	Heat Exchange Institute 1300 Summer Avenue Cleveland, OH 44115

HI	Hydraulic Institute 1230 Keith Building Cleveland, OH 44115
HPVA	Hardwood Plywood and Veneer Association 1825 Michael Faraday Drive Reston, VA 20190
IAPMO	International Association of Plumbing and Mechanical Officials 5001 E. Philadelphia Street Ontario, CA 91761
ICBO	International Conference of Building Officials 5360 South Workman Mill Road Whittier, CA 90601
ICEA	Insulated Cable Engineers Association P. O. Box P South Yarmouth, MA 02664
ICRI	International Concrete Repair Institute 10600 West Higgins Road, Suite 607 Rosemont, IL 60018
IEEE	Institute of Electrical and Electronics Engineers, Inc. 3 Park Avenue, 17 th Floor New York, NY 10016-5997
IES	Illuminating Engineering Society c/o United Engineering Center 120 Wall Street Floor 17 New York, NY 10005
ISA	Instrument Society of America 67 Alexander Drive Research triangle Park, NC 27709
ISO	International Organization for Standardization 1, ru de Varembé, Case Postale 56 CH-1211 Genna 20, Switzerland
JIC	Joint Industrial Council 7901 Westpark Drive McLean, VA 22101
MFMA	Metal Framing Manufacturers Association 401 Michigan Avenue Chicago, IL 60611
MILSPEC	Military Specifications Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120

MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. 127 Park Avenue, N.E. Vienna, VA 22180
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt rd bldg C, Suite 312 Glen Ellyn, IL 60137
NACE	National Association of Corrosion Engineers P. O. Box 986 Katy, TX 77450
NEC	National Electrical Code National Fire Protection Association 470 Atlantic Avenue Boston, MA 02210
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814
NELMA	Northeastern Lumber Manufacturers Association, Inc. 272 Turtle Road P. O. Box 87A Cumberland Center, ME 04021
NEMA	National Electrical Manufacturer's Association 1300 N. 17 th Street, Suite 1752 Rosslyn, VA 22209
NESC	National Electric Safety Code American National Standards Institute 1430 Broadway New York, NY 10018
NETA	InterNational Electrical Testing Association 3050 Old Centre Avenue, Suite 102 Portage, MI 49024
NFP	National Forest Products Association (Formerly National Lumber Manufacturer's Association) 1619 Massachusetts Avenue Washington, DC 20036
NFPA	National Fire Protection Association Batterymarch Park Quincy, MA 02269
NHLA	National Hardwood Lumber Association P. O. Box 34518 Memphis, TN 38184-0518
NIST	National Institute of Standards and Technology 100 Bureau Drive, Suite 1070 Gaithersburg, MD 20899-1070

NSF	National Sanitation Foundation P.O. Box 130140 789 N. Dixoboro Road Ann Arbor, MI 48113
OSHA	Occupational Safety and Health Act U.S. Department of Labor Occupational and Health Administration San Francisco Regional Office 200 Constitution Avenue Washington, DC 20210
PCI	Prestressed Concrete Institute 200 W. Adams Street, Suite 2100 Chicago, IL 60606
PPIC	The Plumbing & Piping Industry Council, Inc. 135 Calle Catalina Place Houston, TX 77007
RIS	Redwood Inspection Service California Redwood Association 818 Grayson Road, Suite 201 Pleasant Hill, CA 94523
RLM	Reflector and Lamp Manufacturers Standard Institute
RMA	Rubber Manufacturers Association 1400 K Street Washington, DC 20005
SAE	Society of Automotive Engineers 400 Commonwealth Drive Warrendale, PA 15096
SBC	Standard Building Code Published by SBCCI
SMC	Standard Mechanical Code Published by SBCCI
SBCCI	Southern Building Code Congress International 1116 Brown-Marx Building Birmingham, AL 35203
SCMA	Southern Cypress Manufacturers Association 805 Sterick Bldg. Memphis, TN 38103

SDI	Steel Door Institute 30200 Detroit road Westlake, OH 44145
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc. 4201 Lafayette Center Drive Chantilly, VA 20151
SPC	Society for Protective Coatings 40 24 th Street, 6 th Floor Pittsburgh, PA 15222
SPI	Society of the Plastics Industry, Inc. 1667 K Street, NW Suite 1000 Washington, DC 20006
SPIB	Southern Pine Inspection Bureau P.O. Box 10915 Pensacola, FL 32524
SSPC	The Society for Protective Coatings (formerly called: Steel Structures Painting Council) 40 24 th Street, 6 th Floor Pittsburgh, PA 15222-4656
SSPWC	Standard Specifications for Public Works Construction Building News, Inc. 3055 Overland Avenue Los Angeles, CA 90034
TEMA	Tubular Exchanger Manufacturer's Association 3251 Corte Malpaso, Suite 507 Camarillo, CA 93012
UL	Underwriters Laboratories Inc. 2600 NW Lake Road Camas, WA 98607
USBR	Bureau of Reclamation U.S. Department of Interior Engineering and Research Center Denver Federal Center, Building 67 Denver, CO 80225
USACE	United States Army Corps of Engineers Jacksonville District P. O. Box 4970 Jacksonville, FL 32232-0019
WCLIB	West Coast Lumber Inspection Bureau 6980 SW Varns Street P. O. Box 23145 Tigard, OR 97223

WWPA

Western Wood Products Association
(Formerly called: West Coast Lumbermen's Association (WCLA))
522 SW 5th Avenue, Suite 500
Portland, OR 97204

END OF SECTION

SECTION 01200 PROJECT MEETINGS AND REPORTS

PART 1 - GENERAL

1.01 SCOPE

- A. Summary of Work: This SECTION includes the following administrative and procedural requirements:
1. Project Meetings:
 - a. Preconstruction conference
 - b. Progress meetings
 2. Schedules and Reports:
 - a. Initial coordination submittals
 - b. Construction Schedules (See SECTION 01310)
 - c. Special reports
- B. Related Work Specified Elsewhere:
1. SECTION 01300 – Submittals
 2. SECTION 01310 – Cost Loaded Construction Schedule

1.02 SUBMITTALS:

- A. All submittals shall be made in accordance with SECTION 01300.
- B. Submittals mentioned in this SECTION.
1. Weekly Construction Log
 2. Weekly One-week Look-back and Two-week Look-ahead
 3. Construction Schedule
 4. Submittal List/Log

1.03 PROJECT MEETINGS:

- A. Pre-construction Conference
1. The FWC will administer a pre-construction conference to review items stated in the following agenda and to establish a working understanding between the parties as to their relationships during conduct of the WORK.
 2. The Preconstruction conference shall be attended by:
 - a. The CONTRACTOR, Project Superintendent, Schedule Superintendent, and Foreman
 - b. Representatives of principal Subcontractors and Suppliers
 - c. Architect/Engineer and his Resident Project Representative if any
 - d. The FWC or its representative
 - e. Other affected parties determined by the FWC
 3. Draft Agenda:
 - a. Projected Construction Schedules

- b. Critical WORK sequencing
 - c. Designation of responsible personnel
 - d. Project coordination
 - e. Procedures and Processing of:
 - i. Field decisions
 - ii. Requests for information
 - iii. Substitutions
 - iv. Submittals
 - a) Pre-construction/Initial Submittals
 - b) Submittal List/Log
 - v. Change Orders
 - vi. Applications for payment
 - f. Procedures for testing
 - g. Procedures for maintaining record documents including As-Builts
 - h. Use of Premises:
 - i. Office, work and storage areas
 - ii. FWC's requirements
 - i. Construction facilities, controls, and construction aids
 - j. Temporary utilities
 - k. Safety and first aid
 - l. Security
 - m. Requirements of any permits obtained by the FWC and/or the CONTRACTOR
4. Location of Meeting: The CONTRACTOR shall secure an air condition location with restroom facilities near the Project site for 25 people with the ability to teleconference.

B. Progress Meetings:

1. The FWC will administer a progress meeting a minimum of every week and at other times requested by the FWC. The FWC, CONTRACTOR and all Subcontractors active on the Site shall be represented at each meeting. The CONTRACTOR may request attendance by representatives of his Suppliers and other Subcontractors, or other entities concerned with the Project or involved with the planning, coordination or performance of future Project activities. All participants in the meeting shall be familiar with the Project and authorized to conclude matters relating to the WORK.
2. The CONTRACTOR and each Subcontractor shall be prepared to report on and discuss the current construction progress, any anticipated future changes to the Construction Schedule, and advise if their current progress, and anticipated future schedules are compatible with the WORK.
3. If one Subcontractor is delaying another, the CONTRACTOR shall direct such changes as are necessary for those involved to mutually agree on the Construction Schedule changes in the best interest of construction progress.
4. Draft Agenda:
 - a. Review of construction progress since previous meeting

- b. Field observations, interface requirements, conflicts
 - c. Issues which may impede the Construction Schedule
 - d. Off-site fabrication
 - e. Delivery schedules
 - f. Submittal schedules and status
 - g. Site utilization
 - h. Temporary facilities and services
 - i. Hours of Work
 - j. Hazards and risks
 - k. Housekeeping
 - l. Quality and Work standards
 - m. Change orders
 - n. Documentation of information for payment request
 - o. Corrective measures and procedures to regain projected schedule, if necessary
 - p. Revisions to the Construction Schedule
 - q. Progress and schedule during the succeeding WORK period
 - r. Review proposed changes for:
 - i. Effect on the Construction Schedule and on the Completion Date
 - s. Other business
5. Location of Meetings: On-site. FWC Field Office provided by CONTRACTOR. If FWC Field Office not available, the CONTRACTOR shall make provisions for these weekly meetings to be held on-site inside with air conditioning and appropriate sanitary facilities.
 6. At each meeting the CONTRACTOR shall submit a written weekly Construction Log to the FWC along with a written One-week Look-back and Two-week Look-ahead of construction activities including schedule of submittal submissions.
 7. Meeting Reporting: After each meeting, minutes of the meeting will be distributed by the FWC to each party present and to parties who should have been present.

C. Special Reports:

1. When an event of an unusual and/or significant nature occurs at the Site, a special report shall be prepared and submitted by the CONTRACTOR to the FWC. List the chain of events, persons participating, the response by CONTRACTOR's personnel, an evaluation of the results or effects, and similar pertinent information.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01300 SUBMITTALS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION includes definitions, descriptions, transmittal, and review of Submittals.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01310 - Construction Schedules
 - 2. SECTION 01700 - Contract Closeout
- C. Refer to Paragraphs 1.03 for Submittals mentioned in this SECTION.

1.02 GENERAL INFORMATION:

- A. Definitions:
 - 1. Submittals include Shop Drawings, product data, and samples which are prepared by the CONTRACTOR, Subcontractor, MANUFACTURER, or Supplier and submitted by the CONTRACTOR to the FWC as a basis for approval of the use of Equipment and Materials proposed for incorporation in the WORK or needed to describe installation, operation, maintenance, or technical properties.
 - a. Shop Drawings include custom-prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.
 - b. Product data includes standard printed information on materials, products and systems not custom-prepared for this Project, other than the designation of selections from available choices.
 - c. Samples include both fabricated and unfabricated physical examples of materials, products, and WORK; both as complete units and as smaller portions of units of WORK; either for limited visual inspection or (where indicated) for more detailed testing and analysis. Mock-ups are a special form of samples which are too large to be handled in the specified manner for transmittal of sample Submittals.
 - 2. Submittals include, but are not limited to, Requests for Information, Change Orders, Work Change Directives, Field Orders, Daily Reports, Applications for Payment and other schedule related submittals, Technical Reports, Administrative Submittals, Certificates, and Warranties not defined as Shop Drawings, Product Data, or samples.
 - a. Technical Reports include laboratory reports, tests, technical procedures, technical records, CONTRACTOR's design analysis and CONTRACTOR's survey field notes for construction staking, before cross-sections and after cross-sections, and similar type submittals.
 - b. Administrative Submittals are those submittals required by the Contract Documents or deemed necessary for administrative records. These submittals include, but are not limited to, maintenance agreements, workmanship bonds, Project photographs, physical work records, statements of applicability, copies of industry standards, as-constructed data, security/protection/safety data, and similar type submittals also listed in SECTION 01700 and elsewhere in the Contract Documents.
 - c. Certificates and warranties are those Submittals on Equipment and Materials where a written certificate or guarantee from the MANUFACTURER or Supplier is called for in the Specifications or the General Terms and Conditions.

- d. Reports as required by Contract describing CONTRACTOR's means and methods for items such as dewatering, earth and water retaining, erosion/turbidity control, safety plans, and similar type Submittals.
3. Refer to ARTICLE 1.03 of this Part for detailed lists of documents and specific requirements.
- B. Quality Requirements: Submittals shall be of high enough digital quality so that they are legible and reproducible. Every line, character, and letter shall be clearly legible. Documents submitted to the FWC that do not conform to these requirements shall be subject to rejection by the FWC, and upon request by FWC, the CONTRACTOR shall resubmit conforming documents. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as necessary to meet such requirements. CONTRACTOR's (or its Subcontractor's) failure to initially satisfy the legibility quality requirements will not relieve CONTRACTOR (or its Subcontractors) from meeting the required schedule for submittal of Shop Drawings and product data.
- C. Language and Dimensions:
1. All words and dimensional units shall be written in the English language.
 2. International System of Units dimensional unit equivalents may be stated in addition to the United States customary units. United States customary units are required.
- D. Submittal Completeness:
1. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable the FWC to review the information effectively.
 2. Where standard drawings are furnished which cover variations of the general class of equipment, each such drawing shall be individually annotated to describe exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations that do not apply to the Submittal. The use of "highlighting" is not an acceptable means of annotating Submittals. Such annotation shall also include proper identification of the Submittal permanently attached to the drawing.
 3. Reproduction or copies of Drawings or portions thereof will not be accepted as complete fabrication or erection drawings. The CONTRACTOR may use a reproduction of the FWC-prepared Drawings for erection drawings such as to indicate information on erection or to identify detail drawing references. Where the Drawings are revised to show this additional CONTRACTOR information, the FWC's title block shall be replaced with a CONTRACTOR's title block and the FWC's professional seal (e.g.: Professional Engineer, Registered Architect, Licensed Surveyor, or other design professional seals) shall be removed from the Drawing. The CONTRACTOR shall revise these erection drawings for subsequent FWC revisions to the Drawings.

1.03 SUBMITTALS:

- A. If a submittal item is listed below, the CONTRACTOR shall provide that submittal even if that submittal is not listed elsewhere in the Contract Documents unless directed otherwise by FWC. The CONTRACTOR shall provide all submittals listed anywhere within the Contract Documents even if that submittal is not listed below. The CONTRACTOR shall provide all submittals as deemed necessary by the FWC in order for the FWC inspectors to inspect the CONTRACTOR's performance of the WORK.
- B. Submittal items shall include, but not be limited to, the following.
1. MANUFACTURER's specifications
 2. Catalogs, or parts thereof, of manufactured equipment
 3. Shop fabrication and erection drawings
 4. General outline drawings of equipment showing overall dimensions, location of major components, weights, and location of required building openings and floor plates

5. Detailed equipment installation drawings, showing foundation details, anchor bolt sizes and locations, baseplate sizes, location of FWC's connections, and all clearances required for erection, operation, and disassembly for maintenance
6. Schematic diagrams for electrical items, showing external connections, terminal block numbers, internal wiring diagrams, and one-line diagrams
7. Bills of material and spare parts list
8. Instruction books and operating manuals
9. Material lists or schedules
10. Performance tests on equipment by MANUFACTURERS
11. Concrete mix design information
12. Samples and color charts
13. All drawings, calculations, catalogs or parts thereof, MANUFACTURER's specifications and data, samples, instructions, and other information specified or necessary:
 - a. For FWC to determine that the Equipment and Materials conform with the design concept and comply with the intent of the Contract Documents.
 - b. For the proper erection, installation, operation and maintenance of the Equipment and Materials which the FWC will review for general content but not for substance.
 - c. For the FWC to determine what supports, anchorages, structural details, connections, and services are required for the Equipment and Materials, and the effects on contiguous or related structures and Equipment and Materials.
14. Weekly Construction Logs: Weekly Construction Logs shall include, but need not be limited to (a) Date, (b) Weather conditions for each day and any impact weather conditions caused to CONTRACTOR's ability to work, (c) Jobsite physical conditions, (d) Available or not-available resources, (e) Work performed each day and status, (f) Disruptions and delays, (g) Inventory changes including major material delivered or delayed (h) Potential risks and concerns of future delays, (i) Incidents that occurred, (j) Notes or comments of other relevant information related to the Project.
15. Welder qualification tests
16. Welding procedure qualification tests
17. X-ray and radiographic reports
18. Field test reports
19. Concrete cylinder test reports
20. Certification on Materials:
 - a. Steel mill tests
 - b. Paint lab tests
 - c. Cement tests
21. Soil test reports
22. Temperature records
23. Shipping or packing lists
24. Job progress schedules
25. Equipment and Material delivery schedules
26. Progress photographs

27. Warranties
 28. Fire protection and hydraulic calculations
 29. Surveying field notes, preliminary and final Surveyor's Reports
 30. Pump tests
 31. Traffic control plan
 32. Technical Reports
 33. Written Certificates and Warranties
 34. Submittal Log
- C. Submittal Action Stamps or Designation: The FWC's review action stamp or designation, appropriately completed, will appear on all Submittals of CONTRACTOR when returned by the FWC. Review status designations listed on FWC's action designation are defined as follows:
1. "ACCEPTED AS DRAWN": Signifies Equipment or Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is acceptable for incorporation in the WORK. CONTRACTOR is to proceed with fabrication or procurement of the items and with related WORK.
 2. "ACCEPTED AS NOTED": Signifies Equipment and Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is acceptable for incorporation in the WORK subject to the condition that as constructed it shall be in accordance with all notations and/or corrections indicated. CONTRACTOR is to proceed with fabrication or procurement of the items and with related WORK in accordance with FWC's notations.
 3. "RETURNED FOR CORRECTION": Means that deviations from the requirements of the Contract Documents exist in the Submittal. CONTRACTOR is to resubmit revised information responsive to FWC's annotations on the returned Submittal or written in the letter of transmittal. Fabrication or procurement of items represented by the Submittal and related WORK is not to proceed until the Submittal is approved.
 4. "NOT APPROVED": Signifies Equipment and Material represented by the Submittal does not conform with the design concept or comply with the intent of the Contract Documents and is disapproved for use in the WORK. CONTRACTOR is to resubmit Submittals responsive to the Contract Documents.
 5. "PRELIMINARY SUBMITTAL": Signifies Submittals of such preliminary nature that a determination of conformance with the design concept or compliance with the intent of the Contract Documents must be deferred until additional information is furnished. CONTRACTOR is to submit such additional information to permit layout and related activities to proceed.
 6. "FOR REFERENCE ONLY": Signifies Submittals which are for supplementary information only; pamphlets, general information sheets, catalog cuts, standard sheets, bulletins and similar data, all of which are useful to the FWC in design, operation, or maintenance, but which by their nature do not constitute a basis for determining that items represented thereby conform with the design concept or comply with the intent of the Contract Documents. The FWC reviews such Submittals for general content but not for substance.
 7. Resubmit Submittals the number of times required for FWC's "ACCEPTED AS DRAWN," or "FOR REFERENCE ONLY". However, any need for more resubmittals than the number set forth in the accepted schedule, or any other delay in obtaining acceptance of Submittals, will not be grounds for extension of the Contract Time.
- D. Submittal Log and Schedule:

1. CONTRACTOR shall maintain an accurate Submittal Log and a Distribution List for the duration of the WORK, showing current status of all Submittals required for the complete Project and Distributees at all times in a form acceptable to the FWC. CONTRACTOR shall make the Submittal Log available to the FWC for its review on request, and shall bring a copy of the Submittal Log to all Progress Meetings.
2. Prepare for the FWC, a schedule and log for submission of all Submittals specified or necessary for FWC's review of the use of Equipment and Materials proposed for incorporation in the WORK or needed for proper installation, operation or maintenance. Submit the schedule and log with the procurement schedule and WORK progress schedule. Schedule submission of all Submittals to permit review, fabrication, and delivery in time to not cause a delay in the WORK of CONTRACTOR or his Subcontractors or any other contractors as described herein.
3. The Construction Schedule shall indicate the anticipated dates of original submission for submittals, and shall be prepared in accordance with SECTION 01310 and submitted in accordance with this SECTION.
4. Schedule as required to achieve full compliance of all Submittals required prior to fabrication or manufacture for submission in accordance with the General Terms & Conditions. Submittals pertaining to storage, installation and operation at the Site are required for review and approval prior to delivery of the Equipment and Materials.

E. Transmittal of Submittals:

1. All Submittals furnished by Subcontractors, MANUFACTURERS, and Suppliers shall be submitted to the FWC by CONTRACTOR in electronic PDF format as indicated below. After checking and verifying all field measurements, transmit all Submittals to the FWC for acceptance in accordance with the General Terms & Conditions and as follows:
 - a. Check and certify Submittals of Subcontractors, Suppliers, and MANUFACTURERS with CONTRACTOR's approval prior to transmitting them to the FWC. CONTRACTOR's certification of approval shall constitute a representation to the FWC that CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or they assume full responsibility for doing so, and that they have coordinated each Submittal with the requirements of the WORK and the Contract Documents.
 - b. At the time of each submission, call to the attention of FWC in the CONTRACTOR's Letter of Transmittal any deviations from the requirements of the Contract Documents.
 - c. Provide all Submittals in electronic format, compatible with Adobe Professional, Version 8 (or higher), and submitted as a single file, using PDF bookmarks and/or chapters to identify divisions within the Submittal package ("PDF File Format"). At the FWC's request, and/or with the FWC's prior approval, the CONTRACTOR shall submit native format files when, in the opinion of the FWC, doing so will facilitate the FWC's review of the Submittal information.
 - d. The specification section and article number must be correctly listed for each submittal.
 - e. Make all modifications noted or indicated by FWC and return revised copies, or samples until accepted. Revised Submittals must be complete and conformed, including all pages/sheets with the required revisions and any additional or replacement pages/sheets. Direct specific attention in writing, or on revised Submittals, to changes other than the modifications called for by the FWC on previous Submittals. Subsequent review cycles for returned or revised Submittals shall replicate the process described in items c. above.
 - f. If the FWC's review action is "ACCEPTED AS NOTED", the Submittal will be designated such, and electronically transmitted back to the CONTRACTOR. Upon receipt of this notification from the FWC, the CONTRACTOR shall resubmit one (1) conformed electronic copy in PDF File Format to the FWC for final distribution. The FWC may reject, without review, conformed copy Submittals for which the CONTRACTOR does not

provide a narrative including, in numbered list format, (a) the FWC's comment/note, (b) the CONTRACTOR's resolution of each comment/note and the location of the resolution (i.e.: page number(s), drawing number(s)) that addresses the respective comment/note, and (c) the statement: "Other than revisions listed on herein, this conformed copy is the identical information as was provided in the FWC's response dated [enter date]." In addition, if the Submittal is required to be signed and sealed by a Professional Engineer registered in the State of Florida, this version of the submittal shall be signed and sealed. Submittal will not be considered final until all copies have been received by the FWC. Submittal will be designated "DISTRIBUTION COPY (PREVIOUSLY ACCEPTED)" by the FWC. Accepted Submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the Submittal and resubmit for review.

g. WORK requiring a Submittal shall not be commenced or shipped until the Submittal has been designated "ACCEPTED AS DRAWN," "ACCEPTED AS NOTED," or "FOR REFERENCE ONLY" by the FWC.

2. Test Reports: Responsibilities of CONTRACTOR and FWC regarding tests and inspections of Equipment and Materials and completed WORK are set forth elsewhere in these Contract Documents.

F. FWC's Review:

1. The FWC will review and return Submittals to CONTRACTOR with appropriate notations. Instruction books and similar Submittals will be reviewed by the FWC for general content but not for substance.
2. The FWC's acceptance of Submittals will not relieve CONTRACTOR from his responsibility as stated in the FWC's General Terms and Conditions.

G. Instruction Books / Operation & Maintenance Manuals:

1. Equipment instruction books and manuals shall be prepared by the MANUFACTURER and shall include the following:
 - a. Index and tabs
 - b. Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers
 - c. Applicable drawings
 - d. Name of contact person, phone number, and address of the nearest authorized service facility
 - e. Attached to the above shall be a notice of the exact warranty effective dates, beginning and ending
 - f. All additional data specified
2. Information listed above shall be submitted electronically in a PDF File Format.
 - a. Instruction Books/Operation & Maintenance Manuals shall contain the following:
 - i. Equipment name
 - ii. MANUFACTURER's name
 - iii. Project name
 - iv. Contract number
 - v. Reference to applicable Drawing No. & Technical Specifications Section

- b. Format: The overall manual should be constructed around certain types of structures or equipment in the Project, and not merely assembled by technical specification section, so that all pertinent data needed by personnel to operate or maintain the equipment or structure is in one (1) manual (as far as is practical). The CONTRACTOR shall coordinate with the FWC as to how the manuals are to be assembled (Bookmarked).
- H. Samples: Office samples shall be of sufficient size and quantity to clearly illustrate the following:
 - 1. Functional characteristics of the product, with integrally related parts and attachment devices
 - 2. Full range of color, texture, and pattern

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01310 CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.01 SCOPE:

- A. The CONTRACTOR shall provide a Construction Schedule in accordance with the General Terms and Conditions. The WORK under this Contract shall be planned, scheduled, executed, and reported by the CONTRACTOR. The CONTRACTOR shall adhere to established technical standards for CPM (Critical Path Method) scheduling unless otherwise directed by the FWC. The CONTRACTOR is required to provide the Construction Schedule in electronic format that graphically depicts activities.
- B. The CONTRACTOR shall provide a Submittals Schedule documenting the scheduling of the submission of all submittals for approval in accordance with the General Terms and Conditions. The Submittals Schedule shall allow sufficient time for review and approval by FWC and sufficient time for the manufacturer and acquisition of materials to not impact the Construction Schedule.
- C. The CONTRACTOR shall provide a Schedule of Contract Values (Schedule of Values) in accordance with the General Terms and Conditions.
- D. The CONTRACTOR shall be responsible for coordinating its own schedules (including subcontractors) as well as the construction activities of others as required to fully execute the WORK.

1.02 QUALITY ASSURANCE:

- A. The CONTRACTOR shall perform the WORK covered by this SECTION with personnel having substantial experience in scheduling construction projects which required the development and maintenance of the schedule throughout the Project duration.
- B. It is the responsibility of the CONTRACTOR to work with each subcontractor and supplier to obtain information pertinent to the planning and updating of their respective activities in the Construction Schedule and Submittals Schedule.
- C. It is the responsibility of the CONTRACTOR to work with the FWC to resolve any related scheduling issues.

1.03 DEALING WITH SUBSTITUTES:

- A. All versions of the CONTRACTOR's Construction Schedule shall be based solely on the WORK as awarded, and shall exclude any substitute proposals, even if the CONTRACTOR pursues a substitution in accordance with the provisions of the Contract.
- B. The FWC's final determination on any proposed substitutions may not be made until after the CONTRACTOR's Construction Schedule is prepared and accepted. Accepted proposed substitutions shall be identified in the schedule as Change Orders.

1.04 USE OF FLOAT:

- A. Total Float is the amount of time a scheduled activity can be delayed without delaying the completion of the WORK beyond the contractually required end date. Contract Float is the number of days between the CONTRACTOR's anticipated date for early completion of the WORK, or specified part, and the corresponding Contract Time. Total Float and Contract Float belong to the Project and are not for the exclusive benefit of any party. Contract Float and Total Float shall be available to the FWC or the CONTRACTOR to accommodate changes in the WORK or to mitigate the effect of events which may delay performance or completion. The FWC will monitor and optimize the use of float for the benefit of the Project.
- B. The CONTRACTOR shall adjust or remove any float suppression techniques (e.g., preferential sequencing, out-of-sequence activity relationships, crew movements, equipment use, form reuse, extended durations, imposed dates, lags, etc.) as a prerequisite to a request for an increase in Contract Price and/or Contract Time. Use of constraints or lags should be minimized and require approval by

the FWC. The accepted Construction Schedule must have a single longest path with zero Total Float (Critical Path). Multiple longest paths are not acceptable.

1.05 NON-COMPLIANCE: The FWC may refuse to recommend/authorize a progress payment in the event of the CONTRACTOR's failure, refusal or neglect to provide the required schedule information, since this will preclude the proper evaluation of the CONTRACTOR's progress. Remedies for the CONTRACTOR's failure, neglect or refusal to comply with the requirements of this SECTION are in addition, and not limited to, those provided under other sections of the Contract.

1.06 SUBMITTALS

- A. All submittals shall be provided in accordance with SECTION 01300.
- B. Submittals mentioned in this SECTION.
 - 1. Construction Schedule
 - 2. Schedule Narrative Report
 - 3. Submittal Schedule
 - 4. Schedule of Contract Values (Schedule of Values)

PART 2 - PRODUCTS

2.01 GENERAL CRITERIA:

- A. The Construction Schedule shall be prepared by the CONTRACTOR and reflect the CONTRACTOR's plans, means and methods, techniques and sequences for performing of the WORK.
- B. The Construction Schedule shall break down the WORK into distinct activities with interdependencies to the extent required to clearly depict the planned approach for completion of the WORK and to effectively manage the execution of the WORK.
 - 1. The Construction Schedules shall divide the WORK into manageable and logical segments and specify the progression from the Notice to Proceed (NTP) to Substantial Completion (SC) to Final Completion (FC) within Contract Time.
 - 2. The Construction Schedule is to include, at minimum, appropriate time allowances for submittals, procurement, coordination with others, construction, start-up/check-out, operational and performance testing, commissioning, and Contract Close-Out.
 - 3. The Construction Schedule shall include preparation, review and acceptance of Shop Drawings, material fabrication and material deliveries. The information in the Submittals Schedule and the Construction Schedule must be compatible. The Submittals Schedule includes all submittals while the Construction Schedule need only include Shop Drawing submittals.
- C. The CONTRACTOR shall schedule any requirements such as submittal reviews of the FWC indicated in or required by the Contract Documents. The Construction Schedule shall incorporate appropriate activities and WORK sequences based upon the Contract Documents.

2.02 CONSTRUCTION SCHEDULE SUBMITTAL:

- A. The Construction Schedule and Submittals Schedule submittals shall consist of an electronic file containing PDF formats of the schedules including a graphic representation of the Construction Schedule and schedules progress along with a written narrative.
- B. An updated Construction Schedule showing progress to date and an updated Submittals Schedule showing progress to date along with a Schedule Narrative Report shall be provided with each request for application for payment. The schedules progress date and the date of application for payment must match.
- C. The Schedule Narrative Report shall consist of a written description of how the WORK will be accomplished in accordance with the accepted Construction Schedule and Submittal Schedule. The Schedule Narrative accompanying each schedule update shall, at a minimum, compare current progress and cost performance to the last update for all milestones and activities, including longest path

activities. If there are potential or actual delays, the narrative shall state the cause of the delay and impact to the Construction Schedule and define steps that have been taken or intend to be taken to mitigate delay impacts. The CONTRACTOR shall list any changes in activities duration and logic. The narrative shall provide sufficient detail to allow the FWC to verify the progress of the WORK, compare actual versus planned activities, and identify assumptions made in scheduling work, including Change Order work. The CONTRACTOR shall direct specific attention, in writing, to adjustments or corrections made, either in response to the FWC's comments on the previous submittal or otherwise. A Schedule Narrative Report must be provided for all schedule updates.

- D. All schedules shall be in accordance with the Contract Time requirements of the Contract. Neither the FWC's review of the Construction Schedule, nor the FWC's statement of acceptance, will relieve the CONTRACTOR from the responsibility for complying with Contract Time requirements, adhering to those sequences of work indicated in or required by the Contract Documents, or from completing any omitted WORK within the Contract Time.
- E. Acceptance by the FWC of the Construction Schedule updates shall be a CONDITION PRECEDENT to the processing of Applications for Payment.
- F. The CONTRACTOR shall submit the Construction Schedule to the FWC for review and acceptance not more than 20 calendar days after NTP. It will be reviewed for conformance to the requirements of the Contract Documents. If the schedule is not accepted and requires revisions, the CONTRACTOR will revise this Construction Schedule and resubmit it for review and acceptance no later than ten (10) calendar days of the rejection notice
- G. Schedule updates shall accurately reflect all approved Change Orders including the exact duration. They will be reviewed for conformance to the requirements of the Contract Documents as amended by Change Orders. The Schedule of Values shall accurately reflect all approved Change Orders including the exact cost.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01320 CONSTRUCTION VIDEO AND PHOTOGRAPHS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION specifies administrative and procedural requirements for construction photographs.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 SUBMITTALS: Submit photographs electronically as specified in SECTION 01300 and in PART 3, this SECTION.

- A. Submittals mentioned in this SECTION.
 - 1. Pre-Construction Video
 - 2. Progress Site Photographs

1.03 QUALITY ASSURANCE: Photographs and video shall be clear and sufficient to show significant detail, not blurred, or taken in shadow, nor too distant. The FWC may require that the photographs or video be retaken should the quality be insufficient. Costs for such re-takes are the CONTRACTOR's responsibility at no extra cost to the FWC.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC REQUIREMENTS: Specified in PART 3, this SECTION.

PART 3 - EXECUTION

3.01 COLOR AUDIO VIDEO TAPING OF CONSTRUCTION AREA:

- A. Prior to beginning any construction, the CONTRACTOR shall prepare a color audio video recording of all the areas to be affected by construction.
- B. The audio video recording shall be done within the two-week period prior to placement of materials or equipment on the construction area and furnished one week prior to the start of construction. The audio video recording shall be done with a FWC Representative present.
- C. To preclude the possibility of tampering or editing in any manner, all video recordings shall, by electronic means, generate and display continuously and simultaneously on the screen digital information to include the date and time of recording. The time information shall consist of hours, minutes and seconds, separated by colons (i.e., 10:35:18).
- D. The audio video recording shall consist of one video and one audio track which shall be recorded simultaneously. All tracks shall consist of original live recordings and thus shall not be copies of other audio and video recordings. The audio track shall contain the narrative commentary.
- E. The rate of speed in the general direction of travel of the conveyance used during recording shall be controlled to provide a usable image. Panning rates and zoom-in, zoom-out rates shall be controlled sufficiently such that playback will produce clarity of the object viewed.
- F. All recording shall be done during times of good visibility. No recording shall be done during periods of visible precipitation, unless otherwise authorized by the FWC.

- G. The FWC shall have the authority to designate what areas may be omitted or added for audio video coverage.
- H. When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall not be less than eight feet to insure perspective.
- I. In some instances, audio video coverage will be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking or special conveyance by the FWC. The use of a drone is acceptable as long as the Contractor abides by all applicable regulations, ordinances, and laws associated with the use of a drone. The drone video shall meet the requirements of this SECTION.
- J. Areas covered shall include offsite roadways that will be subjected to heavy usage such as for haul routes or delivery of heavy components or equipment.

3.02 PROGRESS SITE PHOTOGRAPHS:

- A. The CONTRACTOR shall be responsible for photographs of the Site to show the existing and general progress of the WORK. The FWC will advise as to which views are of interest. Photographs shall be taken of the following areas and at the following times.
 - 1. Existing Site conditions before Site WORK is started. Number of views shall be adequate to cover the Site.
 - 2. Progress of the WORK from beginning and throughout construction. Progress photos must be provided with each pay request. Pay requests will not be considered acceptable until photographs are provided. Number of views shall be adequate to cover the Site.
 - 3. Finished Project after completion of WORK. Number of views shall be adequate to show the finished WORK.
 - 4. If Project is not completed during the Contract Time, or authorized extensions, photographs shall continue to be taken at no increase in Contract Price.
- B. Photographs shall be taken with a minimum of one (1) megapixel minimum resolution.
- C. Provide a CD or similar electronic storage device containing all photographic images in JPG format. Label storage device with the name and Contract number of Project, name of CONTRACTOR, description of view, and date photograph was taken.
- D. Deliver photographic storage device to FWC with pay applications.

3.03 ADDITIONAL PHOTOGRAPHS: From time to time the FWC may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Price or an Allowance.

- A. The FWC will give the photographer three (3) days' advance notice, where feasible.
- B. In emergency situations, the photographer shall take additional photographs within 24 hours of the FWC's request.
- C. Circumstances that could require additional photographs include, but are not limited to:
 - 1. Substantial Completion of a major phase or component of WORK.
 - 2. FWC's request for special publicity photographs.
 - 3. Special events planned at Project Site.
 - 4. Immediate follow-up when on-site events result in construction damage or losses.
 - 5. Photographs to be taken at fabrication locations away from Project Site.

6. Extra record photographs at time of final acceptance.

END OF SECTION

SECTION 01410 TESTING AND QUALITY CONTROL

PART 1 - GENERAL

1.01 SCOPE

A. Summary of Work:

1. The CONTRACTOR shall provide and maintain an effective Quality Control Program for the WORK as described in the CONTRACTOR's Quality Control Plan.
2. The CONTRACTOR shall establish and implement a Quality Control Plan to perform sufficient inspection of all items of the WORK, including that of Subcontractors, to insure conformance to the Technical Specifications and the Drawings with respect to the materials, workmanship, construction, equipment performance, and identification.
3. The CONTRACTOR's job supervisory staff may be used for quality control, supplemented as necessary by additional personnel for surveillance or special technicians to provide capability for the controls required by the Technical Specifications. The CONTRACTOR's Quality Control Plan must clearly identify the quality control leader and personnel organizational system. The leader must have the authority to direct the removal and replacement of defective work.
4. The Quality Control Plan shall identify all tests to be performed during construction including the frequency of those tests. The CONTRACTOR shall afford the opportunity with proper notifications for the FWC to witness all testing including the gathering of samples for testing.
5. The Quality Control Plan shall include a system for organizing each individual test that is required and documenting each individual test result in such a way that it can be easily determined by FWC which tests have been performed, which tests have passed and which tests are still required to be performed. It is the CONTRACTOR's responsibility to verify and document that every test required has been performed. The same organization and documentation is required for inspections.
6. The Quality Control Plan shall include the process to be utilized by the CONTRACTOR for selecting the appropriate Proctor test result for utilization in performing in-place density and moisture tests.
7. After the Contract is awarded and before the construction begins, the CONTRACTOR shall meet with the FWC to discuss quality control requirements. The meeting shall develop mutual understanding relative to the details of the Quality Control Plan, including the appropriate forms to be used for recording the quality control operations, inspections, administration of the Quality Control Plan, and the interrelationship of the CONTRACTOR and the FWC inspection.
8. The CONTRACTOR shall submit his written Quality Control Plan for review, describing the activities and listing those inspection and testing activities that the CONTRACTOR will perform prior to beginning the WORK. The CONTRACTOR's Quality Control Plan shall describe how he will communicate timely notification to allow for inspection activities performed by the FWC, or its representatives, for on and off-site construction activities
9. All compliance inspections shall be recorded on the appropriate forms, including but not limited to the specific items required in each SECTION of the Technical Specifications. The completed forms, including record of corrective actions taken, shall be furnished to the FWC. The FWC's quality control representative will maintain a list of all deficiencies which are not corrected the same day as they are discovered.
10. Should recurring deficiencies in an item or items indicate that the Quality Control Plan is not adequate, the CONTRACTOR shall take corrective actions as directed by the FWC to update the Quality Control Plan, to satisfactorily address and resolve any reoccurring deficiencies.

11. The CONTRACTOR shall provide a minimum of 48 hours written notice for each test and each inspection to be performed by the CONTRACTOR to afford the FWC the ability to witness all tests and participate in all inspections. If the test or inspection is not performed as scheduled and is delayed, a new 48 hours notification is required from the CONTRACTOR. If the notifications are not provided within the specified time, the CONTRACTOR shall repeat the test or inspection with the FWC in attendance at the CONTRACTOR's expense including the removal of materials if necessary in order to repeat the test or inspection.

B. Related Work Specified Elsewhere:

1. SECTION 01300 – Submittals. Submittals mentioned in this SECTION.
 - a. Quality Control Plan
 - b. Compliance Inspection Forms
 - c. Testing Laboratory Certifications
 - d. Certified Test Results

1.02 TESTING LABORATORY SERVICES

- A. All tests which require the services of a laboratory to determine compliance with the Contract Documents shall be performed by an independent commercial testing laboratory acceptable to the FWC. The laboratory shall be staffed with experienced technicians, and shall be properly equipped, ACI certified, and fully qualified to perform the tests in accordance with the specified standards. The CONTRACTOR shall provide the FWC with copies of the testing laboratory current certifications for the tests to be performed.

1.03 TESTING SERVICES

- A. All testing and inspections required in connection with the performance of the WORK including all testing and inspections specified in the Contract Documents shall be performed and paid for by the CONTRACTOR, and a certified copy of all results will be furnished to the FWC within five (5) days of the test.
- B. The CONTRACTOR is responsible for all testing and inspection services required to achieve an effective Quality Control Program, to assure that the WORK strictly complies with the Contract requirements. The CONTRACTOR shall pay all costs for such services.
- C. The field sampling and testing will be performed in the manner indicated in the Technical Specifications, with minimal interference to the construction operations.
- D. The CONTRACTOR shall perform the appropriate representative Proctor tests in accordance with SECTION 02200 for all prepared soils and for each prepared soil stockpile to be utilize for any fill and backfill.
- E. For concrete pours, the CONTRACTOR shall perform a minimum of one cylinder test set per every 150 cubic yards of concrete per day, one air test per cylinder test set, and one slump test per truck load of concrete.

1.04 QUALITY ASSURANCE TESTING BY FWC

- A. The FWC at its discretion will perform quality assurance testing. Upon notification from FWC, the CONTRACTOR shall collect duplicate samples for certified testing by FWC. The CONTRACTOR shall afford the FWC the opportunity to perform testing and inspections. This field sampling and testing will be performed with minimal interference to the construction operations and will not be the basis of a claim delay by the CONTRACTOR. The CONTRACTOR will receive certified copies of all tests performed by the FWC. It is the CONTRACTOR's responsibility to correct items with

noncompliant test results at the CONTRACTOR's expense and to pay for the quality assurance testing by FWC with a failed result.

1.05 TRANSMITTAL OF TEST RESULTS:

- A. Written certified reports of test results and engineering data furnished by the CONTRACTOR shall be submitted as specified in SECTION 01300.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01510 TEMPORARY UTILITIES AND FACILITIES

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION includes requirements of a temporary nature not normally incorporated into final WORK. It includes the following:
 - 1. Utility services
 - 2. Construction and support facilities
 - 3. Construction aids
 - 4. Fire protection
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 01530 - Protection of Work, Project Controls, Temporary Barriers and Security
 - 3. SECTION 01590 - Field Offices and Sheds
 - 4. DIVISIONS 2 through 16

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American National Standards Association (ANSI):
 - a. A10 Series - Safety Requirements for Construction and Demolition
 - b. ANSI/ASME PTC 19.1 Test Uncertainty, Instrument and Apparatus
 - 2. Florida Department of Transportation (FDOT)
 - a. Standard Specifications for Road and Bridge Construction
 - 3. Florida Trench Safety Act (90-96, Laws of Florida)
 - 4. National Electrical Contractors Association (NECA):
 - a. Electrical Design Library - Temporary Electrical Facilities
 - 5. National Fire Protection Association (NFPA):
 - a. NFPA 10 - Standard for Portable Fire Extinguishers
 - b. NFPA 70 - National Electrical Code
 - c. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations
 - 6. National Electrical Manufacturers Association (NEMA)
 - 7. Underwriters Laboratories (UL)

1.03 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Site Plan: Submit to the FWC a Site Plan indicating all CONTRACTOR's facilities including but not limited to:
 - 1. Trailers
 - 2. Equipment Yard
 - 3. Parking
 - 4. Traffic Control
 - 5. Laydown Area
 - 6. Staging Area
 - 7. Fuel Yard including Spill Prevention System
 - 8. Utility Routing
 - 9. Ground Surface Material
 - 10. Drainage
- C. Temporary utilities and facilities certifications and permits

1.04 QUALITY ASSURANCE:

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
 - 1. Building Code requirements
 - 2. Utility company regulations
 - 3. Police, Fire Department, and rescue squad rules
 - 4. Environmental protection regulations
- B. Standards:
 - 1. Comply with NFPA 10 and 241, and ANSI A10 Series standards "Temporary Electrical Facilities."
 - 2. Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70.
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits. Submit copies of those certifications and permits to FWC.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT:

- A. Provide new materials and equipment. If acceptable to the FWC, undamaged previously used materials and equipment in serviceable condition may be used. Provide materials and equipment suitable for the use intended, of capacity for required usage, and meeting applicable codes and standards. Comply with requirements of DIVISIONS 2 through 16.
- B. Water: Provide potable water approved by local health authorities.

- C. Water Hoses: Provide 3/4-inch (19 mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- D. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- E. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- F. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- G. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.01 TEMPORARY UTILITIES:

- A. General:
 - 1. Engage the appropriate local utility company to extend temporary electric and phone service to the Project area from nearby existing utilities. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 2. Provide adequate utility capacity at each stage of construction. Prior to availability of temporary utilities at the Site, or in remote areas without services, provide trucked-in services as required for start-up and construction operations.
 - 3. Furnish, install and maintain temporary utilities required for adequate construction, safety and security. Modify, relocate and extend systems as WORK progresses. Repair damage caused by installation or use of temporary facilities. Grade the areas of Site affected by temporary installations to required elevations and grades, and clean the area. Remove on completion of WORK or until service or facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
 - 4. The types of temporary construction utilities and facilities required include, but are not limited to, potable drinking water, wastewater, drainage, dewatering equipment, enclosure of WORK, ventilation, electrical power, lighting, hoisting facilities, stairs, ladders, and roads.
 - 5. Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications and permits for use.
 - 6. Materials used for temporary service shall not be used in the permanent system unless so specified or acceptable to the FWC.

3.02 TEMPORARY ELECTRICITY AND LIGHTING:

- A. New Service:

1. Arrange with utility company to extend existing electric service to temporary office trailers.
 2. Connect temporary service in a manner directed by utility company officials. Provide separate meter for metering of power used by all entities authorized to be at or perform WORK at the Project Site.
 3. The electric service shall be of sufficient capacity and characteristics for the various construction tools, machinery, lights, heating and air conditioning, pumps, and other tools required by CONTRACTOR and his Subcontractors. In areas of the Project where permanent or temporary power service from the local utility is not available, the CONTRACTOR shall supply and maintain engine-driven, power-generator sets.
 4. Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, use of power tools, electrical heating and lighting. Provide overload protection. Supply power for electric welding, if any, from engine-driven, power-generator sets.
 5. Provide adequate artificial lighting for all areas of WORK when natural light is not adequate for WORK.
 6. Sufficient light shall be provided for general construction areas, with additional sufficient lighting for specific tasks and to meet safety requirements.
- B. Use of Permanent System:
1. Prior to use of permanent system to be installed by the power company for construction purposes, obtain written permission of the FWC.
 2. Maintain permanent system as specified for temporary facilities.
- C. Costs of Installation and Operation:
1. Pay fees and charges for permits and applications.
 2. Pay costs of installation, maintenance, removal of temporary services, and restoration of any permanent facilities used.
 3. Pay costs of electrical power used.
 4. Pay costs of furnishing, operating, and maintaining engine-driven power-generator sets, where applicable.

3.03 TEMPORARY HEAT AND VENTILATION:

- A. General:
1. Provide temporary heat, ventilation and cooling as required to maintain adequate environmental conditions in temporary office trailers and storage sheds and to facilitate progress of the WORK, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage. Protect from adverse effects of low temperatures or high humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
 2. Methods of heating and fuel shall be suitable for particular purposes. Portable heaters shall be standard approved units with controls.
- B. Costs of Installation and Operation:
1. Pay fees and charges for applications, permits, and inspections.
 2. Pay costs of installation, operation, maintenance, removal of equipment, and restoration of existing or permanent facilities if used.
 3. Pay cost of power and fuel used.

3.04 TEMPORARY TELEPHONE SERVICE:

A. General:

1. Arrange with local telephone service company to extend existing direct line telephone service to the CONTRACTOR's and FWC's field office site for the use of the FWC and construction personnel and employees.
2. Telephone Service: Local Provider.
3. Minimum Service Required: Direct lines for voice and data communication for the FWC's field office as specified in SECTION 01590.
 - a. One direct line instrument in superintendent's field office.
 - b. Adequate number of service lines and instruments for needs of trades.
 - c. Other instruments and pay telephone station(s) at the option of the CONTRACTOR, or as required by regulations.
4. CONTRACTOR shall arrange with local cellular/mobile telephone service company to provide mobile telephone service for use by CONTRACTOR and so CONTRACTOR can be reached throughout the entire Project area during normal working hours.

B. Costs of Installation and Operation: Pay all costs for installation, maintenance and removal, and service charges for calls.

3.05 TEMPORARY SANITARY FACILITIES:

A. CONTRACTOR-Furnished Facilities:

1. Furnish, install and maintain temporary sanitary facilities for use through construction period. Remove on completion of WORK.
2. Provide for all construction workers under this Contract and representatives at the Site.
3. Toilet facilities shall be of the chemical-aerated recirculation or combustion type, properly vented and fully enclosed with a glass- fiber-reinforced polyester shell or similar nonabsorbent material.

3.06 TEMPORARY CONSTRUCTION AIDS:

A. General:

1. Provide construction aids and equipment required by personnel, available for FWC's use, and to facilitate the execution of the WORK; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.
2. Materials may be new or used, must be suitable for the intended purpose and meet the requirements of applicable codes, regulations and standards.
3. When platform stair framing is in place, provide temporary treads, platforms, and railings for use by construction personnel.

3.07 TEMPORARY STAGING OF FUEL

- #### A.
- At any location where the CONTRACTOR intends to establish a fueling station the CONTRACTOR shall provide a sufficient leak and spill prevention system. If there are any indications that a spill has occurred the CONTRACTOR is fully responsible for the appropriate reporting to governmental entities having responsibilities, for informing FWC immediately, for cleaning up the spill and for providing complete written documentation of the incident including documentation of satisfactory resolution to FWC.

3.08 TEMPORARY BYPASS FLOW: The CONTRACTOR can submit a bypass flow system, if required by their means and methods, as a submittal per SECTION 01300.

3.09 INSTALLATION AND REMOVAL:

- A. Relocation: Relocate construction aids as required by progress of construction, by storage or WORK requirements, and to accommodate requirements of FWC and other CONTRACTOR's at the Site.
- B. Removal: Remove temporary materials, equipment and services when construction needs can be met and allowed by use of permanent construction, or at completion of the Project.
- C. Repair: Clean and repair damage caused by installation or by use of temporary facilities.
 - 1. Remove foundations and underground installations for construction aids.
 - 2. Grade the areas of the Site affected by temporary installations to required elevations and clean the area.

END OF SECTION

SECTION 01530 PROTECTION OF WORK, PROJECT CONTROLS, TEMPORARY BARRIERS AND SECURITY

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work: This SECTION includes General Requirements for:

1. Safety
2. Protection of the WORK
3. Protection of existing property
4. Environmental controls
5. Access roads and parking areas
6. Traffic control and use of roadways
7. Temporary Barriers
8. Security

B. Related Work Specified Elsewhere:

1. SECTION 01300 – Submittals
2. SECTION 01590 – Field Offices and Sheds
3. SECTION 01700 - Contract Closeout
4. SECTION 02435 - Turbidity Control and Monitoring

C. Submittals mentioned in this SECTION.

1. Safety Plan
2. Dust Control Plan
3. Surface Water, Groundwater and Erosion Control Plan
4. Pollution Control and Spill Prevention Plan
5. Traffic Control Plan
6. Security Control Plan

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.

1. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 SAFETY AND PROTECTION OF WORK AND PROPERTY:

A. General:

1. The CONTRACTOR is responsible for Site safety. The CONTRACTOR shall provide the FWC a copy of their Safety Plan.
2. The CONTRACTOR shall provide for the protection of the WORK. Provide protection at all times against rain, wind, storms, frost, freezing, condensation, or heat so as to maintain all WORK and Equipment and Materials free from injury or damage. At the end of each day all new WORK likely to be damaged shall be appropriately protected.
3. The CONTRACTOR shall notify the FWC immediately if at any time, operations are stopped due to conditions which make it impossible to continue or to obtain proper results.
4. The CONTRACTOR shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations, pits, and trenches dewatered sufficiently to permit continuous construction.
5. The CONTRACTOR shall protect floors from damage by proper covering and care when handling heavy equipment, painting, or handling mortar or other such materials. Use proper cribbing and shoring to prevent overloading of floors while moving heavy equipment. Provide metal pans under pipe-threading machines and other machines that may leak oil and clean such pans daily, keeping oil off of the floors. Restore floors to former condition where damaged or stained.
6. The CONTRACTOR shall not load concrete less than 28-days old without the written permission from the FWC.
7. The CONTRACTOR shall restrict access to roofs except as required by the WORK. Where access is required, provide protection with plywood, boards, or other suitable materials.

B. Property Other than FWC's:

1. The CONTRACTOR shall provide for the protection of property of others that may be impacted by the CONTRACTOR's efforts. Report immediately to the owners thereof and promptly repair damage to existing facilities resulting from construction operations.
2. Names and telephone numbers of representatives of the power company having jurisdiction over power lines in the WORK area can be obtained from the FWC. The CONTRACTOR shall contact the power company a minimum of seven (7) calendar days prior to performing WORK within 500' of power line property, right-of-way or easement lines.
3. The applicable requirements specified for protection of the WORK shall also apply to the protection of existing property of others.
4. The CONTRACTOR shall restore all property affected by the CONTRACTOR's operations to the original or better condition, to the satisfaction of the FWC.

3.02 ENVIRONMENTAL CONTROLS:

A. Dust Control:

1. The CONTRACTOR shall provide and apply methods of positive dust control to minimize raising dust from construction operations.
2. The CONTRACTOR shall clean interior spaces and surfaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

3. The CONTRACTOR shall schedule operations so that dust and other contaminants will not fall on wet or newly-coated surfaces.
 4. The CONTRACTOR shall cover materials transported to and from Site as necessary to prevent depositing material on offsite roadways or creating dust.
 5. The CONTRACTOR shall submit a Dust Control Plan.
- B. Water and Erosion Control:
1. The CONTRACTOR shall provide methods necessary to control and manage surface water. The CONTRACTOR shall prevent damage surface water damage to the WORK, the Site, or adjoining properties as specified in SECTION 02435.
 2. The CONTRACTOR shall control fill, grading, and ditching to manage and direct surface water away from excavations and other construction areas, and to direct surface water to proper storage and/or conveyance facilities.
 3. The CONTRACTOR shall control and manage surface water and ground water as necessary to prevent flooding, erosion, or other damage to the WORK and any portion of the Site and to adjoining areas.
 4. Prepare and submit a Surface Water, Groundwater and Erosion Control Plan to FWC for review.
- C. Debris Control and Clean-Up:
1. The CONTRACTOR shall keep the premises free at all times from accumulations of debris, waste materials, and rubbish. The CONTRACTOR's responsibilities shall include, but not be limited to the following:
 - a. Adequate trash receptacles at the Site, emptied promptly when filled.
 - b. Daily pickup of litter and trash on site.
 - c. Periodic cleanup to avoid hazards or interference with operations at the Site and to maintain the Site in a neat condition.
 - d. The keeping of construction materials such as forms and scaffolding neatly stacked.
 - e. Immediate cleanup to protect the WORK by removing splattered concrete, oil, paint, corrosive liquids, and cleaning solutions from walls, floors, and other surfaces before the surfaces are marred.
 2. The CONTRACTOR shall prohibit overloading of trucks to prevent spillages on access and haul routes. Provide periodic inspection of traffic areas to enforce requirements.
 3. Final cleanup is specified in SECTION 01700.
- D. Pollution Control:
1. The CONTRACTOR shall provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by the discharge of hazardous or toxic substances from construction operations.
 2. The CONTRACTOR shall provide equipment and personnel and perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids. Excavate and dispose of any contaminated earth off-site in approved locations, and replace with suitable compacted fill and topsoil.
 3. The CONTRACTOR shall take special measures to prevent harmful substances from entering public waters, sanitary sewers, or storm sewers.
 4. If hazardous materials are discharged, report to authorities as required by applicable law or regulations and notify the FWC immediately.

5. Prepare and submit a Pollution Control and Spill Prevention Plan to FWC for review.

3.03 TRAFFIC CONTROL AND USE OF ROADWAYS:

A. Traffic Control:

1. The CONTRACTOR shall provide, operate, and maintain equipment, services, and personnel, with traffic control and protective devices, as required to expedite safe vehicular traffic flow on haul routes, at Site entrances, onsite access roads, and parking areas. This includes barricades and other devices or personnel as necessary to adequately protect the public and the Site. Prepare and submit a Traffic Control Plan to FWC for review.
2. The CONTRACTOR shall remove temporary equipment and facilities when no longer required. Restore grounds to original, better, or specified conditions.
3. The CONTRACTOR shall provide and maintain suitable detours or other temporary expedients if necessary.
4. Bridge over open trenches where necessary to maintain traffic and for safety.
5. The CONTRACTOR shall consult with applicable governing authorities to establish public thoroughfares which will be used for Site access. All operations shall meet the approval of owners or agencies having jurisdiction.

B. Maintenance of Roadways:

1. The CONTRACTOR shall repair off-site roads, water control and FWC structures and levees damaged by operations. Keep traffic areas as free as possible of excavated materials and maintain in a manner to eliminate dust, mud, and hazardous conditions.
2. All operations and repairs shall meet the approval of owners or agencies having jurisdiction.

3.04 BARRIERS:

A. General:

1. The CONTRACTOR shall furnish, install, and maintain suitable barriers as required to prevent public entry, protect the public, and to protect the WORK, existing facilities, trees, and plants from construction operations. Remove the barriers when no longer needed or at completion of the WORK.
2. Areas outside of approved access and haul roads, approved areas of construction and approved secondary borrow areas shall have suitable barriers to prevent unauthorized access and activities. Remove the barriers when no longer needed or at completion of the WORK.
3. The CONTRACTOR may use new or used materials, suitable for the intended purpose, but must not violate requirements of applicable codes and standards or of regulatory agencies.
4. Barriers shall be of a neat and reasonably uniform appearance, structurally adequate for the required purposes.
5. The CONTRACTOR shall maintain barriers in good repair and a clean condition for adequate visibility.
6. The CONTRACTOR shall relocate barriers as required by progress of the WORK.
7. The CONTRACTOR shall repair damage caused by the installation of barriers and restore damaged areas to original or better condition, to the satisfaction of the FWC.

3.05 SECURITY:

- A. The CONTRACTOR is solely responsible for initiating and maintaining security at the construction Site. CONTRACTOR shall take all necessary precautions for the security of, and shall provide the necessary protection to:
 - 1. Materials and equipment incorporated into the WORK, or stored on-site prior to incorporation into the WORK.
 - 2. Temporary field offices and sheds, and their contents including those listed in SECTION 01590.
 - 3. Plant and equipment including any equipment furnished for use by the FWC.
- B. The CONTRACTOR shall replace, in kind, any materials or equipment lost, damaged or destroyed at no cost to the FWC.
- C. Prepare and submit a Security Control Plan to FWC for review.

3.06 REMOVAL

- A. The CONTRACTOR shall remove temporary equipment and facilities when no longer required. Restore grounds to original, better, or specified conditions.

END OF SECTION

SECTION 01570 TRAFFIC CONTROL

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work:

1. The WORK of this SECTION shall consist of furnishing all labor, material, and equipment and performing all operations in connection with traffic control in accordance with the Drawings, permits and applicable codes and as specified herein.
2. The CONTRACTOR shall provide Maintenance of Traffic (MOT) in accordance with the Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction Section 102 and FDOT Standard Index No. 600.

B. Related Work Specified Elsewhere:

1. SECTION 01300 - Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.

1. The Florida Department of Transportation (FDOT)
 - a. Standard Specifications for Road and Bridge Construction
 - i. Section 102 - Maintenance of Traffic
 - ii. Section 700 - Highway Signing
 - iii. Section 706 - Raised Retro-Reflective Pavement Markers and Bituminous Adhesive
 - iv. Section 710 - Painted Pavement Markings
 - v. Section 711 - Thermoplastic Traffic Stripes and Markings
 - b. Design Standards
 - i. Index 600 Series - Traffic Control through Work Zones
2. American Association of State Highway and Transportation Officials (AASHTO)
3. American Society for Testing and Materials (ASTM)
4. County Codes
5. U. S. Department of Transportation, Federal Highway Administration, "Manual on Uniform Traffic Control Devices" (FHWA)

1.03 SUBMITTALS: Submittals shall be in accordance with SECTION 01300.

- A. The CONTRACTOR shall submit a Maintenance of Traffic (MOT) Plan meeting the requirement of the FDOT Index No. 600 Series.
- B. If required by jurisdictional authority for the roadway impacted by the WORK/access, the CONTRACTOR shall hire Florida Registered Professional Engineer registered in the State of Florida with current FDOT Advanced MOT Certification to design the temporary traffic control plan(s).

Plan(s) must address all phases of the WORK including but not limited to the modifications at the intersection of Oil Well Road and SAL Grade Road.

PART 2 - PRODUCTS

- 2.01 GENERAL: Coordinate with the Drawings to verify which of the following products is used in the WORK, to verify which is required by the Standards stated and to verify which is required by the Charlotte County right-of-way (ROW) permit to be obtained by the CONTRACTOR including any other Charlotte County requirements.
- 2.02 HIGHWAY SIGNING: Erecting aluminum or steel roadway signs with supporting posts and electronic signs. The roadway signs and material shall conform to the requirements on FDOT Standard Specifications: Section 700 and Charlotte County requirements.
- 2.03 RAISED RETRO-REFLECTIVE PAVEMENT MARKERS: Installing raised retro-reflective pavement markers and removing pavement markers within the Project limits as designated in the plans. The reflectorized pavement markers and materials shall conform to the requirements of FDOT Standard Specifications: Section 706.
- 2.04 PAINTING TRAFFIC STRIPES: Painting reflectorized traffic stripes, including edge stripes and traffic guide. The painting and materials shall conform to the requirements of FDOT Standard Specifications: Section 710.
- 2.05 THERMOPLASTIC TRAFFIC STRIPES AND MARKINGS: Placing and materials shall conform to the requirements of FDOT Standard Specifications: Section 711.

PART 3 - EXECUTION

- 3.01 SIGNS, MARKERS, PAINTING:
 - A. Erection of signs and sign supports shall be in accordance with Section 700 of the FDOT Specifications.
 - B. Placement of the markers shall be in accordance with Section 706 of the FDOT Specifications.
 - C. Thermoplastic markings shall be in accordance with Section 711 of the FDOT Specifications.

END OF SECTION

SECTION 01580 PROJECT IDENTIFICATION AND INFORMATIONAL SIGNS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION includes basic requirements for Project Identification and Informational signs required during construction.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 1300 Submittals

1.02 SUBMITTALS:

- A. Submit as specified in SECTION 01300.
- B. Includes, but not limited to, the following for each sign:
 - 1. Shop Drawings, sign materials, sign proofs and product data as applicable.
 - 2. Show content, layout, lettering, colors, and structure.

PART 2 - PRODUCTS

2.01 DESIGN REQUIREMENTS: The CONTRACTOR shall design sign(s) and structure(s) to withstand wind and environmental conditions in accordance with all applicable laws and regulations. Provide with a finish adequate to withstand weathering, fading, chipping, and peeling for duration of construction.

2.02 IDENTIFICATION SIGNS:

- A. Project Identification:
 - 1. The CONTRACTOR shall construct sign mounting structure(s) and framing of wood or metal, structurally adequate to meet the requirements of Paragraph 2.01 above and/or as shown on the Contract Documents.
 - 2. The Project Identification sign panel shall be constructed of minimum 3/4-inch thickness B/C exterior grade plywood. Panels shall be one sheet with an overall size of 48 inches by 96 inches. Fonts to be 3 inches high.
 - 3. Rough hardware shall be galvanized steel or aluminum.
 - 4. Coating: Paint shall be suitable for outdoor applications and shall be resistant to weathering, peeling, chipping and fading. Sign colors shall be approved by the FWC.
 - 5. Information Content:
 - a. Project title/name, location, FWC logo and name as shown on the Contract Documents
 - b. Names and titles of authorities (i.e. Commissioners, etc.)
 - c. Name of prime CONTRACTOR and major Subcontractors
- B. CONTRACTOR Identification: If not a part of the Project identification sign, provide and install the CONTRACTOR's standard sign.

2.03 INFORMATIONAL SIGNS:

- A. Construction:

1. This includes signs for traffic, construction workers, and general public in regards to directions, warnings, hazards, locations of areas, facilities, equipment, and others of a similar nature.
2. The CONTRACTOR shall provide signs of design, size, color, and lettering as required by regulatory agencies and/or as shown on the Contract Documents. Signs shall be painted metal, plastic, or fiberglass. Materials shall be suitable for the conditions in which signs are to be placed, such as weathering and fading.
3. The CONTRACTOR shall construct sign mounting structure(s) and framing of wood or metal, structurally adequate to meet the requirements of Paragraph 2.01 above and/or as shown on the Contract Documents.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Project and Contractor Identification Signs: The CONTRACTOR shall
 1. Install all required signs in locations acceptable to the FWC. Install so as not to obstruct traffic or construction operations.
 2. Erect on framing or foundation, and rigidly brace.
 3. Maintain signs in good repair, in a neat, clean and readable condition.
 4. Remove all signs, framing, supports, and foundations upon completion of the Project unless directed otherwise by FWC.
- B. Informational Signs: The CONTRACTOR shall
 1. Install at appropriate locations and in sufficient quantities to assure visibility and to the satisfaction of FWC. Relocate as required by progress of the WORK.
 - a. A minimum of one sign shall be installed at the intersection of Oil Well Road and SAL Grade Road forbidding construction traffic from proceeding further east on Oil Well Road.
 - b. A minimum of two signs shall be installed on the Babcock/Webb Road within the construction limits on the east side of the Project forbidding construction traffic from using that road outside of the construction limits.
 - c. Install signs as needed and to the satisfaction of FWC.
 2. Maintain signs in good repair, in a neat, clean, and readable condition.
 3. Remove all signs, framing, supports, and foundations upon completion of the Project unless directed otherwise by FWC.

END OF SECTION

SECTION 01590 FIELD OFFICES AND SHEDS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary: This SECTION includes requirements for temporary field offices and other structures for office and storage space required by CONTRACTOR and the FWC.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 01510 - Temporary Utilities and Facilities
 - 3. SECTION 01600 - Equipment and Materials
- C. Use of Existing Facilities: Existing facilities at the Site shall not be used for field offices.
- D. Use of Permanent Facilities: Permanent facilities, when substantially completed, shall not be used for field offices or for storage.
- E. Submittals mentioned in this SECTION.
 - 1. CONTRACTOR Field Office Site Plan
 - 2. FWC Field Office Site Plan and Internal Layout Plan
 - 3. Storage Shed and Trailer Site Plan

PART 2 - PRODUCTS

2.01 FIELD OFFICES:

- A. General:
 - 1. Provide trailers, mobile buildings, or buildings constructed with floors raised aboveground, with steps and landings at entrance doors.
 - 2. Buildings shall be structurally sound, secure, and weathertight.
 - 3. Provide four (4) appropriate portable type fire extinguishers at each office and storage area.
 - 4. Maintain offices for duration of Contract.
 - 5. Install office spaces ready for occupancy within 60 days of the Notice to Proceed.
 - 6. Obtain any required building permits for installation of temporary field offices and sheds.
 - 7. These facilities shall be in accordance with all applicable rules, ordinances, and regulations.
- B. CONTRACTOR's Office:
 - 1. Provide a field office for CONTRACTOR's superintendent on the Site.
 - 2. Field office shall be of size required for general use, with lights, heat and air conditioning, furnishings, telephone service, and other necessary facilities and utilities required by CONTRACTOR's operations.
 - 3. Prior to preparing the area for the installation of any facilities, the CONTRACTOR shall stake out the area proposed to be utilized for the facilities for approval by FWC.
 - 4. Prepare and submit a CONTRACTOR Field Office Site Plan.
- C. FWC Office:
 - 1. Provide a field office for FWC use in a location on the Site with parking space for seven (7) vehicles. The parking area shall have at least a shellrock surface.
 - 2. Provide the following minimum requirements:
 - a. 1,440 square foot minimum, 24-foot by 60-foot trailer
 - b. Two secure entrance doors, keyed to the same key - seven (7) keys
 - c. Minimum of five windows with operable sash and insect screens

- d. Lockable storage closet, minimum area of 60 square feet
- e. Resilient floor covering
- f. Minimum of four (4) individual offices
- g. Conference room, minimum area of 500 square feet
- h. Furnishings:
 - i. Seven (7) standard size desks with three (3) drawers, swivel desk chair with arms, and side chairs
 - ii. Conference table with twelve (12) swivel chairs
 - iii. Seven (7) throw tables of sufficient size for full size Drawings and submittals
 - iv. One (1) plan rack to hold a minimum of six (6) racks of drawings
 - v. Three 4-drawer legal-size metal filing cabinets with lock and key
 - vi. Three (3) sets of six (6) linear feet of bookshelves, 10 inches minimum depth
 - vii. Twenty (20) folding chairs
 - viii. One (1) wastebasket per desk and table
 - ix. One (1) tackboard, 36 inches x 30 inches
 - x. Three (3) white boards 48 inches x 60 inches
 - xi. One (1) first aid kit and identifying sign
 - xii. Fire extinguishers per 2.01.A
- i. Services:
 - i. Lighting Interior: 50 foot-candles at desktop height; Exterior lighting at entrance door
 - ii. Heating and air conditioning
 - iii. Electrical Service: Minimum of four circuits, 110V, 60 hertz; Minimum of (16) 110V duplex convenience outlets
 - iv. In-trailer toilet facilities connected to holding tank
 - v. Electric water cooler with bottled water
 - vi. 21 cubic foot (c.f.) refrigerator
 - vii. Microwave oven, one (1) cubic feet
 - viii. One ten (10) pot coffeemaker
 - ix. Kitchen sinks with running cold water
 - x. Ice Machine or Weekly Ice delivery with freezer adequate for nine person Field Staff
 - xi. Multi-line phone service for each office and conference room.
 - xii. Internet service and WI-FI service for entire trailer.
- 3. Prior to preparing the area for the installation of the FWC Field Office and parking area, the CONTRACTOR shall stake out the area proposed to be utilized for the facilities for approval by FWC.
- 4. The Contactor shall prepare and submit an FWC Field Office Site Plan and Internal Layout Plan along with the product data sheets for all items and services to be provided with the field office.
- 5. The CONTRACTOR is responsible for the security of the FWC Field Office.
- 6. Maintenance:
 - a. The CONTRACTOR shall provide bottled water (500 mL bottles) and water service for the water cooler to support FWC needs.
 - b. The CONTRACTOR shall provide all maintenance services for the water system and the sanitary system.

- c. The CONTRACTOR shall pay for all utility services including pest control and trash removal and pick-up.
- d. The CONTRACTOR shall provide weekly maintenance of FWC Field Office including cleaning of floors and furniture, janitorial service and providing supplies for the kitchen and toilet facilities.
- e. The CONTRACTOR shall repair immediately any damage, leaks or defective service.

2.02 STORAGE SHEDS AND TRAILERS:

A. On-Site:

1. The CONTRACTOR shall provide temporary buildings or trailers needed for storage of Equipment and Materials installed under this Contract.
2. Provide ventilation and heating as required by Equipment and Material stored or as per MANUFACTURER's requirements.
3. The CONTRACTOR shall be solely responsible for temporary buildings and trailers located on site.
4. Prior to preparing the area for the installation of any facilities, the CONTRACTOR shall stake out the area proposed to be utilized for the facilities for approval by FWC.
5. Prepare and submit a Storage Shed and Trailer Site Plan.

B. Off-Site:

1. The CONTRACTOR shall advise the FWC of any arrangements made for storage of Equipment and Materials in a place other than the Project Site. The CONTRACTOR shall furnish with Application for Payment evidence of insurance coverage for off-site stored materials and any other required documentation in conformance with the General Terms & Conditions.

PART 3 - EXECUTION

3.01 LOCATION, INSTALLATION AND MAINTENANCE:

A. General:

1. Place temporary buildings, trailers, and stored materials in locations acceptable to FWC.
2. Installed field offices and sheds to resist winds and elements of the locality where installed.
3. Remove when no longer needed at the Site or when WORK is completed.
4. Keep areas around facilities including parking areas free of weeds, leaves, mud, water, or ice.
5. At completion of WORK, remove temporary buildings and trailers, foundations (if any), utility services, and debris. Prepare disturbed site to grade and stabilize to conditions required by the CONTRACT and as specified by FWC.

END OF SECTION

SECTION 01600 EQUIPMENT AND MATERIALS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION includes general requirements for transportation, handling, delivery, storage, and protection of CONTRACTOR furnished Equipment and Materials.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 01640 - Start Up/Check Out/Manufacturer's Field Services for Contractor Furnished Equipment
 - 3. SECTION 01660 - Equipment and System Performance and Operational Testing
- C. Submittals mentioned in this SECTION.
 - 1. Precast supplier instructions for transportation, lifting and storage
 - 2. MANUFACTURERs instructions for handling, lifting, storing, service during storage, unpacking, protecting, cleaning, and installing

1.02 DEFINITIONS: Definitions used in this Paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including such terms as "systems," "structure," "finishes," "accessories," "furnishings," "special construction," and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.

- A. Products: Items purchased for incorporation in the WORK, regardless of whether they were specifically purchased for the Project or taken from the previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and other terms of similar intent.
- B. Equipment: A product with operational or non-operational parts, regardless of whether motorized, manually operated, or fixed. Equipment may require service connections such as wiring or piping.
- C. Materials: Products that must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form part of the WORK.

1.03 QUALITY CONTROL:

- A. Equipment and Material Incorporated into the WORK: Provide products that comply with the requirements of the Contract Documents, are undamaged, and unless otherwise indicated, are unused at the time of installation. The CONTRACTOR shall provide products that are complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect.
- B. Standard Products: Where they are available and comply with the Technical Specifications, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- C. Continued Availability: Where, because of the nature of its application, the FWC is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard products for which the MANUFACTURER has published assurances that the products and its parts are likely to be available to the FWC at a later date.
 - 1. Conform to applicable Technical Specifications, codes, standards, and regulatory agency requirements.

2. Comply with size, make, type, and quality specified, or as specifically approved in writing by the FWC.
 3. Manufactured and Fabricated Products:
 - a. Design, fabricate, and assemble in accordance with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Equipment and Materials shall be suitable for service conditions intended.
 - d. Equipment capacities, sizes, and dimensions indicated or specified shall be adhered to unless variations are specifically approved in writing.
 - e. Provide labels and nameplates where required by regulatory agencies or to state identification and essential operating data.
 - f. Two (2) or more items of the same kind shall be identical, supplied by the same MANUFACTURER.
 4. Do not use equipment and material for any purpose other than that for which it is designed or is specified.
- D. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- E. Identification: Each item of equipment shall have permanently affixed to it a label or tag with its equipment number designated in this Contract. The label or tag shall be stainless steel and shall be located so as to be easily visible.

1.04 TRANSPORTATION AND SHIPMENT:

- A. Shipment Preparation: The CONTRACTOR shall require MANUFACTURERS and suppliers to prepare Equipment and Materials for shipment in a manner to facilitate unloading and handling, and to protect against damage or unnecessary exposure in transit and storage, for CONTRACTOR supplied equipment. Provisions for protection shall include the following:
1. Crates or other suitable packaging materials
 2. Covers and other means to prevent corrosion, moisture damage, mechanical injury, and accumulation of dirt in motors, electrical equipment, and machinery
 3. Suitable rust-preventive compound on exposed machined surfaces and unpainted iron and steel
 4. Grease packing or oil lubrication in all bearings and similar items
 5. Precast concrete components shall be transported, lifted and stored as specified by the precast supplier. Precast supplier shall provide written instructions to the CONTRACTOR as to the above. The CONTRACTOR shall provide a copy to the FWC.
- B. Marking: Each item of Equipment and Material shall be tagged or marked as identified in the delivery schedule or on Submittals, submitted in accordance with SECTION 01300. Complete packing lists and bills of material shall be included with each shipment. Each piece of every item need not be marked separately, provided that all pieces of each item are packed or bundled together and the packages or bundles are properly tagged or marked.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Delivery – The CONTRACTOR shall:
1. Arrange deliveries of Equipment and Materials in accordance with construction schedules, in ample time to facilitate inspection prior to installation, and to avoid delay of the WORK.

2. Deliver, store and handle Equipment and Materials in accordance with the MANUFACTURER's recommendations using means and methods that will prevent damage, deterioration, and loss, including theft.
 3. Control delivery schedules to minimize long term storage at the Site and to prevent overcrowding of construction areas. In particular, coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.
 4. Avoid conflict with Work of FWC or other contractors.
 5. Deliver Equipment and Materials to the Site in MANUFACTURER's sealed containers or other packaging system with identifying labels and instructions for handling, storing, unpacking, protecting, and installing.
 6. Mark deliveries of component parts of equipment to identify the equipment, to permit easy accumulation of parts, and to facilitate inspection and measurement of quantity or counting of units.
 7. Immediately upon delivery, inspect shipment to assure:
 - a. That each product complies with requirements of Contract Documents and reviewed Submittals.
 - b. Quantities are correct.
 - c. Containers and packages are intact, labels are legible.
 - d. Equipment and Materials are properly protected and undamaged.
- B. Storage – The CONTRACTOR shall:
1. Store Equipment and Materials immediately after delivery, and protect it as necessary until completion of the WORK. Store in accordance with MANUFACTURER's instructions with seals and labels intact and legible.
 2. Store Equipment and Materials in a manner that will not endanger the supporting construction and/or existing structures and facilities.
 3. Store Equipment and Materials that are subject to damage by elements in weathertight enclosures.
 4. Maintain temperature and humidity within ranges required by the MANUFACTURER.
 5. Protect motors, electrical equipment, plumbing fixtures, and machinery of all kinds against corrosion, moisture deteriorations, mechanical injury, and accumulation of dirt or other foreign matter.
 6. Protect exposed-machined surfaces and unpainted iron and steel as necessary with suitable rust-preventive compounds.
 7. Protect bearings and similar items with grease packing or oil lubrication.
 8. Handle and store steel plate, sheet metal, and similar items in a manner to prevent deformation.
 9. Exterior Storage – The CONTRACTOR shall:
 - a. Provide platforms, blocking, or skids to support fabricated products aboveground; and to prevent soiling, staining and damage. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
 - b. Store loose granular materials on solid surface areas to prevent mixing with foreign matter.
 - c. Provide surface drainage to prevent flow or ponding of rainwater where items are stored.

10. Equipment and Materials shall not show any pitting, rust, decay, or other deleterious effects of storage prior to final acceptance of WORK.
 11. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and are free from damage or deterioration.
 12. Prior to storing, the CONTRACTOR shall stake proposed areas for storage for FWC approval.
- C. Handling – The CONTRACTOR shall:
1. Provide equipment and personnel necessary, to properly unload and handle Equipment and Materials, by methods to prevent damage, soiling and /or staining of the Equipment and Materials, or packaging.
 2. Handle by methods to prevent bending or overstressing. Where lifting points are designated, lift components only at those points.
 3. Provide additional protection to surrounding surfaces as necessary to prevent damage.
- D. Maintenance of Storage – The CONTRACTOR shall:
1. Inspect stored Equipment and Materials on a regularly scheduled basis.
 2. Verify that storage facilities comply with the MANUFACTURER's product storage requirements, including environmental conditions continually maintained.
 3. Verify that surfaces of products exposed to elements are not adversely affected. Any weathering of finishes is not acceptable under requirements of Contract Documents.
 4. For mechanical and electrical equipment in long-term storage, provide the MANUFACTURER's service instructions to accompany each item, with notice of enclosed instructions on the exterior of the package. Service the Equipment, as necessary on a regularly scheduled basis.
- E. Protection after installation – The CONTRACTOR shall:
1. Provide substantial coverings as necessary to protect all installed Equipment and Materials from damage from subsequent construction operations. Remove the protective coverings when no longer needed or as specified.

1.06 EXISTING EQUIPMENT AND MATERIALS:

- A. Equipment and Materials to be reused:
1. For Equipment and Materials specifically indicated or specified to be reused in the WORK, use special care in removal, handling, storage, and reinstallation to assure proper function in the completed WORK.
 2. Arrange for transportation, storage and handling of products which require off-site storage, restoration, or renovation and pay all costs for such work.
 3. The CONTRACTOR may at his option, furnish and install new items in lieu of those specified to be reused.
- B. Equipment and Materials not to be reused:
1. The following Equipment and Materials to be removed shall remain FWC's property and are not to be reused in the WORK. The CONTRACTOR shall Remove from its location, prepare for handling and storage, and deliver to FWC.
 - a. None.

- C. Equipment and Materials designated to be removed but not reused or delivered to FWC, shall become the property of the CONTRACTOR and shall be removed from the Site.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS:

- A. Specified in each applicable SECTION of the Technical Specifications and Drawings.

2.02 PRODUCT SELECTION AND SUBSTITUTIONS:

- A. Specified in the Invitation to Bid and General Terms & Conditions.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS:

- A. Installation:
 - 1. When Contract Documents require that installation of WORK shall comply with MANUFACTURER's printed instructions, the CONTRACTOR shall:
 - a. Obtain and distribute copies of such instructions if not a part of Submittals, containers, or packaging to all parties involved in the installation, including a copy to the FWC.
 - b. Maintain one complete set of instructions at the Site during installation and until Final Acceptance.
 - c. Handle, install, connect, clean, condition, and adjust all products in accordance with such instructions and in conformance with the specified requirements. Should job conditions or specified requirements conflict with the MANUFACTURER's instructions, consult with the FWC for further instructions.
 - d. Not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents, and approved in writing by the MANUFACTURER and the FWC.
 - e. Accurately locate and align with other work, and anchor all Equipment and Materials securely in place except as required for proper movement and performance.
 - f. Clean and protect all exposed surfaces as necessary to ensure freedom from damage and deterioration until Final Acceptance.

END OF SECTION

SECTION 01640 START-UP/CHECK-OUT/MANUFACTURER'S FIELD SERVICES FOR CONTRACTOR
FURNISHED EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION includes requirements of the CONTRACTOR in relation to services to be performed at the Site by the MANUFACTURERS and Suppliers of CONTRACTOR Furnished equipment, regarding the erection, start-up, and testing of CONTRACTOR Furnished equipment.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 01660 - Equipment and System Performance and Operational Testing

1.02 SUBMITTALS:

- A. All submittals shall be in accordance with SECTION 01300.
- B. Submittals mentioned in this SECTION.
 - 1. Equipment Installation Report/Placing Equipment in Operation Forms including Equipment Alignment Measurements.
 - 2. Equipment Start-up/Check-out Plan for each piece of equipment including but not limited to pumping systems, generator, gate, flashboard riser, stop logs and instrumentation and controls (I&C).
 - 3. MANUFACTURER Equipment and Materials Ready for Testing Certification.

1.03 SERVICES REQUIRED:

- A. The following services are to be provided for all CONTRACTOR Furnished Equipment and Materials under this Contract:
 - 1. Provide the services of Qualified Field personnel from the MANUFACTURER(s) and Supplier(s) of Equipment and Materials furnished by the CONTRACTOR and installed under this Contract, and perform all required MANUFACTURER's Field Services. Qualified field personnel shall be certified by the MANUFACTURER of the specific product or system as having the necessary knowledge and experience to perform the required Field Services.
 - 2. Where such services are specified, the CONTRACTOR shall not perform any WORK related to the installation or operation of the Equipment and Materials furnished and installed under this Contract without direct supervision and guidance from the MANUFACTURER's and Supplier's Qualified Field personnel unless the FWC concurs otherwise, in writing.
 - 3. For the installation of the pumping systems, the generator, the gate, the flashboard risers, the stop logs, the I&C, and where else required, the MANUFACTURER's and Supplier's Qualified Field personnel shall perform the following:
 - a. Observe the erection, installation, start-up and testing of equipment.
 - b. Instruct and guide the CONTRACTOR in proper equipment installation, start-up, testing and operation procedures.
 - c. Supervise the initial start-up, operational check, and any required adjustments of the equipment.

- d. Instruct and train the FWC's designated personnel in proper operation and maintenance of all CONTRACTOR Furnished equipment.
 - e. Furnish a written report, in accordance with SECTION 01300, to the FWC covering all WORK done at least once each week and when WORK on each item of equipment or system is completed.
4. The CONTRACTOR shall provide at least five (5) working days advance notice prior to the arrival of any MANUFACTURER's and/or Supplier's Qualified Field personnel at the Site.
- B. The CONTRACTOR shall submit an equipment start-up/check-out plan (Plan) to the FWC for review. The Plan at a minimum shall include the equipment and components to be started/checked-out/tested, start-up/check-out/testing duration, personnel required, and details of procedures to be used.

PART 2 - PRODUCTS (Specified in applicable Sections)

PART 3 - EXECUTION

3.01 OPERATION AND TESTING:

- A. Placing Equipment in Operation:
- 1. The CONTRACTOR shall place all Equipment and Materials installed under this Contract into successful operation according to instructions of the Supplier, MANUFACTURER, or their Qualified Field personnel, including making all required adjustments, tests, operation checks, plus the following:
 - a. Cleaning, sounding, blowing-out, and flushing of lubricating oil and water systems, and other pipelines.
 - b. All required lubrication, fuels, supplies, power, consumables, water, and labor for the duration of start-up and testing, and until Substantial Completion of the WORK.
 - c. Tests of lubrication system safety interlocks and system performance.
 - d. Final alignment checks and measurements made under observation of the FWC. Alignment checks shall include opening connections, if required, to ensure there are no abnormal stresses on equipment from pipes, ducts, or other attachments. Alignment shall be within tolerances specified by the MANUFACTURER, and the measurements shall be recorded and furnished to the FWC.
 - e. Motor rotation checks before connecting couplings.
 - f. Inspection of sleeve bearings for adequate contact.
 - g. Checking of anchor-bolt tensions, grout and shims. Tighten all anchor bolts with calibrated torque wrenches using care not to over stress the bolts.
 - 2. After "run-in" and acceptance of alignment, and where specified, affix major equipment in place using standard tapered dowels with jack-out nuts at the head ends to facilitate equipment removal.
 - 3. Record and submit all of the above operations on forms acceptable to the FWC.
 - 4. Provide all necessary attendants and personnel as part of the WORK to accomplish the above operations until such time as individual items, systems, equipment, or sections of the Project are acceptable for operation by the FWC.
 - 5. Provide attendants on a continuous basis, as required, to complete the start-up/check-out/testing procedures without interruption once they have been started and to provide all necessary training to FWC personnel.
- B. Performance Tests:

1. Equipment and Materials Furnished by the CONTRACTOR:
 - a. The FWC may conduct acceptance tests after installation to determine if the Equipment and Materials installed as part of the WORK perform in accordance with Contract Documents. Final acceptance of Equipment and Materials will be based on the acceptable results of such tests.
 - b. No tests will be conducted on Equipment and Materials for which MANUFACTURER's Field Service is specified unless the MANUFACTURER's Field Representative is present and declares in writing that the Equipment and Materials are ready for testing.
 - c. The tests will be made as set forth in the Contract Documents unless the interested parties mutually agree upon some other manner of testing.

END OF SECTION

SECTION 01660 EQUIPMENT AND SYSTEM PERFORMANCE AND OPERATIONAL TESTING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION contains requirements for the CONTRACTOR in documenting testing work required under this Contract. In addition, this SECTION contains requirements for the CONTRACTOR during installed performance testing of all mechanical, electrical, instrumentation, and Heating, Ventilation, and Air Conditioning (HVAC) equipment and systems, including structures for watertight construction, provided under this Contract and all equipment furnished by the FWC. This SECTION supplements but does not supersede specific testing requirements found elsewhere in this Contract.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 01310 – Construction Schedule
 - 3. SECTION 01640 - Start-up/Check-out/Manufacturer’s Field Services for Contractor Furnished Equipment
 - 4. SECTION 01700 – Contract Closeout

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B40.1 – Standard for Pressure Gauges and Gauge Attachments
 - 2. American Society of Testing Materials (ASTM):
 - a. E77 - Standard Test Method for Inspection and Verification of Thermometers
 - 3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
 - a. E 41.8 - Standard Methods of Measurement of Flow of Gas
- B. Dye Dilution: Flow Measurement in Open Channels and Closed Conduits
- C. U.S. Department of Commerce
 - 1. National Bureau of Standards: Calibration Method, Vol. 1
- D. U.S. Geological Survey (USGS)
 - 1. Techniques of Water-Resources Investigations of the United States Geological Survey: Measurement of Discharge Using Tracers

1.03 QUALITY CONTROL:

- A. The Quality Control Plan shall include, but not be limited to, the following:
 - 1. A testing plan setting forth the sequence in which all testing work required under this Contract will be implemented
 - 2. A documentation program to record the results of all equipment and system tests

3. An installed performance testing program for all mechanical, electrical, and instrumentation equipment and systems installed under this Contract
 4. A calibration program for all instruments, meters, monitors, gages, and thermometers installed under this Contract
 5. A calibration program for all instruments, gages, meters, and thermometers used for determining the performance of equipment and systems installed under this Contract
- B. For the purposes of this SECTION, a system shall include all items of equipment, devices and appurtenances connected in such a fashion as their operation or function complements, protects or controls the operation or function of the others. The CONTRACTOR's Quality Control Manager shall coordinate the activities of all Subcontractors and suppliers for equipment and materials supplied by both the CONTRACTOR and the FWC to implement the requirements of this SECTION.

1.04 CALIBRATION:

1. All test equipment (gages, meters, thermometers, analysis instruments, and other equipment) used for calibrating or verifying the performance of equipment installed under this Contract shall be calibrated to within plus or minus two (2) percent of actual value at full scale. Test equipment employed for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale. Pressure gages shall be calibrated in accordance with ANSI/ASME B40.1. Thermometers shall be calibrated in accordance with ASTM E77 and shall be furnished with a certified calibration curve.
2. Liquid flow meters, including all open channel flow meters and all meters installed in pipelines with diameters greater than two (2) inches shall be calibrated in situ using either the total count or dye dilution methods. Gas flow meters installed in piping systems with diameters greater than six (6) inches shall be calibrated in situ using the pitot tube velocity averaging method. Flow meter calibration work shall be performed by individuals skilled in the techniques to be employed. Calibration tests for flow metering systems shall be performed over a range of not less than ten (10) percent to at least 75 percent of system full scale. At least five (5) confirmed valid data points shall be obtained within this range. Confirmed data points shall be validated by not less than three (3) test runs with results which agree within plus or minus two (2) percent.

1.05 SUBMITTALS:

- A. Submittal material, to be submitted in accordance with SECTION 01300, shall consist of the following:
1. Equipment Testing Quality Control Plan
 - a. Include requirements per paragraph 01660-1.03.
 - b. The CONTRACTOR's plan for documenting the results from the test program in conformance with the requirements of paragraph 01660-2.02 A, including:
 - i. Proposed plan for documenting the calibration of all test instruments
 - ii. Proposed plan for calibration of all instrument systems, including flow meters and all temperature, pressure, weight, and analysis systems
 - c. The credentials and certification of the testing laboratory proposed by the CONTRACTOR for calibration of all test equipment.
 - d. A summary of the Quality Control Manager's qualifications for testing equipment.
 2. Equipment Testing Schedule

- a. A schedule presenting the CONTRACTOR's plan for testing the equipment and systems installed under this Contract
 - b. A schedule establishing the expected time period (calendar dates) when the CONTRACTOR plans to commence operational testing of the completed systems.
3. Equipment Test Plan
- a. Pre-operational check-out procedures, reviewed and approved by the respective equipment MANUFACTURERS.
 - b. Description of the temporary systems and installations planned to allow operational testing to take place.
 - c. Detailed testing plans, setting forth step-by-step descriptions of the procedures proposed by the CONTRACTOR for the systematic testing of all equipment and systems installed under this Contract.
 - d. Sample forms for documenting the results of field pressure and performance tests.
4. Equipment Test Results

PART 2 - PRODUCTS

2.01 GENERAL:

- A. The CONTRACTOR shall prepare test plans and documentation plans as specified in the following paragraphs. The FWC will not witness any test work for the purpose of acceptance until all test documentation and calibration plans and the specified system or equipment test plans have been submitted and accepted.

2.02 DOCUMENTATION:

- A. The CONTRACTOR shall develop a records keeping system to document compliance with the requirements of this SECTION. Calibration documentation shall include identification (by make, MANUFACTURER, model, and serial number) of all test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory.

Equipment and system documentation shall include date of test, equipment number or system name, nature of test, test objectives, test results, test instruments employed for the test and signature spaces for the FWC's witness and the CONTRACTOR's Quality Control Manager. A separate file shall be established for each system and item of equipment. These files shall include the following information as a minimum:

1. Metallurgical tests
2. Factory performance tests
3. Accelerometer recordings made during shipment
4. Field calibration tests
5. Field pressure tests
6. Field performance tests
7. Field operational tests

The CONTRACTOR shall develop test documentation forms specific to each item of equipment and system installed under this Contract. Acceptable documentation forms for all systems and items of equipment shall be produced for review by the FWC.

2.03 TEST PLANS

- A. The CONTRACTOR shall develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this Contract. Each test plan shall be specific to the item of equipment or system to be tested. Test plans shall identify by specific equipment or tag number each device or control station to be manipulated or observed during the test procedure and the specific results to be observed or obtained. Test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, Subcontractors' and MANUFACTURER's representatives to be present and expected test duration.
1. As a minimum, the test plans shall include the following features:
 - a. Step-by-step proving procedure for all control and electrical circuits by imposing low voltage currents and using appropriate indicators to affirm that the circuit is properly identified and connected to the proper device
 - b. Calibration of all analysis instruments and control sensors
 - c. Performance testing of each individual item of mechanical, electrical, and instrumentation equipment. Performance tests shall be selected to duplicate the operating conditions described in the Contract.
 - d. System tests designed to duplicate, as closely as possible, operating conditions described in the Contract
 2. Test plans shall contain a complete description of the procedures to be employed to achieve the desired test environment.
 3. Delivery of all test plans required for the systematic field performance and operational tests for all equipment and systems installed under this Contract shall be made four (4) calendar weeks in advance of the date the CONTRACTOR wishes to begin such testing. Once the FWC has reviewed and taken no exception to the CONTRACTOR's test plans, the CONTRACTOR shall reproduce the plans in sufficient number for the CONTRACTOR's purposes and an additional copy for delivery to the FWC. No test work shall begin until the CONTRACTOR has delivered the specified number of final test plans to the FWC.
- B. The following testing plans shall be provided for this Contract.
1. SAL Grade Pump Station including automatic float switch operations, generator operations, and extended operations.
 2. Bond Farm HEI Pump Station including automatic float switch operations and extended operations.
 3. Primary Discharge Structure including full open and close of gate.
 4. Flashboard Risers and Stop Logs including installation and removal of all boards and logs.

2.04 TESTING SCHEDULE

- A. The CONTRACTOR shall produce a testing schedule setting forth the sequence contemplated for performing the test work. The schedule shall be in bar chart form, plotted against calendar time, shall detail the equipment and systems to be tested, and shall be coordinated with the CONTRACTOR's Construction Schedule specified in SECTION 01310. The schedule shall show the contemplated start date, duration of the test and completion of each test. The test schedule shall be submitted no later than four (4) weeks in advance of the date testing is to begin. The FWC will not witness any testing work for the purpose of acceptance until the CONTRACTOR has submitted a schedule to which the FWC takes no exception. The test schedule shall be updated weekly, showing actual dates of test work, indicating systems and equipment testing completed satisfactorily and meeting the requirements of this Contract.

- B. All performance and operational testing required under this SECTION shall be completed prior Substantial Completion.

2.05 SYSTEM AND EQUIPMENT PERFORMANCE TESTS:

- A. Each item of mechanical, electrical, instrumentation and HVAC equipment installed under this Contract shall be tested to demonstrate compliance with the performance requirements of this Contract.
- B. Each electrical, instrumentation, mechanical, piping, and HVAC system installed or modified under this Contract shall be tested in accordance with the requirements of this Contract.

2.06 OPERATIONAL TESTS:

- A. Once all equipment and systems have been tested individually, the CONTRACTOR shall fill all systems with the intended process fluids sufficient to satisfy all individual component and system tests. The CONTRACTOR shall then operate all systems for a continuous period of not less than five (5) days or as specified by the FWC, simulating actual operating conditions to the greatest extent possible. The CONTRACTOR shall install temporary connections, bulkheads and make other provisions to recirculate process fluids or otherwise simulate anticipated operating conditions. During the operational testing period, the CONTRACTOR's Quality Control Manager and testing team shall monitor the characteristics of each machine and system and report any unusual conditions to the FWC.

2.07 PRODUCT DATA:

- A. Records produced during the testing program shall be considered as Product Data, to be provided in accordance with SECTION 01300.

PART 3 - EXECUTION

3.01 GENERAL:

- A. The CONTRACTOR's Quality Control Manager shall organize teams made up of qualified representatives of equipment suppliers (for both CONTRACTOR and FWC supplied equipment and materials), Subcontractors, the CONTRACTOR's independent testing laboratory, and others, as appropriate, to efficiently and expeditiously calibrate and test the equipment and systems installed and constructed under this Contract. The objective of the testing program shall be to demonstrate, to the FWC's complete satisfaction, that the structures, systems, and equipment constructed and installed under this Contract meet all performance requirements and the facility is ready for Substantial Completion. In addition, the testing program shall produce baseline operating conditions for the FWC to use in a preventive maintenance program.

3.02 CALIBRATION OF FIXED INSTRUMENTS:

- A. Calibration of analysis instruments, sensors, gages, and meters installed under this Contract shall proceed on a system-by-system basis. No equipment or system performance acceptance tests shall be performed until instruments, gages, and meters to be installed in that particular system have been calibrated and the calibration work has been witnessed by the FWC.
- B. All analysis instruments, sensors, gages, and meters used for performance testing shall be subject to recalibration to confirm accuracy after completion, but prior to acceptance of each performance test. All analysis instruments, sensors, gages, and meters installed under this Contract shall be subject to recalibration as a condition precedent to Substantial Completion.

3.03 PERFORMANCE TESTS:

- A. General: Performance tests shall consist of the following:
 - 1. Pressure and/or leakage tests

2. Electrical testing as specified in DIVISION 16
3. Wiring and piping, individual component, loop, loop commissioning and tuning testing as described in DIVISION 16
4. Pre-operational checkout for all mechanical and HVAC equipment. Pre-operational check-out procedures shall be reviewed and approved by the respective equipment MANUFACTURERS.
5. Initial operation tests of all mechanical, electrical, HVAC, and instrumentation equipment and systems to demonstrate compliance with the performance requirements of this Contract.

In general, performance tests for any individual system shall be performed in the order listed above. The order may be altered only on the specific written authorization of the FWC after receipt of a written request, complete with justification of the need for the change in sequence.

- B. Pressure and Leakage Tests: Pressure and leakage tests shall be conducted in accordance with applicable portions of the Specifications. All acceptance tests shall be witnessed by the FWC. Evidence of successful completion of the pressure and leakage tests shall be the FWC representative's signature on the test forms prepared by the CONTRACTOR.
- C. Functional Checkout: Prior to energization (in the case of electrical systems and equipment), all circuits shall be run out and tested for continuity and shielding in accordance with the procedures required in DIVISION 16.
- D. Component Calibration and Loop Testing: Prior to energization (in the case of instrumentation system and equipment), all loops and associated instruments shall be calibrated and tested in accordance with the procedures required in DIVISION 16.
- E. Electrical Resistance: Electrical resistance testing shall be in accordance with DIVISION 16.
- F. Pre-Operational Tests: Pre-operational tests shall include the following:
 1. Alignment of equipment using reverse dial indicator method
 2. Pre-operation lubrication
 3. Tests per the MANUFACTURERS' recommendations for prestart preparation and pre-operational check-out procedures
- G. Functional Tests:
 1. General:
 - a. Once all affected equipment has been subjected to the required pre-operational check-out procedures and the FWC has witnessed and has not found deficiencies in that portion of the work, individual items of equipment and systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these specifications. **If available, canal water may be employed for the testing of all liquid systems except gaseous, oil, or chemical systems. If not available, potable water shall be employed as the test medium.** Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including noise, temperatures and vibration; to observe performance characteristics; and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems such as looped piping, electrical power, compressed air, or control air the CONTRACTOR shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system at no additional cost to the FWC. Disposal methods for test media shall be subject to review by the FWC. During the functional test period, the CONTRACTOR shall obtain baseline operating data on all equipment with motors greater than 1 horsepower to include

amperage, bearing temperatures, and vibration. The baseline data shall be collected for the FWC to enter in a preventive maintenance system.

- b. Test results shall be within the tolerances set forth in the detailed specification sections of this Contract. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory functional test, any doubt, dispute, or difference should arise between the FWC and the CONTRACTOR regarding the test results or the methods or equipment used in the performance of such test, the FWC may order the test to be repeated.
 - c. If the repeat test, using such modified methods or equipment as the FWC may require, confirms the previous test, then all costs in connection with the repeat test will be paid by the FWC. Otherwise, the costs shall be borne by the CONTRACTOR. Where the results of any functional test fail to comply with the Contract requirements for such test, then such repeat tests as may be necessary to achieve the Contract requirements shall be made by the CONTRACTOR at his expense.
 - d. The CONTRACTOR shall provide, at no expense to the FWC, all power, fuel, compressed air supplies, water, chemicals, and any other necessary consumable item, all labor, temporary piping, heating, ventilating, and air conditioning for any areas where permanent facilities are not complete and operable at the time of functional tests, and all other items and work, required to complete the functional tests. Temporary facilities shall be maintained until permanent systems are in service.
2. Retesting: If under test, any portion of the work should fail to fulfill the Contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the work as are affected thereby, shall, unless otherwise directed by the FWC, be repeated within reasonable time and in accordance with the specified conditions. The CONTRACTOR shall pay to the FWC all reasonable expenses incurred by the FWC, including the costs of the Engineer if applicable, as a result of repeating such tests.
 3. Post-Test Inspection: Once functional testing has been completed, all machines shall be rechecked for proper alignment and realigned, as required. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the FWC. All machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. Any defects found during the course of the inspection shall be repaired or the specific part or entire equipment item shall be replaced to the complete satisfaction of the FWC at no cost to the FWC.

END OF SECTION

SECTION 01700 CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION includes administrative and procedural requirements for Contract Closeout including, but not limited to, the following:
 - 1. Inspection procedures
 - 2. Project record document submittal
 - 3. Operation and maintenance manual submittal
 - 4. Submittal of warranties
 - 5. Final cleaning
 - 6. CONTRACTOR's Certification
- B. Closeout requirements for specific construction activities are included in the appropriate SECTIONS in DIVISIONS 1 through 16.
- C. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 01050 - Field Engineering and Surveying
 - 3. SECTION 01530 – Protection of Work, Project Controls, Temporary Barriers and Security
 - 4. SECTION 01640 - Start-up/Check-out/Manufacturer's Field Services for Contractor Furnished Equipment
 - 5. SECTION 01660 – Equipment and System Performance and Operational Testing

1.02 SUBSTANTIAL COMPLETION:

- A. Preliminary Procedures: Requirements shall be in accordance with the General Terms and Conditions. Before requesting inspection for certification of Substantial Completion, the CONTRACTOR shall satisfy the following:
 - 1. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents. Submit in accordance with SECTION 01300.
 - 2. Obtain and submit releases enabling the FWC unrestricted use of the WORK and access to services and utilities. Include Certificates of Occupancy (C.O.), operating certificates, and similar releases, as required.
 - 3. Submit Record Documents, including but not limited to, maintenance manuals, Project photographs, damage or settlement surveys, boundary surveys, all As-Built and Topographic Surveys as per SECTION 01050, per other SECTIONS and per the General Terms and Conditions. Submit similar record information as specified in Paragraph 1.04.
 - a. All As-Built and other drawings shall be provided in AutoCAD electronic format in accordance with the General Terms and Conditions. All other documents shall also be submitted in PDF format in accordance with SECTION 01300.
 - 4. Provide one year's worth of spare parts and expendables for the operation and maintenance of all Equipment and Materials provided under this Contract along with any Special Tooling required to operate and maintain the Equipment.
 - 5. Complete final cleanup requirements, including touch up painting. The site shall be thoroughly cleaned.
 - 6. Touch up and otherwise repair and restore marred, exposed finishes.
 - 7. Within one week prior to Substantial Completion, the CONTRACTOR shall perform a final mowing of all slopes and roads and a final grading of the Perimeter Berm shellrock road including northwest corner of the Project. At this time, the CONTRACTOR shall add four to six inches of

shellrock on the approximately 1400 feet of SAL Grade Road south of the intersection with Oil Well Road and final grade.

- B. Inspection Procedures: On receipt of a request for inspection, the FWC will either proceed with inspection or advise the CONTRACTOR of unfilled requirements. The FWC will reschedule the inspection when in its opinion, the WORK is substantially complete. The CONTRACTOR will prepare the CONTRACTOR's Affidavit of Contract Completion following inspection that is acceptable to FWC.

1.03 TRAINING

- A. Subsequent to the time of Substantial Completion and receipt of As-Builts, Operations and Maintenance Books but prior to the date of Final Acceptance, Contractor and/or Subcontractor shall provide a competent and experienced person (or persons) thoroughly familiar with the work for a reasonable period of time to instruct the FWC personnel in operation and maintenance of equipment and control systems.
- B. This instruction will include normal start-up, run, stop, and emergency operations, location and operation of all controls, alarms and alarm systems, etc. The instruction will include tracing the system in the field and on the diagrams in the instruction booklets so that operating personnel will be thoroughly familiar with both the system and the data supplied.

1.04 FINAL ACCEPTANCE:

- A. Perform Final Acceptance within thirty (30) days after Substantial Completion in accordance with the General Terms and Conditions.

1.05 RECORD DOCUMENT SUBMITTALS:

- A. Refer to the General Terms and Conditions for additional requirements.
- B. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure location. Provide access to record documents for the FWC's reference during normal working hours throughout construction.
- C. As-Built Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Drawings and Shop Drawings. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set. Mark the set to show the actual installation where the installation varies substantially from the WORK as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Call attention to each entry by drawing a "cloud" around the areas affected.
- D. The CONTRACTOR must obtain concurrence from the FWC as to form and content of As-Built/Record information provided in electronic format prior to proceeding, but in general, information similar to that noted below needs to be provided.
 - 1. Drawings:
 - a. Record information concurrently with construction progress.
 - b. Mark record sets with red erasable pencil. Mark each document "AS-BUILT DRAWINGS" in neat, large, printed letters.
 - c. Mark As-Built invert elevations for all water control structures, culverts, etc. Refer to SECTION 01050 for structures which require a permanent benchmark.
 - d. Mark new information that is important to the FWC that is not shown on Drawings or Shop Drawings.
 - e. Note related Change-Order numbers where applicable.
 - f. Include the following:
 - i. Where Submittals (like Shop Drawings) are used for mark-up, record a cross-reference at corresponding location on Drawings.
 - ii. Field changes of dimension and detail.

- iii. Changes made by Change Order or other Modifications.
 - iv. Details not on original Drawings.
 - v. As-Builts shall also include a plot of the actual excavation cross-sections plotted at a maximum of 200 foot intervals with intervals as necessary to define the WORK and overlaid on top of the design cross-sections. Refer to SECTION 01050.
 - vi. As-Builts shall include a plot of the actual levee, embankment, berm, bank and slope cross-sections plotted at a maximum of every 200 feet with intervals as necessary to define the WORK and overlaid on top of the design cross-sections. Refer to SECTION 01050.
 - vii. Give particular attention to concealed elements that would be difficult or expensive to locate at a later date.
 - viii. GPS (global positioning system) coordinates of major structures using the format lat/long DD (decimal/degree) NAD83/2007 (North American Datum).
 - g. Affix the CONTRACTOR's corporate seal on the cover sheet indicating the documents within are representative of the as-built condition of the Project. The seal shall be signed by an officer of the company.
2. Record Specifications: Maintain one (1) complete red line copy of the Technical Specifications and other Contract Documents including addenda. Include with the Contract Documents one (1) copy of other written construction documents, such as Requests for Information (RFIs), Change Orders and modifications issued in printed form during construction.
 - a. Mark these documents to show substantial variations in actual WORK performed in comparison with the text of the Specifications and modifications.
 - b. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
 - c. Note related As-Built information and Product Data.
 - d. Upon completion of the WORK, submit Record Specifications to the FWC for the FWC's records on CD in PDF format. Include the following:
 - i. MANUFACTURER, trade name, catalog number, and Supplier of each product and item of equipment actually installed, including optional and substitute items
 - ii. Changes made by Addendum, Change Order, or other Modifications
 - iii. Related Submittals
 - e. Affix the CONTRACTOR's corporate seal on the cover sheet indicating the documents within are representative of the as-built condition of the Project. The seal shall be signed by an officer of the company.
 3. Record Product Data: Provide one (1) copy of each Product Data submittal. Note related Change Orders and markup of Record Documents.
 - a. Mark these documents to show significant variations in actual WORK performed in comparison with information submitted. Include variations in products delivered to the Site and from the MANUFACTURER's installation instructions and recommendations.
 - b. Give particular attention to concealed products and portions of the WORK that cannot otherwise be readily discerned later by direct observation.
 4. Record Sample Submitted: Immediately prior to Substantial Completion, the CONTRACTOR shall meet with the FWC's personnel at the Project Site to determine which Samples are to be transmitted to the FWC for record purposes. Comply with the FWC's instructions regarding packaging, identification, and delivery to the FWC.
- E. Warranties and Bonds: Submit original documents as specified in FWC's General Terms & Conditions, Supplemental Conditions, SECTION 01300, and Technical Specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 FINAL CLEANING:

- A. General: The General Terms & Conditions require general cleaning during construction. Regular Site cleaning is included in SECTION 01530.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with MANUFACTURER's instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
 - a. Clean the Site of rubbish, litter, and other foreign substances. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
 - b. Remove temporary structures, tools, equipment, supplies, and surplus materials.
 - c. Remove temporary protection devices and facilities which were installed to protect previously completed WORK.
- C. Removal of Field Offices: Remove CONTRACTOR and FWC Field Offices and all associated appurtenances at a timing acceptable to the FWC.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the WORK during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the FWC's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems, surface waters or wetlands. Remove waste materials from the Site and dispose of lawfully.
 - 1. Where extra materials of value remain after completion of associated WORK, they become the FWC's property. Dispose of materials of no value to the FWC as directed by the FWC.
- F. Repairs:
 - 1. Repair damaged protective coated surfaces.
 - 2. Repair roads and other items damaged or deteriorated because of construction operations, including those which have been damaged, but are not located within the Project limits.
 - 3. Restore all ground areas affected by construction operations.

END OF SECTION

SECTION 01730 OPERATION AND MAINTENANCE INFORMATION

PART 1 - GENERAL

1.01 SCOPE: Operation and Maintenance (O&M) instructions shall be provided in accordance with this SECTION, as required in the Technical Specifications and in accordance with the General Terms and Conditions. O&M information shall be provided for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this Contract.

A. O&M instructions must be submitted and accepted before on-site training may start.

1.02 TYPES OF INFORMATION REQUIRED:

A. General: O&M information shall contain the names, addresses, and telephone numbers of the MANUFACTURER, the nearest representative of the MANUFACTURER, and the nearest Supplier of the MANUFACTURER's equipment and parts. See SECTION 01300 for details on how to prepare and submit this data. In addition, one or more of the following items of information shall be provided as applicable.

B. Operating Instructions: Specific instructions, procedures, and illustrations shall be provided for the following phases of operations:

1. Safety Precautions: List personnel hazards for equipment and list safety precautions for all operating conditions.
2. Operator Prestart: Provide requirements to set up and prepare each system for use.
3. Start-Up, Shutdown, and Post Shutdown Procedures: Provide a control sequence for each of these operations.
4. Normal Operations: Provide control diagrams with data to explain operation and control of systems and specific equipment.
5. Emergency Operations: Provide emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.
6. Operator Service Requirements: Provide instructions for services to be performed by the operator such as lubrication, adjustments and inspection.
7. Environmental Conditions: Provide a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or each piece of equipment and describe conditions under which equipment should not be allowed to run.

C. Preventive Maintenance: The following information shall be provided for preventive and scheduled maintenance and repair:

1. Lubrication Data: Provide the following lubrication data.
 - a. A table showing recommended lubricants for specific temperature ranges and applications
 - b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities
 - c. A lubrication schedule showing service interval frequency
2. Preventive Maintenance Plan and Schedule: Provide MANUFACTURER's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide

MANUFACTURER's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

- D. Corrective Maintenance: MANUFACTURER's recommendations shall be provided on procedures and instructions for correcting problems and making repairs.
1. Troubleshooting Guides and Diagnostic Techniques: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
 2. Wiring Diagrams and Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits, including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type identically to actual installation numbering.
 3. Maintenance and Repair Procedures: Provide instructions and list tools required to restore product or equipment to proper condition or operating standards.
 4. Removal and Replacement Instructions: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of test illustrations.
 5. Spare Parts and Supply Lists: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.
 6. Corrective Maintenance Man-Hours: Provide MANUFACTURER's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment MANUFACTURER shall be identified and tabulated separately.
- E. Appendices: The following information shall be provided; include information not specified in the preceding paragraphs but pertinent to the maintenance of the product or equipment.
1. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.
 2. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the MANUFACTURERS and Contract Documents to keep warranties in force.
 3. Personnel Training Requirements: Provide information available from the MANUFACTURERS to use in training designated personnel to operate and maintain the equipment and systems properly.
 4. Testing Equipment and Special Tool Information: Provide information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.03 FIELD CHANGES:

- A. Following the acceptable installation and operation of an equipment item, the item's instructions and procedures shall be modified and supplemented by the CONTRACTOR to reflect any field changes or information requiring field date.

1.04 TRANSMITTAL PROCEDURE:

- A. Unless otherwise specified, O&M manuals, information, and data shall be transmitted in accordance with SECTION 01300. Only complete sets of O&M instructions will be reviewed for acceptance.
- B. Three hardcopies of the specified O&M information shall be provided. For ease of identification, each MANUFACTURER's brochure and manual shall be appropriately labeled with the equipment name and equipment numbers it appears in the project manual. The information shall be organized in the binders in numerical order by the equipment numbers assigned in the project manual. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information. Binders shall be 3-inch, D-ring, presentation type with locking mechanism and clear view vinyl cover for insertion of graphic identifying contents of binder.
 - 1. An electronic PDF shall be provided that replicates this hardcopy information.
- C. If MANUFACTURERS' standard brochures and manuals are used to describe O&M procedures, such brochures and manuals shall be modified to reflect only the model or series of equipment used on this project. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.

END OF SECTION

SECTION 02050 DEMOLITION

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall include the removal of existing features to the limits indicated on drawings where earthwork or other construction operations are to be performed as specified herein. The FWC shall not be responsible for the condition of any items to be removed or salvaged. The items to be demolished include but are not limited to the following:
1. Hay Barn and Cattle Pen
 - a. One-story, wood-framed structure with corrugated metal roofing and corrugated fiberglass panels along exterior walls. Two ends of the barns are open-air, without corrugated fiberglass panels. The floor is exposed soil.
 2. Maintenance Barn
 - a. One-story, steel-framed structure with corrugated metal roofing, exterior wall panels, and a concrete slab-on-grade foundation. The barn includes a kitchen and restroom.
 3. Septic Tank
 4. Fencing
 5. Portions of SAL Grade Road
 6. Culverts
 7. Man-made materials and features encountered during construction, above or below ground
- B. Existing Overhead Power Lines: The CONTRACTOR shall coordinate with the Lee County Electric Cooperative (LCEC) for the removal of the existing overhead power lines and poles by LCEC.

1.02 REFERENCE DOCUMENTS

- A. The following Reference Documents are provided as stated in SECTION 01010.
1. FDOT I-75 SFWMD Permit Mod 08-00155-P, October 20, 2014
 2. Phase I Environmental Site Assessment, October 2014
 3. Phase II Environmental Site Assessment, November 3, 2014
 4. Pre-Demolition Asbestos Survey, March 20, 2020
 5. Septic Tank Closeout Documentation, January 30, 2020

1.03 SUBMITTALS:

- A. Demolition Plan and Schedule:
1. Submit proposed methods and operations of demolition and a demolition schedule for review and approval by the FWC prior to the start of WORK.
- B. Permits:
1. The CONTRACTOR shall be responsible for acquiring appropriate necessary permits for the work. Copies of the permits shall be submitted to the FWC prior to commencement of demolition.
- C. Qualifications for required demolition
- D. Close-out Documentation, if any

1.04 QUALIFICATIONS: The CONTRACTOR shall provide current certifications for the demolition required. These certifications may include demolition of buildings with asbestos and closing out septic tanks.

1.05 RESPONSIBILITIES:

- A. The CONTRACTOR shall not commence demolition of structure(s) prior to written permission of the FWC.
- B. Condition of structures to be demolished:
 - 1. The FWC assumes no responsibility for actual condition of structures to be demolished.
 - 2. Conditions existing at time of inspection for bidding purposes will be maintained by FWC insofar as practicable.
- C. The CONTRACTOR shall remove all such foundations to one foot below the proposed sub-grades, unless otherwise noted.
- D. Explosives: The use of explosives will not be permitted. The CONTRACTOR may use a non-explosive, expanding agent in drilled holes for the demolition of concrete, and shall conform to all MANUFACTURERS' recommendations, including safety precautions for mixing and placing the agent.
- E. The CONTRACTOR shall ensure the safe passage of persons around the area of demolition and clearing. The CONTRACTOR shall conduct operations to prevent injury to adjacent structures, other facilities, and any persons.
 - 1. The CONTRACTOR shall protect existing finish work that is to remain in place from damage due to demolition operations.
- F. Traffic:
 - 1. The CONTRACTOR shall conduct operations and the removal of debris to ensure minimum interference with existing access roads and other adjacent, occupied or used facilities.
 - 2. Do not close, block or otherwise obstruct access roads or other occupied or used facilities without permission from the FWC.
- G. The CONTRACTOR shall promptly repair damages caused to adjacent facilities by demolition operations at no cost to the FWC.
- H. Utilities Disconnection:
 - 1. The CONTRACTOR shall perform all necessary coordination to locate, disconnect, relocate, and/or protect as needed all existing underground, aboveground, and overhead utilities within the limits of demolition prior to commencement of demolition operations. All expenses incurred for the coordination with utility companies and agencies, shall be at no cost to the FWC.
 - 2. The CONTRACTOR shall promptly repair damages to existing utilities that are to remain, at no cost to the FWC.
 - 3. The existing overhead power line that routes through the Project site will be abandoned by the Lee County Electric Cooperative (LCEC). Contact information provided in SECTION 01010. The service provided by this power line will be relocated in buried conduits installed by the CONTRACTOR as indicated on the Drawings. The CONTRACTOR shall coordinate with LCEC on the abandonment of the existing overhead power line and associated appurtenances and the relocation of this power service to provide uninterrupted services to properties to the east of the Project. The abandoned power line belongs to LCEC and LCEC will remove abandoned materials from site. When LCEC is finished with abandonment, if any materials remain on site, the CONTRACTOR shall demolish those materials in accordance with this SECTION.

1.06 CERTIFICATIONS AND TESTING: (Not Used)

1.07 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.08 WARRANTY: (Not Used)

PART 2 - PRODUCTS

2.01 SALVAGE MATERIALS:

- A. The CONTRACTOR shall not salvage any materials from the demolition for FWC use.

PART 3 - EXECUTION

3.01 DEMOLITION:

- A. The CONTRACTOR shall provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
- B. If hazardous materials are found, the CONTRACTOR shall notify the FWC immediately.
- C. The CONTRACTOR shall completely backfill below-grade areas and voids resulting from demolition work if directed by the FWC. The CONTRACTOR shall provide fill consisting of approved soil, gravel or sand (free of trash and debris) and compact fill to approximate density of surrounding native soil if directed to fill below-grade areas and voids. The density of surrounding native soil shall be tested and documented prior to performing adjacent demolition and prior to disturbing the area to be demolished and the surrounding area. The location of the surrounding native soil density test shall be approved by the FWC.
- D. It is recommended that the CONTRACTOR perform a walk-through of the Hay Barn and Maintenance Barn prior to demolition to identify for any suspect asbestos-containing material (ACM) and have all suspect materials sampled and analyzed prior to demolition. As appropriate, demolition activities shall be conducted in accordance with 40 CFR Part 61, Subpart M (NESHAP). Additionally, the CONTRACTOR shall notify FDEP ten working days prior to the start of demolition.
- E. The Hay Barn and associated cattle pen are to be completely demolished and removed. If there is a concrete slab present for this structure, it will be allowed to remain as long as any protrusions through the slab are cut off flush with the slab and plugged with dirt and capped.
- F. Maintenance Barn is to be completely demolished and removed. The concrete slab for this structure is allowed to remain as long as any protrusions through the slab are cut off flush with the slab and plugged with dirt and capped.
- G. Documentation has been provided that the septic tank associated with the Maintenance Barn has been abandoned. If the CONTRACTOR encounters any septic tanks, the CONTRACTOR shall abandon in accordance with local and State requirements. The CONTRACTOR shall provide close-out documentation to FWC
- H. Fencing within construction limits shall demolished. Fencing along the construction limits belongs to adjacent property owners; fencing shall remain and be protected during construction. The CONTRACTOR shall not remove any fencing until the FWC has observed the fence to be removed and provides authorization to remove.

- I. As indicated on the Drawings, portions of the SAL Grade Road within the impoundment interior are to be removed. Unless unsuitable, this soil shall be utilized by the CONTRACTOR in construction of the Project. If unsuitable, the soils shall be placed on site in accordance with SECTION 02200.
- J. The CONTRACTOR shall notify the FWC of any other man-made materials and features encountered during construction such as culverts, pipes or concrete slabs. These materials shall be demolished by the CONTRACTOR unless directed otherwise by FWC.

3.02 DISPOSAL OF DEMOLISHED MATERIALS:

- A. The CONTRACTOR shall remove from Site debris, rubbish, and all other materials resulting from demolition operations.
- B. If hazardous materials are encountered during demolition operations, the CONTRACTOR shall comply with all applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
- C. The CONTRACTOR shall transport materials removed from demolished structures and demolition activities and properly dispose of them at an approved site according to the State, Federal, and local regulations.

3.03 CONNECTIONS TO EXISTING CONSTRUCTION:

- A. The CONTRACTOR shall cut and remove portions of existing construction as required to allow proper installation of new construction.
- B. The CONTRACTOR shall shore, brace and maintain existing structure(s) in a safe condition until permanent supports are completed.
- C. The CONTRACTOR shall repair all damage as a result of installation of shoring and bracing.

3.04 CLEANUP AND REPAIR:

- A. Upon completion of demolition work, the CONTRACTOR shall remove all tools, equipment, and demolished materials from site; see paragraph 1.01 and paragraph 3.02 of this SECTION.
- B. The CONTRACTOR shall repair demolition performed in excess of that required and return structures and surfaces to conditions existing prior to commencement of demolition work. The CONTRACTOR shall repair adjacent construction or surfaces soiled or damaged by demolition work to the satisfaction of the FWC.
- C. The CONTRACTOR shall remove or modify as indicated all existing construction within the construction limits to the extent necessary to permit construction of the work. The CONTRACTOR shall properly dispose of the material at an approved site according to the State, Federal, and local regulations.

END OF SECTION

SECTION 02110 CLEARING AND LAND PREPARATION

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, materials, and equipment necessary for complete and proper Site preparation as approved by FWC based on the CONTRACTOR's staking. The CONTRACTOR shall perform clearing and land preparation activities for excavation and fill areas per this SECTION. The CONTRACTOR shall remove vegetation including trees, heavy brush and other vegetation from areas where earthwork or other construction operations specified in the Drawings are to be performed.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 02050 - Demolition
 - 3. SECTION 02200 - Earthwork
 - 4. SECTION 02221 - Pipe Trenching, Backfilling and Compacting

1.02 APPLICABLE PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Florida Department of Transportation (FDOT)
 - a. Standard Specification for Road and Bridge Construction, Latest Edition

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. Clearing and Land Preparation Plan: Prior to beginning the WORK, CONTRACTOR shall submit a detailed plan for clearing and land preparation in conformance with SECTION 01300. The plan shall detail the sequence of WORK and describe the CONTRACTOR's planned method of clearing and land preparation activities. The plan shall include product data for any proposed herbicides.
- B. CONTRACTOR Obtained Permits including Burn Permits, if applicable.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall ensure the safe passage of persons around areas of clearing and land preparation. The CONTRACTOR shall conduct its operations to prevent injury to adjacent structures, vegetation designated to remain, other facilities and persons.
- B. Traffic:
 - 1. The CONTRACTOR shall conduct its operations and the removal of cleared materials to ensure minimum interference with existing access roads and other adjacent occupied or used facilities.

2. The CONTRACTOR shall not block or otherwise obstruct access roads or other occupied or used facilities without permission from the FWC. Where blockage is allowed, the CONTRACTOR shall provide alternate routes around closed or obstructed traffic ways.
- C. The CONTRACTOR may commence clearing or land preparation within portions of the Project falling within the limits of temporary construction easements or utility Right-of-Way only with specific permission from the FWC for each activity and location. All requirements under A and B above apply within these limits.
- D. The CONTRACTOR may commence clearing or land preparation only after areas have been staked and approved by the FWC.
- E. The CONTRACTOR is responsible for performing all WORK in accordance with all applicable regulations, ordinances and code requirements from the appropriate city, county, State and/or Federal jurisdiction the Project is located in.
- F. The CONTRACTOR shall obtain and pay for any applicable permits. The CONTRACTOR shall observe all applicable permit conditions.

1.07 CERTIFICATIONS AND TESTING: (Not Applicable)

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for FWC inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK as described in FWC's General Terms and Conditions.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 GENERAL CLEARING:

- A. The CONTRACTOR shall remove the vegetative matter in the areas with construction features as defined by the Drawings and in the areas approved by FWC that are staked by the CONTRACTOR. The CONTRACTOR shall complete the work of Clearing and Land Preparation as outlined below.
 1. Mowing or the use of a bush-hog shall be required in areas of heavy grass, weeds, or woody-stalked and tree vegetation.
 2. All woody debris that measures over three-quarters inch in diameter and longer than 18-inches shall be removed.
 3. All stumps shall be ground level to six inches below the surrounding ground level. Stumps on the slopes shall be cut flush with the natural angle of the existing grade and treated immediately with an herbicide approved by the FWC. All seedlings within the FWC approved areas shall be treated with an FWC approved herbicide. If the stumps are located within an area of construction excavation, berm construction, or structure construction, the stump shall be completely removed. This requirement does not apply to the existing berms around the Project site perimeter. If necessary, ask for direction from FWC if a stump shall be removed.
 4. All woody and brush material (whole or chipped), not strippings, shall be removed from the Project construction area and stockpiled at a location authorized by the FWC. Disposal of the woody and brush stockpile from the Project Site shall be accomplished at a maximum of every fifteen workdays.
 5. Remove and properly dispose of any garbage, other waste debris and man-made materials recovered during clearing from the Project Site.

6. On completion of the clearing, remove all sticks, rubbish and other extraneous material and rake the ground surface in order to leave a smooth and clean appearance.
 7. Clearing and land preparation shall proceed sufficiently ahead of earthwork activities to minimize disruption and allow time for determination of the adequacy of the clearing procedure.
 8. All WORK shall be performed in accordance with approved principles of modern arboricultural methods.
 9. All trees to remain in the project area, as designated by the FWC, shall be protected from damage by tree barricades.
 10. All WORK shall be performed without damage to existing amenities, including trees and shrubs. The CONTRACTOR shall be responsible for repair and replacement of existing amenities to the satisfaction of the FWC. The CONTRACTOR shall protect all vegetation, habitats, or amenities on the Project location as indicated on the Drawings, as required by FWC, and as located outside of the FWC approved areas for clearing based on the staking by the CONTRACTOR.
- B. The CONTRACTOR shall clear adjacent to cut or fill sections to a minimum distance of ten (10) feet outside of slope lines unless lesser distances are specified. Clearing in areas of native vegetation for berm construction or removal and canal excavation shall be limited to a distance of 10 feet outside of slope lines as approved by FWC.
 - C. The CONTRACTOR may burn non-man-made combustible products of the clearing operation on the Site with the written approval of the FWC and with permission of the local authorities. The CONTRACTOR shall comply with all local ordinances or regulations for burn locations and methods, including methods for preventing uncontrolled spread of the burn. The CONTRACTOR shall provide the FWC with copies of permits prior to burning.
 - D. The CONTRACTOR may not burn cleared materials within the limits of any utility Right-of-Way without written permission of the controlling agency.
 - E. The CONTRACTOR shall haul all organic materials and residues left from burning operations to an approved landfill or disposal site unless directed otherwise by FWC to dispose within the Project Site.
 - F. Areas disturbed by work operations, such as, but not limited to, access points beyond the limits of the right-of way or areas outside of the approved staking, shall be restored to original or better condition, including, but not limited to, filling, grading, sodding, and seeding/planting/mulching as directed by the FWC.
- 3.02 EROSION CONTROL: The CONTRACTOR shall prevent and control erosion and water pollution as per FDOT Specification Sections 104 -1, 2, 3, 4, 6 and 7, Florida Department of Environmental Protection (FDEP) regulations and permit conditions. Turbidity/erosion controls shall be installed prior to clearing.
- 3.03 UNDERGROUND UTILITIES: The CONTRACTOR shall provide all necessary liaisons with other utilities (underground) by notification, 48 hours in advance, of any digging by telephoning the appropriate Utility Notification Center and local utilities.
- 3.04 PROTECTION, REMOVAL AND/OR RELOCATION OF EXISTING FACILITIES: Existing facilities shall be carefully protected from damage during all phases of the construction. The CONTRACTOR shall make all necessary arrangements with the owner of the facility and be responsible for all costs involved in the proper protection, relocation or other WORK that such owners deem necessary.
- 3.05 DETERMINATION OF COMPLETION OF CLEARING AND LAND PREPARATION: The FWC will inform the CONTRACTOR when each area has been satisfactorily cleared and prepped for construction.

END OF SECTION

SECTION 02200 EARTHWORK

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment, and materials for all excavating, trenching, filling, construction of embankment, backfilling, compacting, grading, and all related items of earthwork necessary to complete the WORK indicated or specified. The Contractor shall assume the typical condition of the site is wet regardless of the time of year and that the entire site has an underlying layer of limestone (refer to SECTION 01010).
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01010 - Summary of Work
 - 2. SECTION 01050 - Field Engineering and Surveying
 - 3. SECTION 01300 - Submittals
 - 4. SECTION 01410 - Testing and Quality Control
 - 5. SECTION 02050 - Demolition
 - 6. SECTION 02110 - Clearing and Land Preparation
 - 7. SECTION 02221 - Pipe Trenching, Backfilling and Compacting
 - 8. SECTION 02401 - Dewatering and Cofferdam
 - 9. SECTION 02486 - Seeding
 - 10. SECTION 02920 - Sodding

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, notify the FWC immediately and follow the requirements in the General Terms and Conditions.
 - 1. American Society of Testing Materials (ASTM):
 - a. C33 - Standard Specification for Concrete Aggregates
 - b. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Standard Effort (12,400 ft-lbf/ ft³ (600 kN-m/m³)).
 - c. D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Modified Effort (56,000 ft-lbf/ ft³ (2,700 kN-m/m³))
 - d. D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
 - e. D3740 – Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
 - f. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - g. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - h. D4564 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sleeve Method.
 - i. D4914 – Standard Test Methods for Density and Unit Weight of Soil and Rock in Place by the Sand Replacement Method in a Test Pit.

- j. D5030 – Standard Test Method for Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
 - k. D6938 – Standard Test Method for In-place Density and Water Content of Soil and Soil-Aggregate by Nuclear Method Shallow Depth
 - l. E329 – Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
2. American Association of State Highway Transportation Officials (AASHTO):
- a. T 27 – Sieve Analysis of Fine and Course Aggregates
 - b. T 99 - Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
 - c. T 180 – Standard Method for Moisture-Density Relations of Soils using a 10 lb (4.54 kg) Rammer and 18 in (457 mm) Drop
- B. Florida Method (FM) of Test:
- 1. FM T-1 011 – Florida Method of Test for Sampling Aggregates
- C. Reference Material per SECTION 01010:
- 1. Subsurface soil data logs are provided for the CONTRACTOR’s reference:
 - a. Geotechnical Engineering Report, Terracon Consultants, Inc., dated February 25, 2020

1.03 DEFINITIONS:

A. Select Fill:

- 1. Select Fill shall be clean, granular material free from debris, peat, roots, seeds of nuisance or exotic species, organic material, sticks, and clods. Select Fill shall have no stones with a diameter greater than two (2) inches in any direction. Select Fill shall have an organic content of less than 3%. Select Fill shall be placed where indicated on the Drawings and shall be used for all fill unless expressly stated otherwise on the Drawings.
- 2. Select Fill may be material excavated for the WORK (native) or may be imported. The CONTRACTOR shall dry, moisture condition, mix and process native soils as necessary to achieve a material that meets the requirements for Select Fill. Mixing is required to be performed by discing unless another method is approved by FWC. All Select Fill shall be stockpiled and tested by the CONTRACTOR. Stockpiles shall be made available to the FWC for inspection and Quality Assurance (QA) testing (refer to SECTION 01410). All Select Fill must be tested and approved prior to placement for construction.
- 3. Select Fill shall meet one of the following Unified Soil Classification System (ASTM D2487) designations: SC, SM, SP-SM, or SP-SC. Select Fill shall have a fines content (percent passing the U.S. No. 200 mesh sieve per ASTM D1140) of 7% or greater up to 15%. Unless otherwise noted, Select Fill shall be used for berms, structural and roadway fill, and other required fill material to complete the WORK. No gravel classifications allowed.
- 4. Maximum loose lift thickness shall be no greater than 12 inches. In areas where hand operated equipment is used for compaction, fill shall be placed in loose lift thickness no greater than 6-inches. When lifts less than or equal to 6-inches are placed, the maximum particle size in any direction shall not exceed one (1) inch.
- 5. Select Fill shall be compacted to not less than 95% of the maximum dry density at a moisture content of +/-2% of optimum as determined by the Modified Proctor Test (ASTM D1557).
- 6. Unless otherwise specifically stated on the Drawings, all fill will be Select Fill.

- B. Drain Sand, Filter Sand: Drain/Filter Sand shall meet one of the following Unified Soil Classification System (ASTM D2487) designations: SP or SW. Drain/Filter Sand shall be imported non-calcareous derived silica sand of naturally occurring hard, strong, durable, angular, uncoated grains of quartz, meeting the gradation requirements of this SECTION and free of organic material and clods unless otherwise approved by FWC. Drain/Filter Sand is to be used in the construction of the horizontal blanket drain around submerged discharge pipes.
1. Drain/Filter Sand shall be compacted between 70% and 80% of solid volume density (ASTM D6683-19).
 2. Drain/Filter Sand shall be imported from an off-site source and meet the quality requirements of ASTM C33/C33M for fine aggregate and shall meet the following gradation requirements:

DRAIN SAND GRADATION			
Sieve No.	Opening (mm)	Percent Passing	
		Min	Max
3/4 inch	19	100	100
3/8 inch	9.51	90	100
#4	4.75	75	100
#8	2.36	50	90
#16	1.18	20	65
#30	0.6	5	25
#50	0.3	0	10
#200	0.075	0	5

- C. Unified Soil Classification System (USCS): USCS is a two-letter classification system used to describe the texture and grain size of a soil. In the USCS system, letters are representative as follows: G stands for gravel, S stands for sand, M stands for silt, C stands for clay, O stands for organic, P stands for poorly graded, W stands for well graded, H stands for high plasticity, and L stands for low plasticity.
- D. Stripping: Stripping is performed after clearing and land preparation per SECTION 02110 is complete. Stripping is performed on all areas to be excavated and areas designated to receive compaction as shown on the Drawings. Stripping is the removal of approximately the top 6 inches of existing soil. Strippings, the material removed by the stripping process, may be considered suitable to promote vegetation growth.
- E. Topsoil: Materials from the stripping operations that are natural, friable soils representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth, and with a pH range of 5.5 to 7.
- F. Excavation: Excavation shall be the removal of all materials within the defined configuration to the limits of excavation shown on the Drawings including seepage canal construction, unsuitable soils removal, and secondary borrow areas. This definition excludes stripping material.
- G. Unclassified Fill: Unclassified Fill may be material used to bring areas to grade where there is no potential for slope erosion and the fill will not support a structure of critical function. Unclassified Fill shall only be placed where indicated on the Drawing and as directed by FWC. Unclassified Fill shall be free from seeds of nuisance or exotic species, and will be composed of material excavated for the WORK or imported material that can be compacted to the required density.

- H. Unsuitable Fill, Unsuitable Soil: Soil that does not meet the requirements for fill addressed thus far in this SECTION shall be considered Unsuitable Fill soil.
- I. Top of Limestone Layer: The top of the limestone layer is the elevation that limestone is encountered such that the limestone is continuous both horizontally and vertically at elevations and depths similar to those documented in the Geotechnical Engineering Report, Terracon Consultants, Inc., dated February 25, 2020 which is provided as a Reference Material per Specification SECTION 01010 paragraph 1.10.A.2. The top of the limestone layer is not the shallow limestone as mentioned in the Geotechnical Engineering Report. An indication that the limestone layer has been reached is the significant groundwater flow rates with quickly flowing groundwater into the excavation as indicated in the Geotechnical Engineering Report. The CONTRACTOR shall be prepared to dewater significant groundwater flow rates once the limestone layer is encountered. The CONTRACTOR shall anticipate difficult excavation/drilling throughout the limestone layer. When the CONTRACTOR has reached the top of the limestone layer, the CONTRACTOR shall notify FWC for approval that the top of the limestone layer has been reached.
- J. The terms “levee”, “berm”, “embankment”, “bank” and “slope” are used interchangeably within the Contract Documents and all have the same meaning and requirements.
- K. The terms “fill” and “backfill” are used interchangeably within the Contract Documents and have the same meaning and requirements.

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Prior to the start of construction, CONTRACTOR shall prepare and submit an Earthwork Plan that includes the below information at a minimum. If during the course of the work, the Earthwork Plan changes from the submitted plan, an all-inclusive updated plan shall be submitted with tracked changes. Tracked changes shall include added text underlined with a distinguishable color from existing text and strike-troughs for deleted text.
 - 1. Approach to accessing areas to perform WORK given the wet nature of the site.
 - 2. Include dewatering approach for access, borrowing, working materials, excavation, stockpiling and construction.
 - 3. Drawing(s) indicating borrow sources, stockpiling, borrow management areas, and soil drying/mixing/processing areas. Include access routes to these areas.
 - a. Per the Contract Documents all of these areas are required to be staked and approved by FWC prior to any disturbance and utilization.
 - b. Include stockpiles of all materials, not just soils.
 - 4. For all materials obtained offsite, provide the address and map of where materials will be obtained.
 - 5. Narrative describing management of strippings, borrow methods, management of stockpiles including erosion protection, sediment control and drainage, management of soil drying/mixing/processing areas, and detailed phasing of WORK.
 - 6. Approach to drying/mixing/processing soils including discing for mixing to obtain the required properties per Contract Documents.
 - 7. Approach for performing all required testing and sequence for when each test will be performed within the earthwork operations.
 - 8. Approach for excavation and construction.
 - 9. Identification of all features proposed for aqueous construction, wholly or partially. Approach for preparing and constructing the required foundation, bedding and backfill for aqueous

construction including means and methods to prevent floatation of project features. Approach for inspection and verification of aqueous construction efforts. All aqueous construction intended to be performed must have prior approval by the FWC.

10. Plan for protecting the WORK including approach for vegetating slopes (refer to SECTION 01010).
 11. Disposal plan including locations for all surplus and unsuitable material.
 12. Schedule for all earthwork related efforts.
 13. List of earthwork equipment that will be used to perform the work.
- C. The CONTRACTOR shall submit laboratory test results on all materials proposed to be used (whether native or imported) as such as Select Fill and Drain/Filter Sand. At a minimum the laboratory testing shall include sieve analysis, organic content, USCS classification and modified proctor per ASTM D1557, as applicable.
- D. Geotechnical Testing Agency Certifications for the required testing.
- E. Field Testing Personnel Experience and Certifications for the required testing.
- F. Earthwork Contractor Qualifications and Experience.
- G. Quality Control Test Results.
- H. Embankment Foundation Remediation documentation per paragraph 3.05.A.2.b in this SECTION.

1.05 QUALIFICATIONS:

- A. Geotechnical Testing Agency Qualifications: The CONTRACTOR shall furnish at his own expense an independent testing agency qualified according to ASTM E329 to perform all testing required to establish and maintain Quality Control. This Quality Control involves conducting soil materials and rock-definition testing during earthwork operations, as documented according to ASTM D3740.
1. Field Testing Personnel: The CONTRACTOR shall use an adequate number of field testing personnel who are thoroughly trained and have a minimum of five (5) years of successful experience in the methods utilized and the certifications to perform the required field testing for the proper performance of the WORK of this SECTION. The CONTRACTOR shall employ the adequate resources and equipment necessary to successfully perform the WORK of this SECTION on schedule.
- B. Earthwork Contractor Qualifications: The CONTRACTOR shall use an adequate number of skilled laborers and installers who are thoroughly trained and have a minimum of five (5) years of successful experience in the necessary crafts and are completely familiar with the methods needed for the proper performance of the WORK of this SECTION. The CONTRACTOR shall employ the adequate resources and equipment necessary to successfully perform the WORK of this SECTION on schedule.

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall excavate any material encountered to the depth and grades required, shall backfill such excavations as required, and shall dispose of excess or unsuitable materials from excavation as approved by the FWC and this SECTION. The CONTRACTOR shall provide and place necessary borrow material to properly backfill excavations as indicated on the Drawings, specified herein, and as directed by the FWC. All areas for placement of material are to be staked and approved by FWC.
- B. Excavation, dewatering, sheeting, and bracing required shall be carried out so as to prevent any possibility of undermining or disturbing the foundations of any existing structure or of the WORK, and so that all WORK may be accomplished and inspected in the dry, except as approved or directed by the

FWC. The CONTRACTOR shall assume all construction is required to be performed in the dry. Aqueous construction may be performed only with prior written approval of the FWC.

1.07 CERTIFICATIONS AND TESTING:

- A. The responsibility to retain the services of an independent testing laboratory shall be as defined in SECTION 01410.
- B. The CONTRACTOR shall furnish, at his own expense, all testing required to establish and maintain the Project's Quality Control (QC) processes required or as specified in this SECTION. Each stockpile is required to be tested. CONTRACTOR shall notify FWC when samples are taken for stockpile tests to allow FWC the opportunity to direct the CONTRACTOR to take samples for FWC QA tests. The CONTRACTOR's test results shall be provided to FWC. The stockpile shall not be utilized until FWC receives all test results from the CONTRACTOR and the QA test, if applicable.
- C. Field density tests shall be in accordance with all applicable ASTM Standards appropriate to each type of material used in the earthwork. CONTRACTOR shall notify FWC when tests are taken to allow FWC the opportunity to perform QA tests. Fill placement that fails to meet Project specification for fines, organic content, or otherwise, will be removed and replaced by the Contractor at his own expense. Failure to meet the specified density will require the CONTRACTOR to re-compact and retest, at his own expense, in those areas. Failure to meet the specified moisture content will require the CONTRACTOR to process soils as needed and retest, at his own expense, in those areas.
- D. Quality testing frequencies shall be as follows:
 - 1. Engineering Properties of Fill Materials
 - a. Borrow stockpiles, prior to placement: One test per 2,500 cubic yards stockpiled material. Determine gradation and other engineering properties to be used as Select Fill in accordance with ASTM C136, ASTM D422, ASTM D1140, ASTM D2216, ASTM D2487, ASTM D2974, ASTM D4318, and ASTM D4972 and per Contract Documents.
 - 2. Optimum Moisture and Laboratory Maximum Density
 - a. Perform tests for each stockpile of Select Fill material to determine the optimum moisture content and laboratory maximum density values (ASTM D1557). One representative test per 5,000 cubic yards of fill, when any change in material occurs, and for each stockpile.
 - b. Perform tests for each excavated bottom and each foundation surface to receive Select Fill, bedding, pipe/culvert placement or concrete placement to determine the optimum moisture content and laboratory maximum density values (ASTM D1557). One representative test shall be performed for each excavated bottom and each foundation surface and when any change in material occurs. In addition, one representative test shall be performed for every 2,000 feet of the Perimeter Berm foundation.
 - 3. In-Place Density and Moisture Content
 - a. At a minimum the CONTRACTOR shall perform an in-place density and moisture tests for each lift of material placed during construction.
 - b. If the construction operation is continuous such as in the construction of a berm, an in-place density and moisture test shall be performed for each lift of material placed for every 250 feet in length. The location of each test within the continuous feature such as a berm shall be varied in order for all tests collectively to provide an appropriate representation of the constructed WORK. The test shall not be taken in an overburdened area of the feature that will be removed. If the construction operation is not continuous such as the placement of soil adjacent to a structure, an in-place density and moisture test shall be performed for each lift of material for that construction operation and in accordance with requirements in this paragraph 1.07.D of this SECTION.

- c. Determine field in-place density in accordance with ASTM D1556, ASTM D2167, or ASTM D6938, as directed. When ASTM D6938 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D1556. ASTM D6938 results in an estimate of the wet unit weight and moisture content of soil. Frequent check testing is required to support interpretation of density and moisture content determinations when using ASTM D6938. One check test per every 20 nuclear gage tests shall be performed if ASTM D6938 is used unless otherwise directed by FWC.
- d. One test per maximum 250 linear feet of foundation surface prior to the placement of any fill, bedding or concrete for any feature.
- e. One test per maximum 250 linear feet of excavation bottom prior to the placement of any fill, bedding or concrete for any feature.
- f. One test per maximum 250 linear feet of prepared excavation surface prior to the placement of any fill.
- g. One test per maximum 250 linear feet of each lift of Select Fill for construction of embankments, berms, roadways or any other feature. For the purposes of this requirement, a 250 linear foot lift is considered that which is performed during the progression of the work and not a 250 linear foot section of the finished work.
- h. One test per maximum 500 square feet of each lift of Select Fill for structure foundations, structure backfill, and areas compacted by hand-operated machines.

1.08 INSPECTION COORDINATION:

- A. The CONTRACTOR shall provide access to the WORK for the FWC for inspection and for performing QA testing at the discretion of FWC. The CONTRACTOR shall provide at least 48 hours advanced notice of its intention to begin new WORK activities. The CONTRACTOR shall provide daily notifications of the testing to be performed the next work day.

1.09 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 MATERIALS ENCOUNTERED:

- A. The CONTRACTOR shall expect the entire site to be heavily vegetated and typical of a site in south Florida that has not been mowed or maintained in excess of 5 years.
- B. The CONTRACTOR shall consider all materials encountered in excavations below the strippings and above the limestone layer as suitable for drying/mixing/processing for use as Select Fill, provided the materials meet the requirements of paragraph 1.03.A in this SECTION.
- C. For excavated materials not meeting the definition of Select Fill in paragraph 1.03.A of this SECTION, the CONTRACTOR shall consider them unclassified, regardless of type, character, composition and condition thereof provided the materials meet the requirements of paragraph 1.03.G in this SECTION.
- D. The CONTRACTOR shall fully expect to encounter a limestone layer during construction. The bottoms of the seepage canals are required to be excavated to the top of the limestone layer. In order to install the culverts at the required inverts, the CONTRACTOR shall assume that excavation of the limestone layer is required in order to provide the minimum required bedding between the culvert and the limestone. The CONTRACTOR shall provide the proper equipment to be able to excavate the limestone. The limestone layer has variable and high hydraulic conductivities. The CONTRACTOR shall assume that upon contacting or breaching the limestone layer that water will immediately flood the excavation

and the CONTRACTOR shall have the proper dewatering equipment in place to address this influx of water. Rock including limestone encountered shall be handled by the CONTRACTOR at no additional cost to the FWC.

PART 3 - EXECUTION:

3.01 GENERAL:

- A. Demolition: The CONTRACTOR shall perform demolition activities as specified in SECTION 02050.
- B. Clearing and Land Preparation: The CONTRACTOR shall perform clearing and land preparation activities as specified in SECTION 02110.
- C. Stripping: The CONTRACTOR shall remove the top layer of soil and vegetation from areas within limits of excavation and areas designated to receive compaction as shown on the Drawings. The CONTRACTOR shall not strip the areas of the existing berm around the Site perimeter or any other locations without approval by FWC. The CONTRACTOR shall strip the required and approved areas as follows:
 - 1. Scrape area clean of all brush, grass, weeds, roots, and other material. All larger material shall have been previously removed during the clearing and land preparation activities.
 - 2. Strip to a depth of approximately six (6) inches or to a sufficient depth to remove excessive roots in heavy vegetation and brush areas as well as all branches 1/2 inch in diameter or greater. All man-made materials shall be removed and properly disposed of off-site.
 - 3. The CONTRACTOR may choose to stockpile the strippings for use as a soil amendment to promote vegetation growth for future sodding and seeding. The CONTRACTOR shall notify the FWC of this intention, remove excessive roots and branches 1/2 inch in diameter or greater, remove all debris and man-made materials, and meet the definition of Topsoil provided in paragraph 1.03.E of this SECTION. The material shall be stockpiled at a location approved by FWC. Otherwise the strippings are considered unsuitable materials.
- D. Site Protection:
 - 1. Protect and maintain benchmarks, monuments, or other established reference points and property corners. If disturbed or destroyed, replace at CONTRACTOR's expense to full satisfaction of FWC and controlling agency as applicable.
 - 2. Verify locations of existing utilities prior to excavation. Take necessary precautions to protect existing utilities from damage due to construction activity. Damages to existing utilities from construction activities shall be repaired by the CONTRACTOR at their expense.
 - 3. Protect from damage structures, pavement, or other items not indicated to be removed. Any item known or unknown that is damaged due to construction activity shall be repaired to original condition at the expense of the CONTRACTOR.
 - 4. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.
- E. Protection of WORK:
 - 1. Top of embankments, grading areas and all disturbed surfaces shall be sloped to drain away from the WORK at a maximum of 2% slope unless a different sloped is specifically specified on the Drawings.
 - 2. The CONTRACTOR shall grade all areas whether specified in the Drawings or not to drain.
 - 3. The CONTRACTOR shall protect the WORK and all areas within the Project Site from erosion and damage. The CONTRACTOR shall immediately repair all damage.
 - 4. After placement of fill, the CONTRACTOR shall revegetate all slopes as they are constructed in accordance with Contract Documents. Slopes include berms, embankments, levees, banks,

and any surface that is sloped. Revegetation shall not be greater than 1500 LF behind the construction. An unvegetated slope shall be vegetated and protected immediately. The effort shall be performed in accordance with the approved Embankment and Slope Protection Plan per SECTION 01010.

F. Dry Fill Placement:

1. All fill placement shall be performed in areas free of standing, stagnant, or flowing water. All fill placement shall be performed in the dry unless approved or otherwise directed by the FWC. Requirements for dewatering are provided in SECTION 02401.

3.02 DISPOSAL OF SURPLUS AND UNSUITABLE MATERIAL:

- A. Paragraph 3.02 in the SECTION does not apply to materials removed during clearing and land preparation activities. Refer to SECTION 02110 for those disposal requirements.
- B. Paragraph 3.02 in this SECTION does not apply to garbage, waste debris and man-made materials which shall be properly disposed of off-site.
- C. The CONTRACTOR shall neatly dispose of all surplus and unsuitable materials including strippings along the interior of completed embankment slopes outside of the Wave Bench areas as shown in the Drawings or in areas otherwise approved by the FWC. Surplus and unsuitable material disposed on-site shall be located within the impoundment interior. Disposal areas shall not be higher than EL 26.0 feet NAVD88.

3.03 STOCKPILE OF MATERIALS: All materials are required to be stockpiled. The CONTRACTOR shall stockpile materials in areas that do not conflict with the WORK and in areas approved by the FWC. Stockpiles must be homogeneous such that samples taken from a stockpile are representative of the entire stockpile. Stockpiles shall be managed to prevent contamination of stockpiled materials, to control erosion and sediment runoff, and to allow to properly and freely drain. Each stockpile shall be given a unique designation and visibly marked with that designation. Stockpiled material not used at the end of the Project shall be disposed in accordance with paragraph 3.02 of this SECTION.

3.04 EXCAVATION AND TRENCHING:

- A. Trenching for Pipes: The CONTRACTOR shall perform trenching for pipes as shown on the Drawings, as required, and as specified in accordance with SECTION 02221.
- B. Extent of Open Excavation: The CONTRACTOR shall perform the excavation such that at any time the amount of excavation open will be held to a minimum consistent with normal and orderly prosecution of the work, or as restricted by permit conditions.
- C. Sheet piling and Bracing: The CONTRACTOR shall provide sheet piling and bracing as required in accordance with the following provisions.
 1. Use when required by the specifications or Drawings and where resulting slopes from excavation or trenching might endanger the structural integrity of in-place or proposed structures.
 2. Stage sheet piling and bracing materials on-site prior to start of excavation. Adjust spacing and arrangement as required by conditions encountered.
 3. Remove sheet piling and bracing as backfill progresses. Fill voids left after withdrawal with ASTM C33 sand or other FWC approved material.
 4. Sheet piling may not penetrate the cross section prism of the Perimeter Berm and installation must be approved by FWC.
 5. In-place structures damaged by sheet piling and bracing activities shall be repaired by the CONTRACTOR at no additional cost to the FWC.

6. Comply with all applicable Sections of Occupational Safety and Health Administration (OSHA).
 7. Comply with all requirements of the Florida Trench Safety Law.
- D. **Blasting:** No blasting is required or permitted for this Project. The CONTRACTOR is required to provide suitable equipment on-site for excavation of the limestone as required.
- E. **Excavation for Structures:** The CONTRACTOR shall perform excavation for structures as shown in the Drawings, as required and as specified below:
1. Excavate area adequate to permit efficient erection and removal of forms.
 2. Trim to neat lines where details call for concrete to be deposited against earth. Subgrade for structures may NOT be above the neat lines. If subgrade is below the neat lines where concrete is to be deposited against earth, concrete shall be used to fill the space as approved by FWC. Elevations for reinforcing steel shall be maintained according to design grade and all clearances shall also be maintained.
 3. Excavate by hand in areas where confined space and access restricts the use of machines.
 4. Notify the FWC immediately when excavation has reached the depth indicated on plans. Perform in-place density and moisture content test to verify excavation bottom meets same requirements as Select Fill. Evidence of unstable soils, which may include pumping, loose, soft, or otherwise visually identified unsuitable materials for placement of concrete, shall be removed or reworked and moisture conditioned as necessary to achieve a satisfactory foundation. If bottom does not meet requirements, inform FWC for direction.
 5. Restore bottom of excavation to proper elevation with concrete in areas that are over excavated as approved by FWC.
 6. Conform to the requirements of SECTION 02221 as applicable.
- F. **New Canal Excavation:** The CONTRACTOR shall perform canal excavation by any method meeting the requirements of these specifications and the Drawings. Transitions in bottom width and elevation shall be uniform. The excavated slopes and bottom of the canals shall be left as smooth as skilled use of the excavating equipment will permit.
- G. **Existing Canal Excavation:**
1. Where Select Fill is required, the CONTRACTOR shall exercise care in excavation to avoid, to the maximum practicable extent, mixing of peat with materials suitable for use in Select Fill.
 2. Excavated peat or topsoil may be stockpiled for use in final dressing and vegetation of side slopes in accordance with Contract Documents, placed in unclassified fill zones or disposed as surplus and unsuitable material per paragraph 3.02 of this SECTION.
- H. **Demucking:** The CONTRACTOR shall remove all organic soils from areas below embankments, berms, structures, piping, and road subgrades and within excavation and borrow areas to the lines and grades as shown in the Drawings. Demucking materials excavated shall not be used for backfill of structures or pipes and shall be placed in unclassified fill zones or disposed as surplus and unsuitable material. Organic soils (including peat) may be used as Topsoil in the top layer of the final dressing of slopes, the embankment and other fill areas requiring sod or grassing.

3.05 EMBANKMENT FILL PLACEMENT:

- A. **Foundation Preparation**
1. Excavation for foundations shall not commence until adequate dewatering in accordance with SECTION 02401 has been achieved to provide a dry and stable excavation bottom and side slopes for completion of the WORK.

2. After clearing, land preparation and stripping within the footprint of the embankment, the exposed surface shall be proof-rolled to identify disturbed subgrade soils, buried hazards, soft and yielding foundation materials or other hazards that could threaten the safety of the embankment or berm.
 - a. Proof-rolling shall be performed with a vibratory roller with a minimum static weight of 20,000 pounds. The roller shall make a minimum of 8 passes over the prepared area. The latter 4 passes shall be performed at right angles to the previous 4 passes.
 - b. Evidence of unstable soils, which may include pumping, loose, soft, or otherwise visually identified unsuitable materials for placement of fill, shall be removed or reworked and moisture conditioned as necessary to achieve a satisfactory foundation. Removed material shall be replaced with Select Fill as shown on the Drawings and compacted to the requirements for Embankment Construction paragraph 3.05.B specified in this SECTION. If material is removed, the underlying newly excavated subgrade shall be proof-rolled prior to placement of fill. Areas that have been reworked shall be proof-rolled to ensure stability prior to placement of fill.
 - c. Perform in-place density and moisture content test to verify excavation bottom meets same requirements as Select Fill.
 - d. CONTRACTOR shall provide at a minimum of 48 hours' notice prior to the performance of proof-rolling operations. All proof-rolling operations shall be witnessed by FWC.
 - e. Areas of foundation remediation per paragraph 3.05.A.2.b in this SECTION shall be documented by the CONTRACTOR and submitted to FWC.
3. In accordance with this SECTION all excavated embankment fill material shall be dried, processed, mixed with a disc, and stockpiled to the requirements of this SECTION.
4. For grades flatter than 3H:1V, scarify the ground surface to a minimum depth of 6 inches. Where ground surface is 3H:1V or steeper, bench the ground surface prior to placement and compaction of Select Fill. Bench heights shall not exceed 12 inches.

B. Embankment Construction:

1. Embankments shall consist of Select Fill and shall be placed to the lines and grades as shown on the Drawings. All Select Fill is required to be stockpiled. All material intended to be placed as Select Fill shall be tested and verified to meet the requirements of Select Fill prior to being moved from the stockpile for placement. The CONTRACTOR shall notify FWC daily which stockpiles by the stockpile unique designation will be utilized for construction during the next work day.
2. At no location shall the completed crest elevation be lower than indicated. Completed side slopes shall be uniform from top to toe of the embankment, and shall be smoothly transitioned. The CONTRACTOR shall perform embankment WORK as shown on the Drawings, as required and in accordance with these Specifications.
3. Select Fill shall be placed in horizontal layers not exceeding twelve (12) inches in loose thickness.
4. Compaction shall be achieved through use of a tamping foot, rubber tire, or vibratory drum roller as appropriate for the material being compacted. Hand operated equipment such as plate compactors and hand operated small vibratory rollers may be used as appropriate. Compaction must occur parallel to the embankment alignment. Compaction perpendicular to the embankment alignment shall not be allowed.
5. The compacted surface of each lift shall be scarified by light disking to a minimum depth of 6 inches before the succeeding lift is placed. The intention of this requirement is to achieve integration and bonding of each subsequent lift of embankment material.

- C. Final Dressing of Slopes: Following the completion of embankment placement and compaction, the CONTRACTOR shall grade embankment slopes and adjacent transition areas so that they are reasonably smooth and free from irregular surface changes. The CONTRACTOR shall comply with the following:
 - 1. The degree of finish shall be that ordinarily obtained from blade grader or similar operations.
 - 2. Provide roundings at bottom of slopes and other breaks in grade.
 - 3. No tire tracks are allowed.

3.06 EXCAVATION, BACKFILLING FOR STRUCTURES AND SITE GRADING FILL:

- A. Pipe Backfill: The CONTRACTOR shall perform pipe backfill as required, as shown, and as specified in accordance with SECTION 02221.
- B. Excavation for foundations shall not commence until adequate dewatering in accordance with SECTION 02401 has been achieved to provide a dry and stable excavation bottom and side slopes for completion of the WORK unless an aqueous or partially aqueous construction approach has been previously approved by the FWC.
 - 1. Structure excavation shall be in accordance with Excavation for Structures paragraph 3.04.E in this SECTION. The foundation area outside of the concrete placement area shall be scarified a minimum depth of 6 inches before placement of the first backfill lift.
- C. Backfilling for Structures:
 - 1. The backfill for structures shall be Select Fill.
 - 2. The backfill for structures shall be benched into the adjacent Select Fill for the embankment.
 - 3. Remove all debris from excavation prior to placement of Select Fill.
 - 4. For Select Fill placed a horizontal distance from the concrete surface equal to the total height of backfill above the top of the concrete footing or above the bottom of the concrete surface to finished grade, the following shall be followed:
 - a. Backfill shall be placed in accordance with the lines, grades, and cross-sections shown in the Drawings.
 - b. Backfill shall be placed horizontally to the concrete surface in a loose lift thickness no greater than 6-inches and compacted with power-driven hand tampers suitable for the materials being compacted. Heavy equipment is not allowed in this area of backfill.
 - c. Backfill shall be compacted with hand operated equipment. CONTRACTOR shall not damage structure during backfill placement. Place backfill in level layers of thickness within the compacting ability of equipment used.
 - d. Place backfill simultaneously on all sides of structures. Differential backfill around structures may not exceed 1 foot in elevation. For walls, backfill shall be brought up evenly on each side of the wall and sloped 2% to drain away from the structure.
 - e. Backfill shall be placed carefully around pipes and tanks to avoid damage to coatings, wrappings, pipes and tanks.
 - f. Backfill shall not be placed against concrete prior to 7 days after concrete pour and concrete has been tested and passed the required 7 day strength test.
 - g. Structure and open excavation shall be protected from erosion and damage until backfill can be placed. All damage shall be immediately repaired.
- D. Backfill for Site Grading and Wave Bench: The CONTRACTOR shall ensure that Unclassified Backfill be placed in twelve (12) inch loose lifts to the lines and grades shown on the Drawings or as approved by the FWC. For the Wave Bench with multiple lifts, each lift shall be scarified prior to placement of the subsequent lift. If hand compaction equipment is used, lifts may not exceed 6 inches in loose

thickness. The CONTRACTOR shall compact unclassified backfill to a density approximating the density of surrounding native material and in a manner that will prevent settlement of the completed area. The surrounding native soil shall not be disturbed prior to testing the density. The location of the surrounding native soil density test shall be approved by the FWC. If the density testing is not performed by the CONTRACTOR prior to the surrounding soil being disturbed, then the required density for the Unclassified Backfill shall be the same as Select Fill unless otherwise specified by the FWC.

3.07 GRADING: The CONTRACTOR shall perform grading as shown on the Drawings, as required, and as provided for below:

- A. Grade and compact all areas within the Project area, including excavated and filled sections and adjacent transition areas, reasonably smooth, and free from irregular surface changes, bumps or depressions.
- B. All areas shall be graded to drain even if area is not specified to be graded in the Drawings.
- C. Degree of finish shall be that ordinarily obtained from blade grader or scraper operations except as otherwise specified. No tire tracks allowed.
- D. Grading tolerances shall be as follows:
 - 1. Embankments and Berms: (-) 0 to (+) 0.25 feet
 - 2. Roads (shellrock and grassed): (-) 0.1 to (+) 0.25 feet
 - 3. Subgrades for structures: (-) 0.1 to (+) 0.1 feet
 - 4. Canals: (+/-) 0.5 feet
 - 5. Other excavation and fill areas not listed: (+/- 0.25 feet)
- E. Finish all ditches, swales, and gutters to drain readily in order to not cause erosion or damage to features.
- F. Provide roundings at top and bottom of banks and at other breaks in grade. No step is allowed at the top or bottom of slopes that would prevent the sheetflow of surface waters or result in damage to the feature.
- G. Slopes shall be immediately sodded after grading and shall be sodded as embankments are constructed vertically to prevent erosion and damage to the slope in order to protect the WORK.

3.08 RESTORATION:

- A. The CONTRACTOR shall restore all areas disturbed by construction activities to equal or better condition and to the satisfaction of the FWC. In accordance with SECTION 02920 sod all disturbed sloped areas that are 4.5H:1V or steeper and/or as shown on the Drawings. All other graded and disturbed areas that are not sodded shall be seeded and mulched in accordance with SECTION 02486. Revegetation shall occur immediately to prevent erosion and damage. All areas shall be graded to drain.

3.09 MAINTENANCE:

- A. The CONTRACTOR shall protect newly graded areas from erosion or damage by vegetating areas immediately.
- B. The CONTRACTOR shall fill, repair, and re-establish grades to the required elevations and slopes for any area that shows settling or erosion occurring prior to final completion.
- C. The CONTRACTOR shall maintain grassed and sodded areas in accordance with SECTION 02920.
- D. The CONTRACTOR is required to protect all WORK and to immediately repair all damage WORK including all damage from erosion.
- E. The CONTRACTOR shall maintain the embankments until final acceptance of all work. The maintenance shall include repairs of any erosion, slides, or other damages.

END OF SECTION

SECTION 02221 PIPE TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, materials and equipment necessary for complete and proper pipe and conduit trenching, backfilling and compacting as specified herein. The Contractor shall assume the typical condition of the site is wet regardless of the time of year and that the entire site has an underlying layer of limestone (refer to SECTION 01010).
- B. All information provided in SECTION 02200 is expressly applicable to the WORK in this SECTION unless expressly stated otherwise.
- C. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 02200 - Earthwork

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society of Testing Materials (ASTM):
 - a. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Standard Effort (12,400 ft-lbf/ ft³ (600 kN-m/m³))
 - b. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ ft³ (2,700 kN-m/m³))
 - c. D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
 - d. D4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
 - 2. Florida Department of Transportation (FDOT):
 - a. Standard Specifications for Road and Bridge Construction, Latest Edition
- B. Reference Material per SECTION 01010:
 - 1. Subsurface soil data logs are provided for the CONTRACTOR's reference:
 - a. Geotechnical Engineering Report, Terracon Consultants, Inc., dated February 25, 2020

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: Submittals shall be in accordance with SECTION 01300.

- A. Pipe, Culvert, and Conduit Excavation and Installation Plan
 - 1. Plan shall include at a minimum approach for dewatering, excavation, sheeting, bracing, insure proper foundation, placement of bedding, placement of pipe, culvert or conduit, backfill, grading, and vegetation.
 - 2. Plan shall include approach to protect the Work and a schedule for all efforts.

3. Plan shall identify all pipe, culvert or conduit proposed to be performed as aqueous construction. Plan will provide the approach for providing the required foundation, bedding and backfill in accordance with Contract Documents for aqueous construction including the means to prevent floatation. Bedding and backfill for pipes, culverts, and conduit provided in the plans is for construction in the dry. If aqueous construction and installation requires alternative bedding and backfill, CONTRACTOR shall include these alternatives in the Plan. Plan will provide the approach for inspections and verification of aqueous construction efforts. All aqueous construction intended to be performed must have prior approval by the FWC along with approval of this Plan.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall make all excavations for piping, culverts, conduits and appurtenant structures in any material encountered to the depth and grades required, shall backfill such excavations and dispose of excess or unsuitable materials from excavation, and shall provide and place necessary borrow material to properly backfill excavations, all as indicated on the Drawings, specified herein, or as directed by the FWC.
- B. Excavation, dewatering, sheeting, and bracing required shall be carried out so as to prevent any possibility of undermining or disturbing the foundations of any existing structure or work, and so that all WORK may be accomplished and inspected in the dry unless approved or otherwise directed by the FWC. Aqueous construction may be performed only with prior approval of the FWC.

1.07 CERTIFICATIONS AND TESTINGS: (Not Applicable)

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC for inspection and for performing QA testing at the discretion of FWC. The CONTRACTOR shall provide at least 48 hours advanced notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in General Terms and Conditions.

PART 2 - PRODUCTS

2.01 MATERIALS: The CONTRACTOR shall furnish materials as required to complete the WORK under this SECTION.

PART 3 - EXECUTION

3.01 EXTENT OF OPEN EXCAVATION: The CONTRACTOR shall perform the excavation such that at any time the amount of excavation open will be held to a minimum consistent with normal and orderly prosecution of the work, or as restricted by permit conditions. The CONTRACTOR shall leave no more than 50 linear feet, or the length of the trench between consecutive drainage structures, open behind pipe laying, whichever distance is greater. In no instance shall any trench be left open for more than 24 hours before backfilling in accordance with these Technical Specifications. The CONTRACTOR is responsible for Site safety and protection of the public.

3.02 CUTTING PAVEMENT: When excavations are required in paved areas the CONTRACTOR shall conform to the following.

- A. When excavations are to be made in paved surfaces, the pavement shall be cut ahead of the excavation by means of suitable sharp tools to provide a uniform sharp edge with minimum disturbance of remaining materials.

- B. Asphalt paving and other improvements in the right-of-way and on other private property affected by this construction shall be duly protected and, where disturbed, shall be restored or replaced to meet original conditions.

3.03 TRENCH EXCAVATION: The CONTRACTOR shall perform trench excavation in accordance with the following.

- A. All excavation for piping shall be open cut. Trench sides shall be approximately vertical between an elevation of 1 foot above the top of the pipe and the centerline of the pipe; otherwise, trench sides shall be as vertical as possible or as required. Trenches may be excavated by machinery to a depth that will not disturb the finish grade.
- B. Trench width shall be as narrow as practical and shall not be widened by scraping or loosening material from the sides.

3.04 EXCAVATION BELOW NORMAL GRADE:

- A. In the event the CONTRACTOR through error or carelessness excavates below the elevation required, the CONTRACTOR shall at his own expense backfill with material as directed by FWC and compact to obtain a suitable bedding all as directed and to the satisfaction of the FWC.
- B. In the event unstable or unsuitable bedding material is encountered at or below the pipe bedding level, the CONTRACTOR shall remove such material and replace it with suitable compacted material to the satisfaction of the FWC.
- C. The CONTRACTOR is required to perform in-place density and moisture content test to verify excavation bottom meets same requirements as Select Fill.

3.05 BACKFILLING TRENCHES:

- A. The CONTRACTOR shall be responsible for obtaining the necessary inspections before, during and after backfilling and shall re-excavate, refill and perform all such related work to obtain satisfactory test results.
- B. The CONTRACTOR shall use excavated materials classified as Select Fill for backfilling and for such grading on the Site as is required. The CONTRACTOR shall dispose of any excess fill or unstable material in areas approved by the FWC. Pipe trenches shall be backfilled with Select Fill around the pipe up to the final grade elevation in accordance with requirements for Select Backfill in SECTION 02200, unless otherwise noted on the Drawings.
- C. The CONTRACTOR shall submit detailed procedures for backfilling for the review and approval of the FWC including bedding and backfilling for any proposed aqueous construction.
- D. Whenever trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed off and finally, made to conform to the surface of the ground. Backfilling shall be carefully performed and the surface restored to the elevation shown on the plans. In unpaved areas the surface of trenches shall conform and be equal to quality, character and material of the surface immediately prior to making the excavation.
- E. Place earth embedment as follows:
 - 1. With level bottom layer at proper grade to receive and uniformly support pipe barrel throughout its length.
 - 2. Form shallow depression under each joint to facilitate jointing.
 - 3. Add second layer simultaneously to both sides of the pipe with care to avoid displacement of the pipe.
 - 4. Place material in maximum 12 inch loose lifts.

5. Temporarily secure pipe as necessary to prevent pipe movement and pipe uplift during backfill and compaction efforts.
-
- 3.06 BACKFILLING OF TRENCH UNDER EXISTING OR PROPOSED ROADWAY/ACCESS ROAD (DIRT/SHELLROCK OR PAVED) AND AREAS TO BE PAVED: The CONTRACTOR shall place material in 12 inch maximum loose layers as previously described. Each layer shall be compacted to same requirements as Select Backfill per SECTION 02200. Any pavement cut or area disturbed by this work shall be replaced to match existing.
 - 3.07 BACKFILLING OF TRENCH OPEN AREAS: The CONTRACTOR shall place material in 12 inch loose maximum lifts as previously described. Each layer shall be compacted to same requirements as Select Backfill per SECTION 02200. Restore the surface to original grade and place sod or seed as required by the Contract Documents.

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide all labor, equipment and materials to construct a roadbed with shellrock in accordance with FDOT Standard Specifications for Road and Bridge Construction Section 285 and as specified herein, and in conformity with the lines, grades, notes and typical cross sections shown in the Drawings.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 01410 – Testing and Quality Control

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Florida Department of Transportation (FDOT):
 - a. Standard Specifications for Road and Bridge Construction
 - 2. American Society for Testing and Materials (ASTM):
 - a. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³ (2,700 kN-m/m³))
 - b. D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: Submittals shall be in accordance with SECTION 01300.

- A. Certified Shellrock Product Data and Test Results
- B. Certified In-Field Shellrock Base Test Results

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS AND TESTING: The CONTRACTOR shall perform field density tests in accordance with ASTM D6938 for every 500 feet of road. Laboratory compaction tests in accordance with ASTM D1557 will also be performed by the CONTRACTOR. Failure to meet the specified density will require the CONTRACTOR to recompact and retest those areas directed by the FWC at the CONTRACTOR's expense.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection and performing QA tests if applicable. The CONTRACTOR shall provide at least 48 hours advance notice of its intention to begin new WORK activities.

- 1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

- 2.01 SHELLROCK: The CONTRACTOR shall provide shellrock-stabilized materials in accordance with FDOT Standard Specifications for Road and Bridge Construction Section 911. With the approval of the FWC, suitable shellrock material may be obtained from approved spoil areas. The minimum acceptable density of the shellrock shall be 129 lbs./cu. ft. Acceptance of the material will be in accordance with FDOT Standard Specifications for Road and Bridge Construction Section 200-7. The CONTRACTOR shall provide certified test results of the material intended to be utilized.

PART 3 - EXECUTION

- 3.01 PREPARATION: The CONTRACTOR shall complete the area to be stabilized to the lines and to a grade parallel to the finished elevation of the stabilized road before the stabilizing material is added.
- 3.02 SPREADING: The CONTRACTOR shall place shellrock on the areas to be stabilized in lifts as specified in the Contract Documents. The material shall be manipulated until uniform distribution of the shellrock throughout the width and depth is secured.
- 3.03 SURFACE: After spreading is complete the CONTRACTOR shall shape the surface so that, after being compacted, it will conform to the lines and grades as determined in the field.
- 3.04 COMPACTING AND FINISHING BASE: After the spreading operations are complete, the CONTRACTOR shall compact the shellrock. The material shall be compacted to the density of not less than 98 percent of the maximum density as determined by ASTM D1557, and in accordance with FDOT Standard Specifications for Road and Bridge Construction Section 200-6 with a minimum LBR of 100.

END OF SECTION

PART 1 - GENERAL1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide all labor, materials and equipment necessary for the construction of an articulated and interlocked anchored concrete block mattress. The articulated concrete block mattress (ACBM) system shall include the erosion control fabric, bedding stone, concrete block units, cable stayed, and anchoring system.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 02200 - Earthwork
 - 3. SECTION 02370 - Riprap System

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Florida Department of Transportation (FDOT)
 - a. Standard Specifications for Road and Bridge Construction
 - 2. American Society for Testing and Materials (ASTM)
 - a. A36 - Standard Specification for Carbon Structural Steel
 - b. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - c. C33 - Standard Specification for Concrete Aggregates
 - d. D6684 - Standard Specification for Materials and Manufacture of Articulating Concrete Block (ACB) Revetment Systems
 - e. D7277 - Standard Test Method for Performance Testing of Articulating Concrete Block (ACB) Revetment Systems for Hydraulic Stability in Open Channel Flow
 - f. D7276 - Standard Guide for Analysis and Interpretation of Test Data for Articulating Concrete Block (ACB) Revetment Systems in Open Channel Flow
 - 3. National Concrete Masonry Association's Design Manual for Articulating Concrete Block (ACB) Revetment Systems.

1.03 DEFINITIONS: (Not Applicable)1.04 SUBMITTALS: The CONTRACTOR shall submit the following in accordance with SECTION 01300:

- A. Shop Drawings showing the type of concrete block and anchoring system proposed for use, including block layout patterns in relation to the feature alignment, anticipated locations of cast-in-place grout joints, mattress junction details, anchors, and proposed installation methods for void filling materials
- B. Shop drawings showing details of the ACBM, underlying geotextile installation, and bedding gravel
- C. Detailed description of the method of installation of the blocks, cables and anchoring system

- D. Detailed description of the filter fabric to be used and a sample
 - E. Submittal shall include all MANUFACTURER's hydraulic testing and calculations in support of the proposed cellular concrete mat system and geotextile
 - F. Certificates: The CONTRACTOR shall submit in accordance with SECTION 01300 certification prepared by a qualified independent testing laboratory indicating the following for each aggregate source or gradation proposed for use:
 - 1. Gradation: FDOT Section 901
- 1.05 QUALIFICATIONS: Each manufacturing, fabricating firm shall demonstrate five (5) years continuous experience manufacturing articulated concrete block systems.
- 1.06 RESPONSIBILITIES: (Not Applicable)
- 1.07 CERTIFICATIONS AND TESTINGS:
- A. All ACBM systems shall be independently tested by a facility experienced in performing such tests. All testing and the interpretation of the test data shall conform to ASTM D7277 and ASTM D7276.
 - B. In addition to the above guidance standards, the following shall also be included:
 - 1. The design of the ACBM system shall be in accordance with the Factor-of-Safety design methodology as per the National Concrete Masonry Association's *Design Manual for Articulating Concrete Block (ACB) Retention Systems, Latest Edition*. The minimum design safety factor shall be 1.8.
 - 2. The analysis shall be performed based upon the stability of the mat due to gravity forces alone, neglecting conservative forces added by cabling, mechanical anchorage, contact with adjacent blocks, or other restraints not attributable to gravity based forces. The analysis must account for a 0.5-inch block projection.
 - 3. The percussion driven earth anchors shall be tested for pullout resistance to minimum of 75% of the load required in 3.04 Anchor Installation of this SECTION. The CONTRACTOR shall perform and provide at least one (1) pullout test result for every 500 linear feet of each side where the ACBM system is installed or at the frequency specified by FWC.
- 1.08 INSPECTION COORDINATION: (Not Applicable)
- 1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Check products upon delivery to assure that the proper material has been received and is undamaged.
 - 1. Blocks
 - a. Provide blocks which are sound and free of defects that would interfere with proper placement or that would impair the strength or longevity of the installation. Discard blocks with the following defects (these properties shall be deemed grounds for rejection):
 - i. Broken appendages.
 - ii. Chips larger than 0.25 inches in any dimension or weight loss exceeding 10% of the average weight of the blocks.
 - iii. Cracks wider than 0.25 inches and/or 1.0 inch in depth.

- b. Store blocks in a suitable location away from mud, paint, wet cement, and other contamination or disturbance.
- c. Blocks rejected prior to delivery from the point of manufacture shall be replaced at the manufacturer's expense. Blocks rejected at the job site shall be repaired with structural grout at the expense of the Contractor.

PART 2 - PRODUCTS

2.01 CONCRETE BLOCK MATTRESS:

- A. Interlocking Concrete Blocks: The CONTRACTOR shall provide blocks, which comprise the mat, constructed of high strength concrete having a minimum compressive strength of 4000 pounds per square inch (psi). Each block shall have at least one (1) preformed hole through the block in order to allow anchor cable to pass through each block.
 - 1. The following materials shall be used for the manufacturing of the concrete blocks:
 - a. Cementitious Materials - Materials shall conform to the following applicable ASTM specifications:
 - i. Portland Cements - Specification C150, for Portland Cement.
 - ii. Blended Cements - Specification C595, for Blended Hydraulic Cements.
 - iii. Hydrated Lime Types - Specification C207, for Hydrated Lime Types.
 - iv. Pozzolans - Specification C618, for Fly Ash and Raw or Calcined Natural Pozzolans for use in Portland Cement Concrete
 - 2. Physical Requirements:
 - a. At the time of delivery to the work site, the units shall conform to the physical requirements prescribed in Table 1 below.

TABLE 1. PHYSICAL REQUIREMENTS			
Compressive Strength Net Area Min. psi		Water Absorption Max., lb/ft³	
Avg. of 3 units	Individual Unit	Avg. of 3 units	Individual Unit
4,000	3,500	10	12

- b. The concrete blocks shall have the following nominal characteristics:

TABLE 2. CONCRETE BLOCKS NOMINAL CHARACTERISTICS						
TYPE	BLOCK WEIGHT		BLOCK SIZE			OPEN AREA %
	Lbs/block	Lbs./Sq.ft.	Length inches	Width inches	Height inches	
1	76-91	40-55	17.4	15.5	6.0	10

3. Visual Inspection:

- a. All units shall be visually inspected after installation. If any of the blocks exhibit cracks, chipping or damage deemed as grounds for rejection as listed in the Delivery, Storage, and Handling paragraph of this Section shall be repaired or replaced as required herein

B. Joints and Cables: The CONTRACTOR shall provide concrete blocks incorporated into the mat that are connected in such a manner as to form a flexible mat. The joints shall provide resistance to movement along the long axis of the levee. In the event the blocks are pre-assembled into panels then placed on the slope, each panel shall be connected to the adjacent panel to provide a continuous mattress. The connections may be made by utilizing anchor cable couples with longitudinal cables. Locking devices shall be provided at the toe end of the lateral cables and at each end of the longitudinal cables to contain the blocks. The cables shall be stainless steel, single strand cables with the diameter being established by the MANUFACTURER to satisfy their panel lifting requirements but in no instance, shall the diameter of the cables be less than 3/8-inch. The revetment cable shall exhibit good resistance to mild concentrations of acids, alkalis, and solvents. Fittings such as sleeves and stops shall be aluminum, washers shall be galvanized steel.

C. Open Space Between the Concrete Blocks or Openings in the Blocks: The CONTRACTOR shall provide concrete blocks that comprise the mat spaced in such a manner as to provide the open space in the mat as required in this SECTION. The open space may be provided by openings in the concrete blocks and/or open spaces between adjacent blocks. Openings in the blocks shall be spaced in such a manner that will enhance the removal of water from the bedding layer. The open space in the blocks or between adjacent blocks shall be at least 1/4-inch but no more than 3-1/2 inches wide.

2.02 EROSION CONTROL FABRIC: Filter fabric shall be as specified in SECTION 02370. Filter fabric shall also comply with FDOT Standard Specifications for Road and Bridge Construction Section 985.

2.03 BEDDING STONE: The CONTRACTOR shall place a layer of bedding stone material beneath the ACBM. The bedding material shall be placed within the limits shown on the Drawings and shall be reasonably well graded in accordance with FDOT Standard Specifications for Road and Bridge Construction Section 901 as well as ASTM C33.

PART 3 - EXECUTION

3.01 FABRIC INSTALLATION: The CONTRACTOR shall install the fabric in accordance with the MANUFACTURER's recommendations and as follows:

- A. Prepare slope and area by grading it as smooth as possible.
- B. Inspect the prepared slope and area for loose or unstable soils or exposed roots and replace such soils and remove exposed roots where needed.
- C. Unroll fabric directly onto prepared slope and area. Fabric shall be laid perpendicular to the flow with a two (2) foot lap in the direction of the flow.
- D. The fabric shall be staked or pinned where necessary to prevent the fabric sections from floating.
- E. Toe-in fabric as shown on Drawings.
- F. The upper part of the fabric shall be toed-in to a trench as recommended by the MANUFACTURER.

3.02 BEDDING STONE PLACEMENT: The CONTRACTOR shall place bedding stone to depth shown in Drawings in accordance with the following requirements:

- A. The stone shall be placed by proceeding from the toe of the slope upward.

- B. Minimize height from which bedding material is dropped.
- C. At no time should stone be dumped onto fabric from top of the slope and allowed to roll down the surface of the fabric.
- D. Placing of bedding stone by methods that will tend to segregate particle sizes will not be permitted.
- E. Thickness of bedding shall have a tolerance of minus zero inches to plus three (3) inches of the thickness shown on the Drawings.
- F. Any damage to the filter fabric or base during placing of the bedding shall be repaired at the CONTRACTOR's expense before proceeding with the WORK.
- G. Compaction of the bedding will not be required, but the bedding shall be finished to present an even surface free from mounds or windrows.

3.03 **CONCRETE BLOCK PLACEMENT:** The CONTRACTOR shall install blocks individually by threading each block with cable to produce a continuous mattress or by placing pre-assembled panels and installed in accordance with the MANUFACTURER's recommendations. The blocks shall be installed perpendicular to the flow-way centerline. Anchors shall be installed as per the MANUFACTURER's recommendations.

- A. All blocks along the edges of the mat shall be visually inspected during installation to insure correct placement and interlock. The mattresses shall be placed directly into position with a maximum space or gap between mattresses of two (2) inch in excess of the nominal joint spacing of block within the mattress. Mattresses out of alignment shall be lifted and reset. Mattresses shall not be pushed or pulled laterally after they are in contact with the geotextile. No overlapping of mats will be accepted and no blocks shall project vertically more than 0.5-inch beyond the adjacent blocks. Any block twisted out of its correct position in the mat shall be repositioned to insure proper interlock and function prior to placement of adjacent mats and cable anchors.
- B. ACB Mat-to-Mat Connections: The ACB mats must be connected with adjacent mats on all sides to form a continuous cabled carpet of concrete blocks over the entire armored surface of the earth embankment. The cabled connections between mats can be made with pig-tail connectors or other manufacturer-approved cable connections. Cabled connections to adjacent mats shall not be less than one (1) connection, equally spaced, per three feet perimeter length around each mat and shall be secured to each other as they are set.
- C. Grade Tolerances: The grading tolerance shall be within two (2) inch from the prescribed elevations with no abrupt variations that would cause unacceptable projections from individual blocks.
- D. Grouted Joints: Use of cast-in-place cementitious grouted joints shall be minimized to the extent practical. The FWC representative shall be informed of all grouted joints not shown on shop drawings prior to field placement such as abutments where ACBM meets pipe penetrations. Field placed grout shall be non-shrink and have a compressive strength of 4000 psi. All cable ties shall be completed before grout placement.
- E. Abutments: The ACBM shall abut pipe outlets, concrete, and other abutments in a neat appearance. Unless a specific detail is indicated on the drawings, voids shall be filled with partial blocks and the gap shall be filled with cast-in-place grout. The grout shall be placed flush with the surface of the blocks, and be float finished.
- F. Protection of WORK: WORK shall be protected against damage from subsequent operations. Displaced or broken blocks shall be removed and replaced to conform to all requirements of this SECTION. Damaged material shall not be incorporated. Equipment shall not be allowed on the ACBM that could crack, cause abrasion, or otherwise damage the blocks. Vehicles shall not operate on the ACBM until placement of the void filler. Vehicle traffic on the ACBM shall be restricted to light weight rubber tired vehicles, and where intermittent access is necessary to accomplish the WORK. These allowances shall

not waive the CONTRACTOR's obligation to maintain the installation until acceptance and to not in any way damage the ACBM.

- 3.04 CONCRETE BLOCK OPENING FILL: The CONTRACTOR shall fill the concrete block openings with crushed stone to a point that provides a smooth finish with the upper surface of the concrete block surface. Crushed stone shall meet FDOT Coarse Aggregate Size No. 57 or FWC approved alternate size. All cable ties and anchoring shall be completed prior to filling the voids.

END OF SECTION

SECTION 02367 FOUNDATION PILING (PRESTRESSED CONCRETE)

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment, and materials necessary to install all foundation piling for the structures as shown or specified. The CONTRACTOR shall assume that all pilings are required to be installed in rock/limestone.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Concrete Institute (ACI):
 - a. 211.4R - Guide for Selecting Proportions for High-Strength Concrete Using Portland Cement and Other Cementitious Materials
 - b. 214.3R - Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
 - c. 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete
 - d. 305R - Guide to Hot Weather Concreting
 - e. 306R - Guide to Cold Weather Concreting
 - f. 309R - Guide for Consolidation of Concrete
 - g. 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures
 - h. 318/318R - Building Code Requirements for Reinforced Concrete and Commentary
 - i. 543R - Guide to Design, Manufacture, and Installation of Concrete Piles
 - 2. American Society for Testing and Materials (ASTM):
 - a. A416 - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete
 - b. A421 - Standard Specification for Stress-Relieved Steel Wire for Prestressed Concrete
 - c. A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - d. A722 - Standard Specification for High-Strength Steel Bar for Prestressing Concrete
 - e. A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - f. C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
 - g. C33 - Standard Specification for Concrete Aggregates
 - h. C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

- i. C109 - Standard Specification for Compressive Strength of Hydraulic Cement Mortars (using 2-in. or (50 mm) Cube Specimens)
 - j. C143 - Standard Test Method for Slump of Hydraulic Cement Concrete
 - k. C150 - Standard Specification for Portland Cement
 - l. C171 - Standard Specification for Sheet Materials for Curing Concrete
 - m. C226 - Standard Specification for Air-entraining Additions for Use in the Manufacture of Air-entraining Hydraulic Cement
 - n. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 - o. C260 - Standard Specification for Air-Entraining Admixtures for Concrete
 - p. C309 - Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete
 - q. C494 - Standard Specification for Chemical Admixtures for Concrete
 - r. C595 - Standard Specification for Blended Hydraulic Cements
 - s. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - t. C666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
- 3. American Welding Society (AWS):
 - a. D1.4 - Structural Welding Code-Reinforcing Steel
 - 4. Federal Highway Administration (FHWA):
 - a. NHI-16-009 / 010 - Design and Construction of Driven Pile Foundations
 - 5. Florida Department of Transportation (FDOT):
 - a. Standard Specification for Road and Bridge Construction, latest edition
 - b. Section 455 - Standard Specification for Structural Foundation, latest edition
 - c. Standard Index 20612 -12 Inches Square Prestressed Concrete Pile
 - 6. Prestressed Concrete Institute (PCI):
 - a. MNL 116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
 - b. MNL 120 - PCI Design Handbook, Precast and Prestressed Concrete
- B. Reference Material per SECTION 01010:
- 1. Subsurface soil data logs are provided for the CONTRACTOR's reference:
 - a. Geotechnical Engineering Report, Terracon Consultants, Inc., dated February 25, 2020

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. The CONTRACTOR shall make submittals for Driven Prestressed Reinforced Concrete Piles in accordance with SECTION 01300 and the following provisions. All information may be submitted together, or in packages as described below. The CONTRACTOR shall be responsible for

coordination of materials, equipment, and installation regardless if the submittals are made together or separately.

1. The CONTRACTOR shall submit to the FWC details associated with fabrication of prestressed reinforced concrete piles as follows:
 - a. Prior to piling fabrication:
 - i. Submit Shop Drawings indicating erection details, build-up details, splice details, and special embedded or attached lifting devices. Shop Drawings shall indicate pick-up and support points for piles. Reinforcing details shall conform to ACI 315.
 - ii. Submit shop certification test reports for MANUFACTURER's supplied cement, aggregates, admixtures, curing materials, reinforcing steel, and strand steel. Aggregate certification shall include gradation and quality results. Admixture certification shall include types and quantities to be used during fabrication.
 - b. Prior to piling installation:
 - i. Submit concrete records for each member indicating date, time and duration of casting, mix proportions, mixing water corrections, slump, air content, method of curing, ambient temperature during curing, duration of curing, concrete strength at time of detensioning, 28-day concrete strength.
 - ii. Submit tensioning and detensioning records indicating date and time of each load, stress, and elongation of strand group under loading and unloading.
2. The CONTRACTOR shall submit details of proposed pile-driving equipment to the FWC prior to driving piling. Data shall include:
 - a. Make and model of pile driving hammer.
 - b. Weight, dimensions, stiffness and coefficient of restitution of cap block assembly (helmet and hammer cushion); dimensions, stiffness, coefficient of restitution and type of material of cushion (pile cushion).
 - c. Cushion stiffness shall be determined as:

$$\frac{AE}{S} = L$$

Where:

- | | | |
|---|---|--|
| S | - | Cushion stiffness |
| A | - | Cushion area |
| E | - | Secant modulus of elasticity of cushion material |
| L | - | Length or height of cushion |

3. The CONTRACTOR shall submit details of proposed pre-drilling diameter, depth, method and equipment.
- C. The CONTRACTOR shall submit records for Driven Prestressed Reinforced Concrete Piles construction as described below:
1. During pile driving, the CONTRACTOR shall submit certified daily records to the FWC that are to include the following for each pile:
 - a. Name of structure and pile number
 - b. Driven pile length
 - c. Pile length after cutoff
 - d. Pile cutoff and tip elevations

- e. Ground surface elevation during driving
- f. Continuous driving resistances, including final driving resistances, and pressure gauge readings or hammer ram stroke
- g. Hammer speed in blows per minute during driving
- h. Date and time of day pile driven
- i. Make and model of pile driving hammer, along with associated capblock cushion material type(s) and dimensions
- j. Time required to drive pile
- k. Predrilling diameter and depth
- l. Heaving or re-driving data
- m. Remarks concerning pile-driving operations
- n. Capacity achieved

1.05 QUALIFICATIONS:

A. Experience Requirement:

- 1. The piling fabricator shall have been regularly engaged in the production of prestressed reinforced concrete piles for a period of not less than five (5) years, and show a quality capability through certification in the PCI (Plant Certification Program) or through an established quality control program based on PCI Manual NML 116.
- 2. The CONTRACTOR shall have a minimum of five (5) years experience installing prestressed concrete piles.

1.06 RESPONSIBILITIES: The CONTRACTOR shall be responsible for layout of each pile to the location shown on the Drawings. The CONTRACTOR shall establish monitoring devices and benchmarks as required to complete the WORK. The CONTRACTOR shall provide elevation reference and mark each pile along its entire length at one (1) foot intervals and along at least the last foot of driving at one (1) inch increments, so as to permit determination of the pile tip elevation and corresponding driving resistances during driving.

1.07 CERTIFICATIONS AND TESTING: (Not Applicable)

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide at least 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS:

A. General Requirements: The CONTRACTOR shall furnish piles as described below.

- 1. Pile type and capacity shall be as follows:
 - a. Prestressed reinforced-concrete piles.
 - b. The design compression capacity of each pile shall not be less than 15 kips, with a corresponding ultimate compression capacity not less than 30 kips.

2.02 PRESTRESSED REINFORCED-CONCRETE PILES:

- A. The CONTRACTOR shall provide piles conforming to the Florida Department of Transportation's "Standard Specifications for Road and Bridge Construction," and as additionally specified or indicated.
- B. Materials for Piling: The CONTRACTOR shall furnish piles conforming to the following:
 - 1. Cement:
 - a. Cement shall conform to ASTM C150, C226, and C595.
 - b. Type IV cement shall not be used.
 - c. The tricalcium aluminate content of the cement shall be limited to a maximum amount not in excess of eight (8) percent.
 - 2. Aggregates:
 - a. Aggregates shall conform to ASTM C33 and to Grade of Coarse Aggregate for Class III Concrete to be utilized in prestressed concrete piling in accordance with FDOT Standard Specifications.
 - b. All aggregates shall be free from any substance that may be deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete.
 - c. Fine aggregate shall consist of clean, natural sand or of hard, dense, durable, uncoated rock particles, and shall be free from injurious amounts of silt, loam, lumps, soft or flaky particles, shale, alkali, organic matter, mica, and other deleterious substances.
 - d. Fine aggregates from different sources of supply shall not be mixed or stored in the same stockpile or used alternately in the same concrete mix or the same structure.
 - e. Fine aggregate shall be well graded from coarse to fine, with a fineness modulus not less than 2.00 or greater than 3.40.
 - 3. Admixtures:
 - a. Chemical admixtures, if used for water reducing set, shall conform to ASTM C494, Type A or Type F.
 - b. Chemical admixtures, if used for water reducing and retarding set, shall conform to ASTM C494, Type D or G.
 - c. Air-entraining admixtures with chlorides shall not be used.
 - d. Flyash will not be permitted.
 - e. All concrete piles that will be underwater shall have Crystalline Capillary Waterproofing (CCW) admixture in accordance with SECTION 03050. Otherwise, it shall be coated in accordance with SECTION 09900, System C-3.
 - 4. Curing Materials:
 - a. Curing materials, if used, shall conform to ASTM C171 or ASTM C309.
 - b. Curing materials, if used, shall provide adequate retention of surface moisture.
 - c. Burlap, if used, shall not have previously been used for the storage or handling of sugar products.
 - 5. Water: Water for mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalies, salts, organic materials, or other substances that may be deleterious to concrete or steel.

6. Reinforcing Steel:
 - a. Non-prestressed reinforcing steel shall conform to ASTM A615, Grade 60.
 - b. Steel for ties and spirals shall conform to ASTM A1064.
 - c. Welding of reinforcing steel shall not be performed without prior written approval by the FWC, and then only to be performed in accordance with AWS D1.4.
 7. Prestressing Steel:
 - a. Prestressing steel shall be seven-wire stress-relieved strand conforming to ASTM A416, or stress-relieved wire conforming to ASTM A421, Type WA.
 - b. The minimum ultimate strength shall be 270,000 pounds per square inch (psi).
 - c. Prestressing steel shall be free from grease, oil, wax, paint, soil, dirt, loose rust, kinks, bends, or other defects.
- C. General Requirements: The CONTRACTOR shall furnish piles conforming to the following:
1. Prestressed reinforced-concrete piles shall be solid, shall be cast as monolithic units of homogeneous high-strength concrete, (Class III in accordance with FDOT Standard Specifications) from butt to tip, and shall be stressed with high-tensile, uncoated, cold-drawn, stressed-relieved steel strands.
 2. Piles shall have a minimum cross-section of 12 inches by 12 inches.
 3. Design of all prestressed piles shall be the responsibility of the CONTRACTOR. Design criteria shall be in accordance with PCI Manual MNL 120.
 4. Piles shall be structurally capable of supporting a minimum load capacity of not less than 15 kips in compression.
 5. Piles shall be designed to withstand stresses associated with handling, storage, and pile driving.
 6. Concrete shall be conveyed from the mixer to the forms and deposited in place as rapidly as practicable by methods that will not cause segregation or loss of ingredients in accordance with ACI 304R.
 7. Concrete shall be deposited as nearly and practicable in its final position in the forms without the need for rehandling.
 8. Free-fall, vertical drop of concrete shall not exceed three (3) feet.
 9. Aluminum conveying or formwork equipment shall not be used.
 10. Chuting shall be performed only where the concrete is deposited into a hopper first before it is placed in the forms.
 11. Conveying equipment shall be cleaned thoroughly before each run.
 12. Concrete, which has segregated in conveying, shall be removed.
 13. Piles shall not be driven until 28 days have elapsed from the time of casting or the CONTRACTOR can provide documented evidence that the pile has attained its intended minimum ultimate compressive strength.
 14. Piles shall be fabricated to conform to the following manufactured tolerances from dimensions stipulated:
 - a. Pile length plus three-eighths inch per 10 feet of length, but not greater than plus one and one-half inch.
 - b. Pile outside width plus three-eighths inch or minus one-quarter inch.
 - c. Pile head out of square plus or minus one-quarter inch per 12 inches of width.

- d. Pile ends shall be plane surfaces and perpendicular to the longitudinal axis of the pile with a maximum deviation of one-eighth inch per foot transversely from a true right angle plane.
 - e. Pile accumulated deviation from straight-line horizontal alignment (sweep) not more than one-eighth-inch per 10 feet of length.
 - f. Pile localized deviation from straight-line horizontal alignment (sweep) not more than one-quarter inch within any 10 feet of horizontal alignment.
 - g. Voids or knock-out inserts in piles, if used, plus one quarter inch.
 - h. Pile stirrup bars and spirals plus three-quarters inch.
 - i. Pile concrete cover to reinforcing steel plus one quarter inch or minus one half inch.
 - j. Pile spacing of spirals plus one-half inch.
 - k. Pile reinforcing tendons plus one-quarter inch.
 - l. Pile handling devices plus six (6) inches.
 - m. Piles shall present a true, smooth, and even surface free from any surface blemishes.
- D. Fabrication: The CONTRACTOR shall furnish piles conforming to the following:
- 1. Performance:
 - a. Piles shall be constructed of dense concrete possessing a minimum ultimate compressive strength of 5,000 psi in 28 days.
 - b. Concrete used in piles shall have a slump of four (4) inches with a plus tolerance of one (1) inch, as determined in accordance with ASTM C143, or as otherwise controlled by FDOT.
 - c. Concrete used in piles shall have an air content from 4 to 6 percent, as determined in accordance with ASTM C231.
 - d. The ends of all piles and the corners of square piles shall be chamfered.
 - e. Test cylinders shall be prepared at the time the concrete is deposited for each production line to determine the strength of the castings. The cylinders shall be cured in the same manner as the piles and shall be placed at the point where the poorest curing conditions are afforded. This point shall be at the coolest region in the bed for steam-cured piles.
 - f. Making and curing of concrete test specimens shall be in accordance with ASTM C31.
 - g. Compressive testing of concrete cylinders shall be in accordance with ASTM C39.
 - h. Pile pick-up points shall be the responsibility of the CONTRACTOR.
 - i. Workmanship of pile fabrication shall conform to PCI Manual MNL-116.
 - 2. Forms:
 - a. Forms shall be of metal, shall be well braced and stiffened against deformation, shall be accurately constructed and watertight, and shall be appropriately treated with lacquer, form oil, or other acceptable material prior to the placement of reinforcing steel so as to prevent bonding of forms to concrete.
 - b. Forms shall permit movement of the pile without damage during release of the prestressing force.
 - c. The bottom of the form shall be within one-quarter inch of a true plane in a length of 50 feet.
 - d. Side forms shall be released as soon as practicable, but shall not be removed until the concrete has attained a minimum compressive strength of not less than 5,000 psi.

3. Placement and Curing:
 - a. Concrete shall not be deposited in the forms until reinforcement steel and anchorages have been appropriately positioned.
 - b. Concrete shall be placed promptly after initial mixing is completed and shall be deposited close to its final position in the form.
 - c. Consolidation of concrete shall be in conformance with ACI 309.
 - d. Vibrator heads, if used, shall be smaller than the minimum distance between steel members for pretensioning.
 - e. Vibration of concrete shall proceed until the concrete is thoroughly consolidated.
 - f. Vibration of concrete shall not be performed in such a manner or for such an extended period of time that segregation of concrete occurs.
 - g. All piles shall be cured in accordance with Section 4 of the PCI Manual MNL-116.
4. Reinforcements and Embedments:
 - a. All reinforcing steel, prestressing steel, pick-up points and embedded items, shall be positioned as indicated within the forms and secured to prevent movement during concrete placement.
 - b. All reinforcing steel and prestressing steel shall have a minimum concrete cover of 3 inches, unless otherwise indicated on the Drawings or directed by the FWC.
 - c. Installation of reinforcing steel and inserts shall permit the even placement of flow of concrete to all parts of the pile.
 - d. Knock-out inserts will not be required.
5. Pretensioning:
 - a. The tension to which the steel is to be pretensioned shall be measured by the elongation of the steel and verified by the jack pressure reading of a gauge.
 - b. Gauges used during pretensioning shall have been calibrated by certified laboratory within 12 months of commencing WORK and shall continue to be calibrated every five (5) months from the date of commencing throughout the term of WORK. Gauges shall be increments to read to the nearest 100 pounds of load.
 - c. Means shall be provided for measuring the elongation of the tendons to within one-eighth-inch.
 - d. When the difference between the results of measurement and gauge reading is more than five (5) percent, the cause of the discrepancy shall be corrected.
 - e. Tensioning steel shall be given a uniform prestress prior to being brought to its design prestress. The same initial prestress shall be induced in each unit when several units of prestressing steel in a pile are prestressed simultaneously.
 - f. Thermal changes, a variation between ambient temperature at time of prestressing and concrete temperature at time of placing concrete, resulting in stress changes shall be accounted for in accordance with PCI Manual MNL-116.
 - g. For the uniform application of load to strands, the face of the anchorage of final design prestress shall be in a plane parallel to its position under initial prestress.
 - h. Final design prestress shall be a minimum stress not less than 8 psi across the cross-sectional area of the pile.
6. Detensioning:

- a. Prestressing force in pretensioned piles shall be released in such a manner that eccentric forces are minimized by maintaining symmetry of forces about the vertical axis of the pile member.
 - b. Tension in the strands shall be released gradually from the anchorage in a manner that will minimize sudden or shock loading.
 - c. Detensioning shall be performed in such a manner and sequence that longitudinal movement is precluded.
 - d. If concrete has been heat cured, detensioning shall be performed immediately following curing while the concrete is still warm and moist and before dimensional changes allowing cracking or undesirable stressing of concrete are allowed to occur.
 - e. Detensioning shall be performed as soon as practicable, but shall not be done until the concrete has attained a minimum compressive strength of not less than 4,000 psi.
- E. Handling and Storage: The CONTRACTOR shall conform to the following regarding handling and storage of piles.
- 1. Unless special lifting devices are attached for pick-up, pick-up points shall be clearly and plainly marked on all piles after removal of forms, and all lifting shall be performed at these points.
 - 2. Piles shall be lifted and handled by a suitable bridge or sling where required, which shall be attached to the pick-up points.
 - 3. Special care shall be provided in handling and transporting concrete piles to prevent any appreciable buckling of the pile or cracking of the concrete.
 - 4. Storage areas for prestressed piles shall be stabilized, and a suitable base shall be provided, so that differential settlement or twisting of pile shall not occur.
 - 5. Stacked piles will not be permitted unless CONTRACTOR provides appropriately separated and supported battens placed across the full width of each bearing point.
 - 6. Battens used for storage of piles shall be arranged in vertical planes at a distance not greater than the width of the pile from designated pick-up points.

2.03 PILE DRIVING EQUIPMENT: The CONTRACTOR shall conform to the following with regards to pile driving equipment.

A. Pile Driving Hammer:

- 1. The CONTRACTOR shall drive piles to either the minimum penetration length stipulated or to the specified and minimum driving resistance which ever is greater.
- 2. Pile driving hammer shall not develop excessive energy, which would result in overstressing or crushing of pile during driving.
- 3. The CONTRACTOR shall submit details of pile hammer to the FWC for approval at least two (2) weeks prior to driving piles. Should a change in hammer or driving equipment be necessitated by the CONTRACTOR, CONTRACTOR shall submit revised details to the FWC for approval at least 2 weeks prior to driving piles with revised equipment.
- 4. The pile-driving hammer shall be operated at all times at speeds and conditions recommended by the hammer MANUFACTURER.
- 5. The boiler or compressor capacities for the steam- or air-operated hammers shall be sufficient to operate the hammer continuously at the full-rated speed and energy.
- 6. For the steam- or air-operated pile hammers, the CONTRACTOR shall provide a pressure gauge to be located on the hammer steam or air line in a position such that it can be clearly read by the pile driver operator.

7. For the double-acting diesel hammer, the CONTRACTOR shall provide a bounce chamber pressure gauge to be located in a position such that it can be clearly read by the pile driver operator.
 8. For a single-acting diesel hammer, the CONTRACTOR shall mark the ram as approved by the FWC to permit determination of the stroke.
 9. The pile driver shall be equipped with fixed leads, secured to the pile-driving rig with rigid bracing, and extending to the lowest point, which the hammer must reach to drive the piles.
- B. Capblock (Helmet and Hammer Cushion) and Cushion (Pile Cushion):
1. Piles shall be protected during driving by a capblock-and-cushion assembly of approved design.
 2. No pile head will be held so firmly that the slight rotation of the pile normally occurring while the pile is being driven will be prevented.
 3. The capblock or cushion materials shall be replaced during driving if it has been damaged, highly compressed, charred, burned, or has become spongy or deteriorated in any manner.
 4. The driving helmet or capblock shall fit loosely around the top of the pile so that the driving helmet does not restrain the pile should the pile tend to rotate during driving.
 5. The driving helmet or capblock shall fit flush with the plane of the pile end so that a uniform impact force is applied to the pile during driving.
 6. If CONTRACTOR elects to use a pile head with projecting strands or mild steel reinforcing, a special driving head or helmet device shall be used to prevent damage to the reinforcement and prevent direct impact forces from being transmitted through the reinforcement.
 7. The CONTRACTOR shall submit to the FWC for approval, details concerning the stiffness of the cushion assembly, the coefficient of restitution, and the weight of the capblock-cushion assembly at least two (2) weeks prior to changes on-site to this equipment.
- C. Templates: Provide a fixed steel pile template adequate to maintain the pile in proper position and alignment during driving in accordance with FDOT Section 455.

PART 3 - EXECUTION

3.01 DRIVEN PILES:

- A. Equipment for Driving Prestressed Reinforced Concrete Piles: All pile-driving equipment shall be subject to the FWC's approval after observation at the Site.
- B. Driving Procedure: The CONTRACTOR shall complete the pile driving in conformance with the guidelines below:
1. Drive each pile continuously and without voluntary interruption until the specified penetration length and driving resistance have been obtained.
 2. Drive piles in contact with surrounding soil and leave permanently in place.
 3. Drive piles in a sequential operation, which will minimize heaving of adjacent piles.
 4. Pile driving operations shall be suspended if impact shock results in problems to any adjacent structures or equipment, until corrective measures can be taken.
 5. No method requiring force to correct the position or line of any pile during driving will be permitted.
- C. Penetration and Driving Resistance:
1. The CONTRACTOR shall drive piles to either the minimum penetration length stipulated or to the specified and minimum driving resistance, which ever is greater. The minimum driving

resistance will be determined utilizing the U.S. Department of Transportation, Federal Highway Administration's Wave Equation Analysis of Pile Driving (WEAP) for the pile hammer and associated capblock-cushion materials and properties, as to be submitted and utilized for pile driving by the CONTRACTOR and according to load test results.

2. The CONTRACTOR shall familiarize itself with conditions present at the Site prior to bidding; specifically, should there be limited access dimensions, headroom clearances, or other conditions, which restrict the use of particular driving equipment, and thereby affect the associated minimum driving resistance.

D. Heaving:

1. The CONTRACTOR shall check for heaving on a reference pile selected by the FWC within each pile group or cluster.
2. The reference pile shall be checked by comparison of elevations before and after driving of all adjacent piles within a group or cluster.
3. Heaving shall be considered as occurring to all piles within a group or cluster when the reference pile head elevation changes in excess of 0.025 foot.
4. Piles within a group or cluster shall be redriven when the reference pile heaves in excess of 0.025 foot.

E. Redriving:

1. A pile selected by the FWC from within the initial pile group or cluster driven shall be redriven not less than 4 hours, and preferably 24 hours, after completion of initial driving in order to check for relaxation or freeze. Relaxation is indicated by a lesser number of blows per inch required to mobilize the pile than was attained at completion of its original final driving resistance.
2. Redriving shall be complete using not less than the same number of blows originally applied to the pile, after the hammer has warmed up. Driving resistance shall be noted for each inch of pile penetration. If redriving indicates relaxation, the FWC shall be notified. All piles within a pile group or cluster, which has indicated relaxation, shall be redriven until the driving resistance for the last inch indicates that specified pile capacities have been attained.
3. Redrive all piles within a group or cluster that have indicated heave of the reference pile.
4. Redrive all reaction piles, if undamaged and if permitted by the FWC, beyond their original pile tip penetration to accommodate tip movement from load test and then to minimum driving resistance criteria.

F. Cutoff:

1. When necessary, and upon approval by the FWC, the CONTRACTOR shall cutoff with pneumatic tools, hydraulic stripper, sawing, or other approved methods.
2. The use of explosives or other method that may damage the reinforcing steel or the concrete of the pile to be left in place will not be permitted.
3. Cutoff shall be perpendicular to the vertical axis of the pile within one half inch of the cutoff elevation indicated.
4. If excavation around the piles is required to achieve pile cutoff, excavated material shall be stockpiled for recompaction or removed and disposed of as directed by the FWC.
5. Concrete and reinforcing steel materials wasted from cutoff methods shall be removed and disposed of offsite at the CONTRACTOR's expense, or as otherwise directed by the FWC.

G. Splices and Build-Ups:

1. The CONTRACTOR shall use full-length piles where applicable.

2. Splicing or building up of piles will not be permitted unless otherwise approved by the FWC subsequently in the field during driving; should such activities be approved by the FWC, such splicing or building up of piles shall conform to design considerations regarding driving stresses, lateral applied loads, and water exposure where required.

H. Predrilling and Jetting:

1. When necessary to assist in attaining the indicated penetration length without damage to piles, the CONTRACTOR shall be required to predrill and grout the pile. CONTRACTOR shall have equipment for predrilling available or on-site and the CONTRACTOR shall assume that that predrilling will be necessary to achieve sufficient embedment length to support uplift loads. The CONTRACTOR is reminded that the site has a layer of limestone. Predrilling will be performed at the CONTRACTOR's expense.
2. Pile points shall be well seated with moderate soil resistance at the point before full driving energy is applied.
3. The CONTRACTOR shall use continuous flight augers for predrilling with a maximum diameter not larger than 13 inches for "typical" pile size and under most Site conditions and a depth of drilling deep enough to penetrate bearing stratum, as approved by the FWC.
4. Jetting will be permitted.
 - a. Where jetting is allowed by the FWC, at least two (2) jets shall be used. All jetted piles shall be driven for the final five (5) feet of penetration, unless otherwise directed by the FWC.

I. Installation Tolerance:

1. Piles shall not exceed a variation from either the vertical axis or battered axis of the pile after driving of more than one-quarter-inch per foot of pile length.
2. The center of axis of the pile head after driving shall not vary from the plan location at cutoff by more than three (3) inches.
3. Acceptable tolerance of top of pile from intended cutoff elevation shall be between one and one-half (1.5) inches and four (4) inches in accordance with FDOT Specifications 455-5.15. The CONTRACTOR may elect to trim piles to cutoff elevation after the pile cap is excavated.

J. Rejected Piles:

1. The FWC will determine the acceptability of all piles driven and may, at their option, reject those piles that do not conform to the Drawings and specifications.
2. The CONTRACTOR shall perform one of the following, as directed by the FWC, for those piles, which have been rejected.
 - a. Leave the piles in place, cut off as directed and drive one (1) or more new piles in locations designated by the FWC to replace the rejected pile and maintain symmetry of the pile group or cluster.
 - b. Withdraw the pile and drive a new pile. Any holes, which result from pile withdrawal, shall be packed with an approved nonplastic (noncohesive) material before redriving the replacement pile.

K. Test Piles:

1. Test piles are not proposed for this project, unless directed otherwise by the FWC or as recommended by the geotechnical engineer.
2. Test piles shall include the cost for surveying, mobilization, demobilization, installation, and standby time for testing.

END OF SECTION

SECTION 02370 RIPRAP SYSTEM

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment, hauling and materials necessary for the proper placement of stone riprap, bedding stone and filter fabric where indicated, including temporary riprap for bypass channel(s), as required by the Contract Documents.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society for Testing and Materials (ASTM):
 - a. C88 - Standard Test Method for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
 - b. C127 - Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
 - c. C295 - Standard Guide for Petrographic Examination of Aggregates for Concrete
 - d. C535 - Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - e. D3744 - Standard Test Method for Aggregate Durability Index
 - f. D5240 - Standard Test Method for Evaluation of Durability of Rock for Erosion Control Using Sodium Sulfate or Magnesium Sulfate
 - g. D5312 - Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions
 - h. D5313 - Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. T85 - Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
 - b. T210 - Standard Method of Test for Aggregate Durability Index
 - 3. Florida Department of Transportation (FDOT):
 - a. Standard Specifications for Road and Bridge Construction
 - i. 514 - Standard Specification for Plastic Filter Fabric (Geotextile)
 - ii. 901 - Standard Specifications for Coarse Aggregate
 - b. Florida Methods:
 - i. 3-C-535 - Resistance to Degradation of Large-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine
 - ii. 5-538 - Sampling and Testing Rip-Rap Material

4. U.S. Army Corps of Engineers (USACE)
 - a. ERDC/GL TR-81-8 Evaluation of Quality and Performance of Stone as Riprap or Armor
 - b. EM 1110-2-1601, Engineering and Design: Hydraulic Design of Flood Control Channels
 - c. EM 1110-2-1100 Part VI, Coastal Engineering Manual: Design of Coastal Project Elements
 - d. EM 1110-2-2302, Engineering and Design: Construction with Large Stone

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. The CONTRACTOR shall furnish to the FWC, testing certificates from a qualified independent testing laboratory prior to acceptance of the rock source to verify the conformity to the requirements of the Contract Documents.
- C. Filter Fabric Product Data

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS:

- A. Riprap Test Reports: The CONTRACTOR's riprap supplier shall submit certified test reports prepared by a qualified independent testing laboratory selected and compensated by CONTRACTOR for the tests required for each Project in the table below. The table shown below also specifies the minimum number of tests for each Project to establish quality control.

Test Required	Number of Tests	Test Method	Test Frequency
Specific Gravity	2	ASTM C127	Every 2,500-ton stockpile
Absorption	2	ASTM C127, AASHTO T 85	Every 2,500-ton stockpile
Sodium Sulfate Soundness	2	ASTM C88, ASTM D5240	Every 2,500-ton stockpile
Durability Index	2	ASTM D3744, AASHTO T 210	Every 2,500-ton stockpile
L.A. Abrasion	2	FM 3-C 535	Every 2,500-ton stockpile
Gradation	1	FM 5-538	Every 2,500-ton stockpile
Freeze and Thawing	1	ASTM D5312	Every Project
Wetting and Drying	1	ASTM D5313	Every Project
Petrography	1	ASTM C295	Every Project

- B. Bedding Stone Test Reports: The CONTRACTOR's bedding stone supplier shall submit certified test reports prepared by a qualified independent testing laboratory selected and compensated by CONTRACTOR for confirmation of weight and gradation.
 - C. Filter Fabric: The CONTRACTOR shall submit MANUFACTURER's data for filter fabric demonstrating compliance with specified material properties, and including MANUFACTURER's recommendations for storage, handling, installation, and anchoring fabric.
- 1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK and suppliers for the FWC as requested for inspection and QA testing. The CONTRACTOR shall provide the FWC at least 48 hours advance notice of its intention to begin new WORK activities.
- 1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - MATERIALS

2.01 RIPRAP:

- A. The CONTRACTOR shall furnish stone for riprap that is sound, durable and angular in shape. No more than 10 percent of the stone for any gradation shall have an elongation (ratio of greatest dimension to least dimension) greater than 3:1, and no stone shall have an elongation greater than 4:1. The riprap material shall be provided by a Florida Department of Transportation (FDOT) certified pit or from onsite excavations and conform to the following additional requirements. The CONTRACTOR shall provide the FWC all required test results for the limestone obtained onsite to verify if it meets the requirements.
- B. Material shall be free from cracks, seams, moldic porosity after shells, non-mineralized or other defects that would tend to increase its deterioration from natural causes. Riprap shall consist of dense, natural rock fragments. Stones shall be resistant to weathering and to water action; free from overburden, spoil, shale and organic material; and shall meet the gradation requirements below. Shale and stones with shale seams and limestone with moldic pores after shells are not acceptable.
- C. Stone for riprap shall have the following properties:

Property Test	Limestone
Unit Weight (Saturated Surface-dry)	145 pcf min
Specific Gravity (Saturated Surface-dry)	2.38 min
Absorption	5% max
Sodium Sulfate Soundness	10% max loss, 5 cycles
LA Abrasion	40% max loss, 1000 revolutions
Freeze and Thawing	15% max, 20 cycles
Wetting and Drying	1% max, 10 cycles with no progressive cracking
Durability Index	Refer to Durability Absorption Ratio

Property Test	Limestone
Petrography	Fresh, interlocking crystalline, no clay minerals, no shell fragments, no voids, and no soluble materials

- Freezing and Thawing and Wetting and Drying. Stone material shall be subjected to freezing and thawing and wetting and drying testing in accordance with ASTM D5312 and ASTM D5313 respectively. Photographs for freezing and thawing and wetting and drying testing shall be taken for each sample tested both before and after testing. Slabs cut for freeze and thawing testing shall have a surface area of 144 square inches on each sawed faced. Any changes observed in the testing specimen including, but not limited to, cracking, spalling, rock popping, or dissolving shall be recorded and photographed at the completion of next test cycle.
- Stones shall consist of durable, sound, hard, angular rock meeting the following requirements for durability absorption ratio, soundness test, and abrasion test:

Durability Absorption Ratio	Acceptability
Greater than 23	Passes
10 to 23	Passes only if Durability Index is 52 or greater
Less than 10	Fails

$$\text{Durability Absorption Ratio} = \frac{\text{Durability Index (Coarse)}}{\% \text{ absorption} + 1}$$

- Petrography. Stone material shall be subjected to comprehensive petrographic evaluation in accordance with ASTM C295. Stone material shall be fresh (no signs of weathering), with interlocking crystalline structure, and free of material such as expansive clays or any detrimental or deleterious features discussed in subparagraph "Stone Material Quality". Crystalline structure refers to igneous, metamorphic, or sedimentary rock texture consisting of interlocking, crystalline grains. Matrices of any stone consisting of argillite, sericite, smectite, talc, chloritic, soft material, or highly weathered material shall be identified and noted. Examination shall include description of any seams, veins, shell fragments, visible pores or joints and an estimate of alteration, degree of weathering, and probable rock durability. The comprehensive petrographic examination shall also include description of dominant, accessory and alteration minerals. The petrographic examination shall be conducted by a State Licensed Professional Geologist specializing in the field of Mineralogy or Petrography. Photographs of stone material examined shall accompany the petrography testing results. Petrography may be completed at a laboratory other than an approved USACE validated commercial testing laboratory; however, certification proving that a State Licensed Professional Geologist specializing in the field of Mineralogy or Petrography will be completing this evaluation must be included in the Evaluation Testing of Stone Submittal for review and approval.
- Stone Material Quality. All stone material shall be free of any detrimental geologic features such as, but not limited to, clay seams, shale seams, argillaceous material, any stylolites, schistose seams, detrimental vugs zones or seams, zones of high foliation, and/or other adverse diagenetic features or seams. No schistose stone material or any highly foliated stone material will be acceptable. Sedimentary or metamorphic stone containing carbonaceous, coal, clay seams/lenses/joints or similar deleterious features will not be permitted or accepted. All stone material utilized shall be free of cracks, blast fractures, bedding seams, foliation seams, foliation joints, joints, any deleterious features such as splits, spalls, delaminations, disaggregations, dissolution, shaley parting, or combination thereof of such features, and/or

other defects that would tend to increase its deterioration from natural causes. An independent licensed Professional Geologist, licensed in any U.S. State, that issues a Professional Geologist License, shall determine if the aforementioned features are present within stone material from any of the proposed Stone Source(s). Discussion of Stone Material Quality and any detrimental or deleterious features present within any source shall be included in Evaluation Testing of Stone and the Stone Source Submittal for that Stone Source. Examples of deleterious and detrimental features in stone can be viewed in ERDC/GL TR-81-8. EM 1110-2-1601, EM 1110-2-1100 Part VI and EM 1110-2-2302 provide guidance on the stone properties, characteristics, and gradations specified herein.

5. Stone gradation based on a representative sample of not less than 2.0 cubic yards. Each stone in the sample shall be individually weighed, and a cumulative plot of percent lighter (by weight) versus stone weight in pounds shall be submitted.

D. The riprap shall be graded as follows:

Type B (6-inch Average Size)		
Sieve Size		Percent Passing by Weight
Maximum	Minimum	
12"	9"	100
8"	7"	50
6"	5"	15

Type A (12-inch Average Size)		
Sieve Size		Percent Passing by Weight
Maximum	Minimum	
21"	15"	100
14"	12"	50
11"	8"	15

Type C (18-inch Average Size)		
Sieve Size		Percent Passing by Weight
Maximum	Minimum	
30"	22"	100
20"	18"	50
16"	12"	15

- E. Control of gradation shall be by visual inspection. The CONTRACTOR shall furnish a sample of the proposed gradation of at least 5 tons or 10 percent of the total riprap weight, whichever is less. If approved, the sample may be incorporated into the finished riprap at a location where it can be used as a frequent reference for judging the gradation of the remainder of riprap. Any difference of opinion between the FWC and the CONTRACTOR shall be resolved by dumping and checking the gradation of two (2) random truckloads of stones. Arranging for and the costs of mechanical equipment, a sorting site, and labor needed in checking gradation shall be the CONTRACTOR's responsibility.
- F. The acceptability of the stones will be determined by the FWC prior to placement. Any visual variability and deviation in the test results of the individual rocks is unacceptable.

2.02 GRANULAR BEDDING:

- A. The CONTRACTOR shall place a layer of bedding material beneath the riprap materials to the lines and grades shown on the Drawings. Stone for use in granular bedding shall weigh not less than 135 pounds/cubic foot (saturated surface dry – pounds/cubic foot). The material shall be composed of tough, durable particles, shall be reasonably free from thin, flat and elongated pieces, and shall contain

neither organic matter nor soft, friable particles in quantities considered objectionable by the FWC. Bedding stone shall be placed within the limits shown on the Drawings and shall be reasonably well graded in accordance with FDOT Section 901. The bedding stone for each type of riprap shall be as follows:

Type of Riprap	Bedding Stone
Type B	ASTM C33 Size No. 57
Type A	ASTM C33 Size No. 357
Type C	ASTM C33 Size No. 2

- 2.03 GEOTEXTILE FABRIC: The CONTRACTOR shall provide a 12 ounce per square yard, non-woven, needle-punched geotextile (filter) fabric conforming to the following properties:

Criteria	Minimum Average Roll Value
Permittivity (sec ⁻¹)	0.7 (<15% passing 200 Sieve)
	0.2 (>15% to <50% passing 200 Sieve)
Minimum Grab Tensile Strength	1.3 kN
Minimum Puncture Strength	0.8 kN
Minimum CBR Puncture Resistance	3.7 kN
Minimum Trapezoidal Tear	0.5 kN
UV Resistance	50% in 500 hours

- 2.04 TEMPORARY RIPRAP: The CONTRACTOR shall furnish temporary riprap as indicated on the Drawings conforming to the requirements of Part 2 of this SECTION for Type A or as approved by FWC.

PART 3 - PERFORMANCE

3.01 FIELD QUALITY CONTROL:

- A. The CONTRACTOR shall recombine the riprap stone sample used for gradation analysis, transport to the Project Site, and place in a location acceptable to the FWC. The size of the riprap stockpiled at the Site shall be clearly identified for reference.
- B. Field control of riprap gradation will be by visual comparison of the representative sample to arriving loads. Arriving loads not bearing reasonable similarity to the sample will be rejected.
- C. The CONTRACTOR may, at his option, arrange for gradation analysis of rejected loads at the Project Site. Should the analysis indicate the rejected stone meets the requirements of this SECTION; all reasonable costs for such analysis will be reimbursed to the CONTRACTOR. In no instance will stone of a coloration or appearance dissimilar to that in the sample be accepted.

3.02 SUBGRADE PREPARATION:

- A. Dry Installation: The CONTRACTOR shall prepare the subgrade to the lines, slopes and elevations indicated on the Drawing. The CONTRACTOR shall clear the subgrade of sticks, stones, debris and other materials that could puncture the overlying filter fabric. The finished subgrade shall not vary from design grade by more than two (2) inches at any location.

- B. Subaqueous Installation: The CONTRACTOR shall excavate the subgrade to the lines and grades shown on the Drawing. Tolerance shall be plus 0.0 feet to minus 0.25-feet in the Impoundment invert, plus or minus 0.25-feet on the Impoundment banks, and plus 0.0 feet to minus 0.1-feet on the top of the Impoundment.

3.03 FILTER FABRIC:

- A. Filter fabric shall be placed only on subgrade approved by the FWC.
- B. Overlap adjacent strips of fabric a minimum of 12 inches, and anchor them with securing pins inserted through both strips of fabric along a line through the midpoint of overlap and to the extent necessary to prevent displacement of the fabric. Securing pins shall be as per the MANUFACTURER's recommendations. The CONTRACTOR may opt for a six (6) inch stitched overlap.
- C. Place the fabric so that the upstream strip of fabric overlaps the downstream strip.
- D. The fabric shall be placed on the entire slope, continuous from top to bottom, without any joints or splices.
- E. Do not drop bedding stone or riprap from heights greater than three (3) feet onto the fabric.

3.04 GRANULAR BEDDING: The CONTRACTOR shall place bedding material beneath the riprap, to a nominal depth of 6 inches except where marine mattress is required.

- A. Bedding material shall be spread uniformly over filter fabric material. Placement shall not commence until the FWC has approved subgrade preparation and filter fabric installation.
- B. Placement methods, which segregate the bedding particles, will not be permitted.
- C. Compaction of the bedding material will not be required, but material shall be finished to a reasonably even surface.
- D. Tolerance shall be + three-tenths foot provided this tolerance is not continuous over an area greater than 200 square feet when placed in the dry, or greater than 400 square feet when placed subaqueous.
- E. The CONTRACTOR shall maintain the bedding material until the riprap is in place.

3.05 RIPRAP: The CONTRACTOR shall proceed placing the riprap upon completion of filter fabric and bedding material and after receiving written approval of the FWC to proceed. The CONTRACTOR shall place riprap in accordance with the following.

- A. Stone shall be placed in such a manner as to produce a reasonably well-graded mass with the minimum practicable percentage of voids.
 - 1. Place to full course thickness in one (1) operation in a manner to avoid displacing or puncturing filter fabric. Stone shall not be dropped from a height greater than three (3) feet above the fabric.
 - 2. Finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Hand place or adjust if necessary to secure the desired results, to the satisfaction of the FWC.
- B. Surface Tolerances:
 - 1. Dry Installation: The finished stone surface shall not vary from design grade by more than three (3) inches at any location, except that any extreme of the tolerance shall not be continuous over an area greater than 100 square feet.

2. Subaqueous Installation if approved by FWC: The finished stone surface shall not vary from design grade by more than plus one (1) foot, minus one-half feet at any location; either extreme of the tolerance shall not be continuous over an area greater than 225 square feet.

3.06 MAINTENANCE:

- A. The CONTRACTOR shall maintain the riprap until accepted by the FWC. The CONTRACTOR shall replace riprap displaced by any cause prior to acceptance.
- B. The CONTRACTOR shall maintain riprap free of weeds and vegetation.
- C. The CONTRACTOR shall repair any erosion adjacent to riprap and adjust riprap to prevent any future erosion.

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary or Work: The CONTRACTOR shall furnish all labor, material and equipment necessary for the removal of all surface and subsurface waters from excavation areas and from the Site for access and the ability to perform the WORK. The CONTRACTOR shall be responsible for the management of all surface water on Site without impacting adjacent properties and the WORK. This SECTION includes the construction of a wellpoint system used in conjunction with an open excavation or cofferdam, temporary cofferdams with steel sheet piling and bracing, or any other systems to assist with dewatering and potential aqueous construction as proposed by the CONTRACTOR. The WORK includes the removal of temporary sheet piling and other temporary features at the completion of the WORK.
- B. Existing Conditions:
 - 1. The typical condition of the site is wet regardless of the time of year. Groundwater/surface water levels historically average 1 foot below existing ground to 2 feet above existing ground. Water levels have been higher than 2 feet above existing ground. Standing water on site is always to be expected regardless of the time of year. The CONTRACTOR shall assume that upon contacting or breaching the limestone layer that water will immediately flood the excavation and the CONTRACTOR shall have the proper dewatering equipment in place to address this influx of water. The CONTRACTOR's dewatering plan shall account for these site conditions.
 - 2. Given the wet conditions of the site, the FWC has obtained a dewatering permit for the Project Site (Refer to Reference Materials in SECTION 01010) to assist the CONTRACTOR with a means to potentially start initial dewatering for site access and mobilization. The dewatering volume and timing provided in this permit is not necessarily the amount of dewatering volume to be managed, as the actual volume and timing will be based on the CONTRACTOR's selected means and methods. The FWC-obtained dewatering permit does not cover all required dewatering efforts that shall be required by the CONTRACTOR in the performance of the WORK. The CONTRACTOR shall not rely on the dewatering approach provided in this FWC-obtained permit as a guarantee this dewatering approach will be sufficient to be able to perform the WORK in accordance with the Contract Documents. The CONTRACTOR shall modify the existing permit or obtain a new permit appropriate for the CONTRACTOR's approach, means and methods to perform the WORK in accordance with Contract Documents. When utilizing the FWC-obtained dewatering permit, the CONTRACTOR shall abide by all requirements of that permit including but not limited to the pre-construction activities such as turbidity monitoring.
- C. Related Work Specified Elsewhere:
 - 1. SECTION 01010 - Summary of Work
 - 2. SECTION 01300 - Submittals
 - 3. SECTION 01530 - Protection of Work, Project Controls, Temporary Barriers and Security
 - 4. SECTION 02050 - Demolition
 - 5. SECTION 02435 - Turbidity Control and Monitoring

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. ASTM International (ASTM)
 - a. A36 - Standard Specification for Carbon Structural Steel
 - b. A328 - Standard Specification for Steel Sheet Piling
- B. Reference Material per SECTION 01010:

1. Subsurface soil data logs are provided for the CONTRACTOR's reference:
 - a. Geotechnical Engineering Report, Terracon Consultants, Inc., dated February 25, 2020
- 1.03 **SUBMITTALS:** The CONTRACTOR shall make submittals in accordance with SECTION 01300 and shall include, but not be limited to, the following:
- A. Dewatering Plan: The CONTRACTOR shall submit to the FWC a site-specific dewatering plan which includes as a minimum the following:
 1. Site-specific detailed description of dewatering operation and the sequences/phases/locations including, but not limited to the dewatering system and temporary cofferdam design, wellpoint design, dewatering equipment, safety procedures, and sequence of construction
 2. A schedule of each phase/location indicating the anticipated start and duration of dewatering activities that clearly indicates any overlap of operations for different phases/locations.
 3. A site plan of the Project indicating the location of the proposed impoundments and/or discharge point(s) with the associated calculations for estimating the area of influence of dewatering, depth of dewatering, pumping rates, duration and volumes, and the proposed method of dewatering
 4. A table (Summary of Dewatering operation) that shows all phases, maximum excavation elevation, maximum dewatering elevation, durations of dewatering and pumpage for each phase and the point of discharge of the dewatering water
 5. For each item dewatered (culvert, structure, etc.) a profile view of the excavation details showing land surface elevation, average dry season water level elevation, final control elevation, maximum depth of excavation, and maximum depth of dewatering
 6. Pumpage calculations that show number of pumps, the maximum day pumpage, the average day pumpage and the total pumpage
 7. Site maps with location of pumps and the routing of the dewatering water to the point of discharge for each phase and a combined map for all phases.
 8. Plan view at a scale that shows dewatering location, routing of the dewatering water to the point of discharge for each phase
 9. Operational plan which describes start-up, acceptance, and how stormwater will be handled during dewatering operations
 10. Monitoring plan of the groundwater and surface water levels to verify that the system is operating as intended and designed
 11. Water quality monitoring plan including the water quality monitoring locations including background and compliance turbidity monitoring locations, the location and type of erosion and turbidity control devices, and the methods necessary to ensure that the state and federal water quality standards are met
 12. Re-watering and shutdown procedures associated with the termination of dewatering operations at each location including the sequence for shutdown and removal of the dewatering system, the maximum allowed rate for the restoration of groundwater and surface water elevations, how that maximum rate will be controlled, and the monitoring system of affected water elevations.
 13. Dewatering system removal plan for each phase/location
 14. The dewatering plan shall include the items specified in paragraph 1.05 of this SECTION.
 15. Qualifications of the design professional(s): The CONTRACTOR shall retain the services of a Professional Engineer registered in the State of Florida for the design of the dewatering system.
 16. Signed and sealed site-specific dewatering system plan shall be submitted to FWC. This site-specific dewatering plan is in addition to any plans and submittals required for regulatory approval. Those regulatory plans and submittals shall also be submitted to FWC.
 17. If applicable, certification from a Professional Engineer registered in the State of Florida that the temporary cofferdam has been designed to meet the criteria specified herein.
 18. If applicable, signed and sealed prints of the temporary cofferdam system shall be submitted to FWC.

19. Means and methods during dewatering for the protection of water, fish, and wildlife resources, including nesting species, shall be in accordance with the approved environmental protection plan and permits.
 20. Means and methods during dewatering for the protection of resources, existing legal uses, offsite land uses, and wetland environments.
- B. The Dewatering Plan is required to be submitted by the CONTRACTOR for approval by FWC under this CONTRACT regardless of permits utilized and/or acquired by the CONTRACTOR.
 - C. Contractor shall acquire and provide copies to FWC of all permits required to dewater, discharge water and protect waterways from turbidity during the dewatering operation.

1.04 QUALIFICATIONS:

- A. The CONTRACTOR shall demonstrate a minimum of ten (10) years' experience in the construction of dewatering systems including, but not necessarily limited to, sheet pile, pumping and cofferdams.
- B. Qualifications of the dewatering system design engineer must demonstrate a minimum of ten (10) years' experience doing similar work as approved by the FWC and be a Professional Engineer registered in the State of Florida.

1.05 RESPONSIBILITIES:

- A. This is a performance specification. Except as otherwise specified or indicated, selection of equipment, materials, and methods shall be CONTRACTOR's responsibility. The dewatering of any excavation areas and disposal of all water handled shall be in strict accordance with all applicable local and State government rules and regulations.
- B. The CONTRACTOR shall be responsible for the design of the dewatering system including, but not limited to, the temporary cofferdam, required pump equipment, temporary shoring, as well as any miscellaneous temporary structures required.
- C. In accordance with Chapter 40E-2 F.A.C., the CONTRACTOR shall be responsible for obtaining the appropriate permit for dewatering activities by submitting the required permit application, fees and other supporting information necessary (including the CONTRACTOR's site-specific dewatering plan) to the South Florida Water Management District and obtain the required dewatering permit.
- D. It is anticipated that offsite discharges will occur due to construction dewatering activities. The CONTRACTOR shall comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) Generic Permits as required in Chapter 62-621.300 Florida Administrative Code. Compliance with these NPDES requirements include submittals of the Notice(s) of Intent to Use the Generic Permit(s), receipt of written notification from the Florida Department of Environmental Protection, compliance with all applicable conditions, monitoring and reporting.
- E. The CONTRACTOR shall prepare a site-specific dewatering plan that shall include at a minimum:
 1. A site plan of the Project indicating the location of the proposed discharge point(s) with the associated water quality monitoring locations including background and compliance turbidity monitoring locations, the location and type of erosion and turbidity control devices, and the methods necessary to ensure that the State water quality standards are met.
 2. Calculations for estimating the area of influence of dewatering, depth of dewatering, pumping rates, duration and volumes, and the proposed method of dewatering must be submitted for review.
 3. A water quality monitoring plan.
 4. Assurances for no off-site impacts.
- F. Volume of water discharged must be reported at each dewatering site. The CONTRACTOR shall submit, calibration data, operating ranges of the pumping equipment, flows validated by direct measurement for each temporary pump and instrumentation to be used to determine flows and daily volumes pumped. Detailed documentation describing the instrumentation and methods used for flow measurements shall be reported.

1.06 CERTIFICATIONS AND TESTING:

- A. A Professional Engineer registered in the State of Florida hired by the CONTRACTOR shall inspect, accept, and certify the temporary sheet piling for temporary cofferdam(s) used for dewatering purposes prior to use in the performance of the WORK. Documentation of that certification shall be submitted to FWC.
- B. A Professional Engineer registered in the State of Florida hired by the CONTRACTOR shall inspect, accept, and certify each dewatering system on Site was installed and is being operated as intended prior to use in the performance of the WORK. Documentation of that certification shall be submitted to FWC.

1.07 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for FWC as requested for inspection. The Contractor shall provide at least 48 hours advance notice of its intention to begin new WORK activities.

1.08 WARRANTY: The CONTRACTOR shall warrant the WORK as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS: All materials used in the construction of the dewatering facilities shall be selected, furnished and installed by the CONTRACTOR in accordance with the CONTRACTOR'S design as submitted to FWC.

2.02 SHEET PILE: The CONTRACTOR shall provide new or used sheet piling, for use in the temporary cofferdam, conforming to the requirements of ASTM A328.

2.03 STRUCTURAL STEEL: The CONTRACTOR shall provide structural steel, for use in the cofferdam, conforming to the requirements of ASTM A36.

PART 3 - EXECUTION

3.01 PERFORMANCE: If applicable, the CONTRACTOR shall furnish and install sheet pile cofferdams in accordance with the following.

A. Cofferdam System:

- 1. The CONTRACTOR shall retain the services of a Professional Engineer registered in the State of Florida for the design of the cofferdam system. The walls and bracing shall be designed to withstand, without damage, the maximum water elevations seen on Site. Bracing will not be allowed to impart loads to the permanent structure. Temporary construction loads to the permanent structure in excess of those imparted during in-situ operating conditions will not be allowed.
- 2. Sheet pile wing walls may be supported by anchor rods connected to anchor walls, concrete deadmen, pilings, etc., so installation of a cofferdam shall be phased to avoid interfering with these elements or otherwise reducing their load-carrying capacity.
- 3. Temporary cofferdams for construction through levees shall be designed such that:
 - a. The cofferdam will act as the levee; i.e. shall be at the minimum height of the levee, for the duration of the construction.
 - b. Sheet piles used in construction of temporary cofferdams shall not penetrate the prism of the Perimeter Berm and installation must be approved by FWC.

B. Approximate locations of cofferdam, structural characteristics and embedment depths shall be determined by the engineer designing the cofferdam.

- C. The layout and design of the interior and exterior bracing system for the cofferdam shall fully accommodate with appropriate factors of safety, all applied loading indicated. Those loadings may be increased if considered appropriate by the engineer designing the cofferdam.

3.02 DEWATERING:

- A. The CONTRACTOR shall provide adequate equipment for removal of storm, subsurface or cofferdam leakage waters, in order for these waters to not impact or damage the WORK.
- B. If a cofferdam is utilized, the CONTRACTOR shall perform all WORK for the water control structure in the cofferdam interior free from water.
- C. The CONTRACTOR shall furnish, install, maintain, and operate all necessary pumping and other equipment necessary for dewatering the WORK area.
 - 1. All dewatering equipment shall be in first-class condition and shall at all times be maintained and operated at the efficiency and capacity necessary for maintaining the WORK area free from standing water or wet conditions that may prevent proper construction.
- D. The CONTRACTOR shall provide dewatering facilities with stand-by pumps with 100 percent standby capacity.
- E. The CONTRACTOR shall comply with all applicable local, State and Federal regulations when disposing of water generated by dewatering operations.

3.03 TURBIDITY BARRIER: The CONTRACTOR shall install and maintain suitable turbidity barriers as described in the Contract Documents. The CONTRACTOR shall install as many turbidity barriers as necessary to address actual conditions at CONTRACTOR's expense.

3.04 REMOVAL OF DEWATERING SYSTEM AND COFFERDAMS:

- A. The CONTRACTOR shall remove the dewatering system in such a manner as to allow groundwater and surface water elevations to slowly return to natural elevations without causing erosion or damage to the structure, foundation or the WORK.
- B. The CONTRACTOR shall slowly flood the dewatered area to establish water surface elevations upstream of water control structure equal to tailwater elevation downstream of water control structure prior to removal of temporary cofferdams.

3.05 NOISE ABATEMENT:

- A. The CONTRACTOR shall furnish, install, and maintain throughout the course of dewatering efforts and of the entire WORK, mufflers, noise-control enclosures, or other noise control methods, measures, and features on and around all dewatering pumps, drive units and equipment such that noise emanating from this equipment does not exceed the permissible sound levels defined in applicable local, State and Federal ordinances, rules and regulations.

END OF SECTION

SECTION 02431 CATCH BASINS, FRAMES AND GRATES

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, materials, and equipment for the construction of the catch basins, frames or grates shown on the Drawings, specified or as directed by the FWC.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 02200 - Earthwork

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society for Testing and Materials (ASTM):
 - a. C55 - Standard Specification for Concrete Building Brick
 - 2. Florida Department of Transportation (FDOT):
 - a. Standard Specification for Road and Bridge Construction, Latest Edition

1.03 DEFINITIONS: In this SECTION and within the Technical Specifications as related to requirements, the terms “catch basin”, “drop inlet”, “inlet structure” and “outlet structure” are interchangeable and are applicable to all appropriate Project features. Ask the FWC for applicability of this SECTION to specific Project features.

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. The CONTRACTOR shall provide submittals for catch basins, frames and grates in accordance with SECTION 01300 and the following provisions. The CONTRACTOR shall be responsible for coordination of materials, equipment, and installation regardless of whether the submittals are made together or separately.
 - 1. The CONTRACTOR shall submit dimensional drawings of catch basin showing wall thickness, reinforcement, locations and invert and top elevations of all penetrations, and details of construction and installation.
 - 2. The CONTRACTOR shall submit detail layout drawings of all catch basin grates and frames. The submittal shall include all dimensions, connection details and loading capacity.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS: (Not Applicable)

- 1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide at least 48 hours advance notice of its intention to begin new WORK activities.
- 1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

- 2.01 PRODUCT REQUIREMENTS: The CONTRACTOR shall provide materials conforming to applicable sections of the Technical Specification, Drawings and Applicable Publications as described below.
- A. Concrete: The concrete shall conform to SECTION 03300.
 - B. Reinforcement: Reinforcement shall conform to SECTION 03200.
 - C. Inlets: Inlets shall be precast concrete and shall conform to the requirements of Section 425, of the FDOT Standard Specifications unless otherwise approved by FWC.
 - D. Grates and Frames: The grates and frames specified on the Drawings shall be gray-iron castings conforming to Section 425, of the FDOT Standard Specifications unless specified otherwise on the Drawings.

PART 3 - EXECUTION

- 3.01 EXCAVATION: The CONTRACTOR shall perform excavation to the required depth and dimensions shown on the Drawings in accordance with SECTION 02200.
- 3.02 CONSTRUCTION: The CONTRACTOR shall perform construction in accordance with Section 425-6, of the FDOT Standard Specifications unless otherwise specified or directed by the FWC. The base of the structure shall be cast-in-place concrete unless otherwise approved by FWC. The walls of the structure shall be reinforced concrete construction.
- 3.03 BACKFILL: The CONTRACTOR shall backfill in accordance with SECTION 02200.

END OF SECTION

SECTION 02434 HDPE CULVERTS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all excavation, sheeting, backfill, bracing, joint sealant, erosion control filter material, dewatering equipment and operations, and other labor, materials, and equipment necessary to properly install the HDPE culverts as shown on the Drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 02200 - Earthwork
 - 3. SECTION 02221 - Pipe Trenching, Backfilling, and Compacting
 - 4. SECTION 02439 - Storm Drainage System - Corrugated Metal Pipe
 - 5. SECTION 03375 - Excavatable Flowable Fill

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Association of State and Highway Transportation Officials (AASHTO):
 - a. M 294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12" to 60") Diameter
 - 2. American Society for Testing and Materials (ASTM):
 - a. D2321 - Standard Practice for Underground Installation of Thermoplastics Pipe for Sewers and Other Gravity Flow Applications.
 - b. D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 - c. D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
 - d. F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - e. F894 - Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.
 - f. F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
 - g. F2306 - Standard Specification for 12 to 60 inch [300 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Application
 - h. F2487 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene and Polypropylene Pipelines
 - i. F2510 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Corrugated Dual- and Triple-Wall Polyethylene and Polypropylene Pipes
- B. Florida Department of Transportation (FDOT):
 - 1. Standard Specifications for Road and Bridge Construction, Latest Edition
 - a. Section 948-2 - Corrugated Polyethylene Tubing and Pipe

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. The CONTRACTOR shall make submittals for HDPE culverts and appurtenances in accordance with SECTION 01300 and the following provisions. The CONTRACTOR shall be responsible for coordination of materials, equipment, and installation regardless of if the submittals are made together or separately.
 - 1. The CONTRACTOR shall submit dimensional drawings of culverts showing all dimensions and details of construction and installation including wall reinforcing and joint details.
 - 2. The CONTRACTOR shall submit Material Certifications.
- B. The CONTRACTOR shall submit an HDPE culvert installation plan. The plan shall include at a minimum the following:
 - 1. Details on the methods used to restrain the pipe to prevent floatation and movement during the installation of the backfill material.
 - 2. Details on the placement of backfill to include the number and thickness of individual lifts.
 - 3. Calculations demonstrating that the culvert pipe restraint system is adequate to counteract the effects of floatation during the placement of the individual lifts of backfill material.
 - 4. Identification if aqueous construction is proposed along with all associated pertinent dewatering information and inspection and verification methods for obtaining foundation and backfill requirements per Contract Documents for FWC approval.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS AND TESTING: The CONTRACTOR shall provide a Certificate of Compliance from MANUFACTURER.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 MATERIALS: The CONTRACTOR shall furnish culverts and materials as shown in Drawings and specified.

- A. The pipe shall be manufactured from a high density polyethylene material which meets or exceeds the minimum cell classification requirements as specified in AASHTO M294, FDOT Section 948-2, and ASTM F2306. Resilient connectors between reinforced concrete and corrugated HDPE pipe shall conform to ASTM F2510.
- B. If rework compounds are required for HDPE pipes, only those generated in the same MANUFACTURER's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.
- C. The polyethylene raw material shall contain additives that provide UV stabilization.
- D. The pipe material shall be resistant to corrosion resulting from the presence of Hydrogen Sulfide and pH values between 2 and 13.
- E. The nominal inside diameter of the pipe shall be true to the specified pipe size.
- F. HDPE fittings and transitions shall be in accordance with ASTM F2306. Bell and spigot connections shall utilize a welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM F2306.

- G. The pipe shall be homogenous and as uniform as commercially practical in color, density and other physical properties. The pipe shall be free from visible cracks, holes, foreign inclusions or other defects.
- H. Backfill Soil Material: Backfill soils shall be Select Fill as specified in SECTION 02200.

PART 3 - EXECUTION

3.01 TRENCH EXCAVATION: Trench excavation shall be performed in accordance with SECTION 02200 and SECTION 02221.

3.02 LAYING PIPE:

- A. Installation of the pipe shall be in accordance with these Specifications and ASTM D2321.
- B. Through all steps of construction, all necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable safety codes and standards.
- C. The CONTRACTOR shall install pipe to the line and grade indicated on the Drawings. The CONTRACTOR shall inspect each pipe before laying, replace any damaged or defective pipe from the job, and replace it.
- D. Pipe shall be laid on a stable foundation providing continuous support to the pipe. A trench cut in rock, stony, or unstable soils shall be excavated to 6" below pipe bottom grade, and brought back to grade with #57 stone or flowable fill. All protrusions, boulders and large stones shall be removed. The bedding shall be graded to the required slope before placing the pipe in the trench. Where bedding must be removed for pipe joint alignment and joining purposes, the bedding shall be replaced and compacted in accordance with these Technical Specifications. The CONTRACTOR shall adequately secure the pipe prior to any placement of backfill to avoid floatation. The remaining backfill shall be Select Fill in accordance with SECTION 02200 and 02221.
- E. Bedding material and pipe shall be installed in the dry unless prior approval is obtained from FWC for aqueous construction.
- F. The CONTRACTOR shall lay pipe upgrade with spigot ends pointing in the direction of the flow. After a section of pipe has been lowered into the trench, the CONTRACTOR shall clean and lubricate the end of the pipe to be joined, the inside of the joint, and the rubber ring immediately before joining the pipe. The CONTRACTOR shall assemble/fabricate all joints in accordance with the recommendations of the MANUFACTURER. The CONTRACTOR shall provide all special tools and appliances required for the jointing assembly. The CONTRACTOR shall use care in handling the pipe to prevent breakage.
- G. After each joint has been made, the CONTRACTOR shall check pipe for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. The CONTRACTOR shall apply sufficient pressure in making the joint to assure that the joint is "home," as defined in the standard installation instructions provided by the pipe MANUFACTURER. Driving or ramming by hand or machinery is not allowed. To assure proper pipe alignment and joint makeup, the CONTRACTOR shall place sufficient pipe zone material to secure the pipe from movement before the next joint is installed.

3.03 JOINING AND CONNECTION PIPE:

- A. The CONTRACTOR shall connect pipe, fittings, and appurtenances in accordance with the MANUFACTURER's requirements.
- B. Joints shall be watertight according to ASTM D3212 requirements. Spigot shall have 2 o-ring gaskets securely seated in a gasket groove. Gaskets shall meet ASTM F477 requirements and be installed in accordance with pipe MANUFACTURER's recommendations. Water tightness shall be field verified in accordance with ASTM F2487.

3.04 LEAK TESTING

- A. Prior to testing, pull a mandrel through each pipe to confirm the pipe was not deformed during installation. The mandrel size shall be approved by FWC and this confirmation shall be witnessed by FWC.
- B. Installed sections of PE Profile Wall pipe shall be examined for leaks by ex-filtration where the ground water is below the pipe obvert, or by infiltration where the ground water is above the pipe obvert.
 - 1. Infiltration Testing: The ground water table around the pipe must be at least 1 foot above the highest elevation of the pipe obvert for the section being examined. When the pipe is sufficiently large, the joints may be examined visually for leaks. For smaller pipe, use CCTV inspection equipment. No leaks should be observed. If a leak is observed, it will be necessary to lower the water table below the area of the leak, and to completely dry and clean the area prior to undertaking a repair weld.
 - 2. Exfiltration Testing: The ground water table around the pipe must be less than 1 foot above the highest elevation of the pipe obvert of the section being examined. Fill the pipe section to 3 feet above the highest pipe obvert. Allow to stand for a minimum of 12 hours. Add additional water as required to return the height of standing water to 3 feet. Let stand for 1 hour and measure the amount of water required to return the standing head to 3 feet. Repeat three (3) times. The volume of 'make-up' water required in each subsequent step should be less than the preceding step. The values of 'make-up' water over time should trend to a value less than 25 USG per inch diameter per mile of pipe per day.

3.05 EXCESS EXCAVATION: The CONTRACTOR shall dispose of excavated material not required for backfill in accordance with SECTION 02200.

3.06 PIPE TESTING REQUIREMENTS: Hydrostatic pipe testing shall be performed as specified in SECTION 15106 with a test pressure of 10 psi for 3 hours.

3.07 BACKFILL REQUIREMENTS: Backfilling shall be accomplished as specified in SECTION 02200 and 02221.

END OF SECTION

SECTION 02435 TURBIDITY CONTROL AND MONITORING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all necessary equipment, labor and materials and utilize appropriate means and methods of turbidity controls necessary and sufficient to ensure that the more restrictive and protective of the following are achieved at all times: (1) all applicable State water quality standards, as prescribed in Chapter 62-302.530, Florida Administrative Code (F.A.C.), incorporated by reference, (2) all applicable environmental permit conditions, as prescribed in the permits listed as Reference Materials in SECTION 01010, (3) all permit conditions as prescribed in the permits obtained by the CONTRACTOR and (4) all stormwater and erosion control shall be in accordance with the Florida Department of Environmental Protection (FDEP) Florida Stormwater Erosion and Sedimentation Control Inspector's Manual.
- B. Wetland areas or water bodies, which are outside the specific limits of construction, must be protected from erosion, siltation, scouring and dewatering.
- C. There shall be no discharge in violation of the water quality standards in Chapter 62-302, Florida Administrative Code.
- D. Turbidity/erosion controls shall be installed prior to clearing, excavation or placement of fill material, shall be maintained until construction is completed, disturbed areas are stabilized, and turbidity levels have fallen to less than 29 NTUs above background.
- E. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards.
- F. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008).
- G. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Florida Department of Environmental Protection (FDEP)
 - a. Florida Stormwater Erosion and Sedimentation Control Inspector's Manual
 - 2. Florida Department of Transportation (FDOT)
 - a. Standard Specification for Road and Bridge Construction
 - i. Sections 104 - 1, 2, 3, 4, 6 and 7
 - 3. U.S. Army Corps of Engineers (USACE)
 - a. Applicable regulations
- B. The environmental protection rules and standards in the applicable sections of the Florida Administrative

Code (F.A.C.), <http://www.dep.state.fl.us/legal/Rules/rulelistnum.htm>, incorporated herein by reference are:

1. Design and Performance Standards - 62-25.025 F.A.C.
2. Quality Assurance - 62-160 F.A.C.
3. Surface Waters of the State - 62-301 F.A.C.
4. Surface Water Quality Standards - 62-302 F.A.C.
5. Generic Permits - 62-621.300(2) & (4) F.A.C.

1.03 **SUBMITTALS:** The CONTRACTOR shall make submittals for the turbidity control and monitoring system in accordance with SECTION 01300 and the requirements herein.

- A. Provide details of the turbidity controls proposed including associated Product data sheets.
- B. Provide proposed layout of the turbidity controls and monitoring system on the Site plan.
- C. Turbidity Monitoring Plan – include approach to and frequency for performing turbidity monitoring and reporting.
- D. Obtain the monitoring data and prepare quarterly reports in accordance with paragraph 3.05.B of this SECTION.
- E. Florida Department of Environmental Protection Stormwater Erosion and Sedimentation Control Inspector Certification.

1.04 **QUALIFICATIONS:** The CONTRACTOR shall have at least one (1) employee, on-site, certified by the Florida Department of Environmental Protection as a Stormwater Erosion and Sedimentation Control Inspector. The certification shall be submitted to the FWC for review prior to the installation, inspection, maintenance, repair or replacement of any erosion or sedimentation control Best Management Practices, including but not limited to the turbidity controls. The turbidity monitoring shall be conducted according to the FDEP-approved procedures.

1.05 **INSPECTION COORDINATION:** The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide at least 48 hours advance notice of its intention to begin new WORK activities.

PART 2 - PRODUCTS

2.01 **TURBIDITY BARRIERS:**

- A. **Fabric:** The CONTRACTOR shall provide floating turbidity barriers with fabric that is flexible and of sufficiently fine mesh to prevent passage of suspended material through the fabric. The floating turbidity barriers shall extend to within a foot of the bottom of the canal/ditch except in the areas with the potential for the presence of manatees the barriers shall be two (2) feet above the bottom.
- B. **Floats:** The CONTRACTOR shall provide floats for the turbidity barriers of sufficient buoyancy to prevent the top of the barrier from submerging under any water and wind conditions. If the top of the barrier becomes submerged for any reason, the CONTRACTOR shall suspend construction operations until the condition is corrected.
- C. **anchors and Weights:** The CONTRACTOR shall provide and maintain an anchor system to secure the turbidity barrier in position. Attach weights to the barrier as necessary to keep the fabric at an angle to the vertical of 30 degrees or less. Fabric material shall not be attached to the canal bottom.

PART 3 - EXECUTION

3.01 **TURBIDITY BARRIERS:**

- A. The CONTRACTOR shall install and maintain the turbidity barriers as noted in the Drawings, as required by permits, and where necessary to maintain turbidity releases at or below the permit

compliance levels. Turbidity barriers shall be installed prior to initiating any WORK, including but not limited to, any clearing, land preparation, dredging, stripping, excavation or backfilling. Turbidity barriers shall be maintained in place until construction is complete and turbidity from construction has dissipated. All barriers shall be adequately marked and appropriate signage erected to identify them as obstructions to navigation if applicable.

- B. The turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. The barriers must not impede manatee movement.
 - a. The applicable U.S. Army Corps of Engineers in-water work protection guidelines for the endangered West Indian Manatee incorporated herein by reference are: http://www.saj.usace.army.mil/Portals/44/docs/regulatory/sourcebook/endangered_species/Manatee/2011_StandardConditionsForIn-waterWork.pdf.
- C. The turbidity barriers shall be properly secured and shall be regularly monitored. Any rips or tears that occur in the turbidity barrier material during use shall be repaired or replaced immediately by the CONTRACTOR at its expense. Rips or tears that occur in the turbidity barrier material in use that are not repaired or replaced immediately by the CONTRACTOR will result in a suspension of excavation and/or construction operations, and shall require repairs and replacements as a prerequisite to the resumption of WORK.
- D. The CONTRACTOR shall keep in place and maintain all barriers until the WORK is complete (construction areas stabilized with established vegetation) and turbidity levels return to the background levels based on the monitoring results. Upon completion of use, the CONTRACTOR shall remove the turbidity barriers and associated items to an off-site location at its own expense.

3.02 CONSTRUCTION:

- A. The CONTRACTOR shall conduct its operations at all times in a manner that minimizes turbidity. The CONTRACTOR is required to conform to the State Water Quality standards as prescribed in Chapter 62-302.530, F.A.C., and to meet the special requirements of any environmental permits that have been issued.

3.03 INSPECTION:

- A. All turbidity controls shall be inspected by the CONTRACTOR every work day, after every rainfall event of 0.5 inches or greater in a 24 hour period, and after every extreme weather event that could dislodge or damage the turbidity controls, to assure that the turbidity controls remain properly installed, undamaged, and fully functional at all times.

3.04 EROSION CONTROL:

- A. The CONTRACTOR shall prevent and control erosion, sedimentation and water pollution as per the Florida Department of Transportation (FDOT) Specification Sections 104-1, 2, 3, 4, 6 and 7 and FDEP regulations and permit conditions. The CONTRACTOR is fully responsible to immediately repair any erosion damage to the WORK and the Project Site and to immediately rectify any sedimentation or water pollution issues.

3.05 MONITORING:

- A. The CONTRACTOR shall conduct and record the results of turbidity monitoring appropriate to the conditions and at the locations, times, and frequencies specified below. An FDEP approved Turbidity Monitoring Log is attached (Appendix A) for the CONTRACTOR's use.
 - 1. Background Monitoring Location: At least 100 feet (or as specified in the applicable environmental permit) upstream of any construction activities that may generate turbidity within a canal or conveyance feature outside the construction area, in the middle of the canal, at mid-depth in the water column, and outside of any visible turbidity plume.

2. Compliance Monitoring Location: Located in the canal or water body adjacent to each WORK area, downstream or radial to the construction or maintenance work area, directly outside of the turbidity barriers, and within the densest portion of any visible plume.
 3. Sampling Time:
 - a. During Activities or Environmental Conditions that Can Generate Construction-Related Turbidity: Water samples for the turbidity measurement shall be collected beginning no sooner than one (1) hour after and no later than two (2) hours after construction activity commences (or as specified in the applicable environmental permit) and every four (4) hours thereafter until the work day ends. Water samples shall be collected at the same time(s) every work day according to this schedule. Any substantial deviation from this schedule must be approved by the FWC, unless otherwise compelled by force majeure, in which case, an explanation must be provided verbally as soon as possible and in writing to FWC within 48 hours of the deviation.
 - b. During Activities and Conditions That Cannot Generate Construction-Related Turbidity: Once daily at 10:00 AM or as specified in the applicable environmental permit.
 4. Equipment: The turbidity monitoring equipment shall meet the specifications and be calibrated, maintained, repaired, and replaced according to the methods, procedures, and frequencies set forth in Chapter 62-160, F.A.C.
 5. Records Management: The individual conducting the turbidity monitoring shall transcribe the readings to the approved Daily Turbidity Monitoring Log form (Appendix A) and sign and date the form at the close of each monitoring day. The notebook containing the signed and dated daily turbidity monitoring log forms shall be accessible to FWC at the construction Site during the work day.
- B. The CONTRACTOR shall submit the quarterly monitoring data (Turbidity Monitoring Log forms), to the FWC. Documents submitted shall contain the following information:
1. Permit number
 2. Project name
 3. Dates of sampling and analysis
 4. A statement describing the methods used in collection, handling, storage and analysis of the samples
 5. A map indicating the sampling locations
 6. A statement by the individual responsible for implementation of the sampling program concerning the authenticity, precision, limits of detection and accuracy of the data.
- C. The CONTRACTOR shall submit monitoring reports that also include the following information for each sample that is taken:
1. Date and time of the day samples were taken
 2. Depth of the water body
 3. Depth of the sample
 4. Antecedent weather conditions
 5. Water level stage
 6. Direction of flow

3.06 EXCEEDANCES OF WATER QUALITY STANDARDS

- A. If at any time, monitoring reveals the turbidity level, at the compliance sampling station is greater than

29 NTUs above the corresponding background sample in Class I or III receiving waters or greater than 0 NTU above background samples in receiving waters classified as OFW (Outstanding Florida Waters), construction activities shall cease immediately and not resume until corrective measures have been taken and turbidity has returned to an acceptable level. Turbidity violations and corrective measures shall be documented in the monitoring reports.

1. The CONTRACTOR must notify the FWC immediately who then, per the permit, must notify the permitting agency of the exceedance. If known, the CONTRACTOR may also contact the FWC's assigned Permitting and Compliance Staff for the Project directly.

END OF SECTION

APPENDIX A

DAILY TURBIDITY MONITORING LOG

Multiple work areas that may contribute to turbidity in receiving waters must be monitored separately. A Site map depicting sampling locations must accompany the quarterly turbidity monitoring reports.

Project Name:	Permit No.:
Collector Name:	Collection Date:
Meter/Sonde Identification No.	

Water Observations		Weather Observations	
Water Level Stages		Temperature:	
Direction of Flow		Conditions:	
Water Depth			

Activity Taking Place During Sampling	Yes	No
Excavation or Filling within 50 ft radius of surface waters or wetlands? Please describe:		
Other In-Water Work? (e.g., dewatering; installing piling or forms; injecting concrete; sand blasting; painting) Please describe:		
Other Activity? (e.g., materials transfer; washdown; interim stabilization) Please describe:		

Turbidity Monitoring Data						
Background Location Description:	Background	Compliance	Background	Compliance	Background	Compliance
	A.M. Mid-Depth		Mid-Day Mid-Depth		P.M. Mid-Depth	
Compliance Location Description:						
Collection Time						
Analysis Time						
Turbidity (NTU)						
Did Compliance Sample exceed 29 NTU's above Background Sample?	<input type="checkbox"/> Yes* <input type="checkbox"/> No		<input type="checkbox"/> Yes* <input type="checkbox"/> No		<input type="checkbox"/> Yes* <input type="checkbox"/> No	
*If the 29 NTU limitation is exceeded, please describe cause and corrective actions taken on reverse side of this form. Immediately stop activities contributing to turbidity and notify the SFWMD Construction Manager and Permit Compliance Staff.						
Explanation of gaps in sampling activity (e.g., rained out, phased activity, etc.):						
Construction activity complete and slopes stabilized? <input type="checkbox"/> Yes <input type="checkbox"/> No						

Statement of Authenticity	
I certify this test was performed as required by Chapter 62-160, F.A.C., conducted with an approved instrument calibrated in accordance with the appropriate FDEP-SOPs. The results are complete and accurate.	
Print Name:	
Signature:	Date:

SECTION 02436 ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide all labor, equipment and materials necessary for the prevention of environmental damage as the result of construction operations under this Contract, to protect the WORK, and for those measures set forth in other requirements of the Technical Specifications.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 02435 - Turbidity Control and Monitoring

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Environmental Protection Agency (EPA):
 - a. Clean Air Act (CAA)
 - b. Clean Water Act (CWA)
 - c. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
 - d. Executive Orders and EPA requirements, as appropriate; and all general and specific Federal Permit Conditions as applicable.
 - e. Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)
 - f. National Environmental Laboratory Accreditation Conference (NELAC)
 - g. National Environmental Policy Act (NEPA)
 - h. National Pollution Discharge Elimination System (NPDES)
 - i. Resource Conservation and Recovery Act (RCRA)
 - j. Safe Drinking Water Act
 - k. Toxic Substance Control Act (TSCA)
 - 2. Code of Federal Regulations (CFR):
 - a. 40 CFR - Parts 109, 261.10, 260-268, 273, 279
 - 3. Florida Department of Environmental Protection (FDEP):
 - a. Florida Administrative Code (FAC)
 - i. 62-770, 62-780
 - b. Florida Stormwater, Erosion and Sedimentation Control Inspector's Manual
 - 4. Florida Department of Transportation (FDOT):
 - a. Standard Specification for Road and Bridge Construction - Sections 104-1, 2, 3, 4, 6 and 7
 - 5. Florida Statutes
 - a. Chapter 403
 - 6. National Oceanic and Atmospheric Administration (NOAA):
 - a. Coastal Zone Management Act (CZMA)
 - 7. National Park Service (NPS):
 - a. Native American Graves Protection and Repatriation Act (NAGPRA)
 - b. National Historic Preservation Act (NHPA)
 - 8. U.S. Army Corps of Engineer (USACE)

9. U.S. Fish & Wildlife Service (FWS):
 - a. Endangered Species Act (ESA)
 - b. Fish and Wildlife Coordination Act (FWCA)
 - c. Migratory Bird Treaty Act (MBTA)
 - B. State and local codes, permits, regulations and ordinances as applicable.
 1. Includes all permits listed in SECTION 01010 and all permits obtained by the CONTRACTOR.
- 1.03 DEFINITIONS: Environmental damage is defined as the presence of hazardous, physical, or biological elements or agents which alter the physical, chemical or biological integrity of the environment in such a way that it represents an unacceptable risk to public health, safety or welfare; unfavorably alter ecological balances; affect other species, biological communities, or ecosystems; or degrade the quality of the environment for aesthetic, cultural, and/or historical purposes. The control of environmental damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.
- 1.04 SUBMITTALS: Submittals shall be in accordance with SECTION 01300.
- A. Environmental Protection Plan: Within 20 calendar days after the Notice to Proceed (NTP), the CONTRACTOR shall submit an Environmental Protection Plan (Plan) for review and acceptance by the FWC in accordance with SECTION 01300. Approval of the Plan shall not relieve the CONTRACTOR of its responsibility for adequate and continuing control of pollutants and appropriate environmental protection measures. Approval of the Plan is conditional and predicated on satisfactory performance during construction. The FWC reserves the right to require the CONTRACTOR to modify the Plan if it is determined that environmental protection requirements are not being met. No physical WORK at the Site shall begin prior to acceptance of the Plan. The Plan shall include, but not be limited to the following:
 1. Identification of the person who shall be responsible for implementation of the Plan for the duration of the Contract. This person shall have authority to respond for the CONTRACTOR in all environmental protection matters.
 2. A list of the Federal, State and Local laws, regulation and permits concerning environmental protection, pollution control and abatement that are applicable to the CONTRACTOR's proposed operations and the requirements imposed.
 3. Methods for protection of features to be preserved within the authorized WORK areas: The CONTRACTOR shall prepare a listing of methods to protect resources needing protection (trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil and historical, archeological and cultural resources including areas within the Site that the Contractor has not been approved to perform construction related efforts).
 4. Procedures to be implemented are to provide all necessary environmental protection and to comply with applicable laws and regulations: The CONTRACTOR shall provide written assurance that immediate corrective action will be taken to correct any environment damage due to accident, natural causes or failure to follow the procedures set out in accordance with the Plan.
 5. Fish And Wildlife Resource Protection Plan – refer to paragraph 3.07.
 6. Environmental monitoring plans, if applicable.
 7. Traffic control plan, if applicable.
 8. Stormwater Pollution Prevention Plan (SWPPP).
 9. Safety Plan.
 10. Drawings showing locations of proposed temporary activities, such as material storage areas or stockpiles of excess spoil or materials.
 11. Erosion and sediment control methods, for protecting surface waters, wetlands, and groundwater during construction. All stormwater and erosion control methods shall be in accordance with the FDEP Florida Stormwater, Erosion and Sedimentation Control Inspector's Manual. The CONTRACTOR shall prevent and control erosion and water pollution as per

Section 02435, FDOT Specification Sections 104-1, 2, 3, 4, 6 and 7 and all applicable FDEP regulations and permit conditions. Efforts shall be in accordance with SECTION 02435.

12. Methods for protection of the WORK, in particular methods for protection of the WORK and all areas on Site from erosion damage and the approach and timing to repairing all damage from erosion which is the CONTRACTOR's responsibility.
 13. Methods for protection of water resources and for monitoring the effectiveness of those protection measures. Refer to paragraph 3.04 of this SECTION.
 14. Spill Prevention Methods: The CONTRACTOR shall identify any hazardous or potentially hazardous substances to be used on the Site and indicate intended actions to prevent accidental or intentional introduction of these materials into the air, ground, water, wetlands or drainage areas. The Plan shall specify the actions that will be taken to meet the federal, state and local laws regarding labeling, storage, removal, transport and disposal of all hazardous or potentially hazardous substances. This plan shall address the items lists in paragraph 3.05 of this SECTION.
 15. Spill Contingency Plan for hazardous, toxic or petroleum material. Plan shall include the approach CONTRACTOR will utilize to clean up after a spill including notifications and timing. The CONTRACTOR is responsible for all spills and associated remediation.
 16. A WORK area plan, showing proposed activities and identifying areas of limited use or non-use, and including measures that will be taken for field identification of these areas.
 17. Recycling and Waste Management Plan. The CONTRACTOR shall include waste minimization efforts in the plan and approach for keeping the Site clean and free of debris, garbage and waste materials. This plan shall address the items lists in paragraph 3.06 of this SECTION.
 18. Dust Control Plan.
 19. Signage maps showing locations of all speed limit signs, Threatened and/or Endangered species signs and any other environmental and permit related signage.
 20. Training Plan. The CONTRACTOR shall include approach and schedule for providing all required training for CONTRACTOR personnel, for FWC and for any other persons with responsibilities and obligations to be on-site during the construction of the Project.
 21. Record keeping and retention plan.
- B. Eastern Indigo Snake Qualified Observer Certification
 - C. Daily Quality Control Reports
 - D. CONTRACTOR Personnel Training Documentation
 - E. Testing Laboratory Name, Address and applicable Certifications
 - F. Environmental Completion Report
 - G. Notification of all Spills to FWC
 - H. Spill Report, if applicable
 - I. Wildlife Logs

1.05 QUALIFICATIONS:

- A. When the Eastern Indigo Snake is identified as a species of concern in the environmental permits the CONTRACTOR shall supply qualified eastern indigo snake observers during ground clearing activities. Qualified Observers are defined as individuals who have been instructed by the USFWS on proper techniques and protocols for protection of the Eastern Indigo Snake during Site activities. The observer's names and documentation showing completion of the USFWS's instruction shall be provided to the USFWS at least 2 weeks prior to the commencement of ground clearing activities. The CONTRACTOR is responsible for arranging this instruction from USFWS.

1.06 RESPONSIBILITIES:

- A. Quality Control: The CONTRACTOR shall establish and maintain quality control for the environmental protection of all items set forth herein. The CONTRACTOR shall record on daily quality control reports or attachments thereto, any problems in complying with applicable laws, regulations and ordinances, and corrective action(s) taken.
- B. Permits and Authorizations: The CONTRACTOR shall apply for, pay for, and obtain all necessary permits or licenses unless the FWC has already acquired them. The CONTRACTOR shall be responsible for implementing and complying with all terms, conditions and requirements of all permits issued for construction of the Project. The CONTRACTOR shall install speed limit signs for off-road and improved road travel including access roads and haul roads for construction equipment and employee vehicles that identify speeds protective of wildlife. The CONTRACTOR shall also provide all necessary signage describing all Threatened and/or Endangered species which are identified in applicable environmental permits.
- C. Training: Prior to the onset of construction activities the CONTRACTOR and all personnel shall be trained at the CONTRACTOR's expense on how to identify and implement the Standard Protection Measures and Guidelines for the Threatened and Endangered Species and ground-nesting birds. The Standard Protection Measures for the Eastern Indigo Snake dated August 12, 2013, is attached in Appendix C. The CONTRACTOR shall provide documentation of those who have been trained to FWC.

1.07 CERTIFICATIONS AND TESTINGS: All physical, chemical, and biological measurements and analyses that are necessary to comply with the monitoring requirements in all applicable permits or in this Contract must be performed according to approved methods and procedures by a commercial laboratory that is certified to perform the required analyses according to the approved methods and procedures by the National Environmental Laboratory Accreditation Conference (NELAC). The CONTRACTOR shall provide the name, address and applicable certifications for the testing laboratory to be utilized by the CONTRACTOR.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide to the FWC at least 48 hours advance notice of its intention to begin new WORK activities.

PART 2 - PRODUCT (ENVIRONMENTAL PROTECTION PLAN)

2.01 NOTIFICATION:

- A. In the event that the FWC notifies the CONTRACTOR of any non-compliance with federal, state or local laws, permits or other elements of the CONTRACTOR's Environmental Protection Plan, the CONTRACTOR shall without delay inform the FWC of the proposed correction action and take such action as approved.
- B. The CONTRACTOR shall notify the FWC immediately of any warnings or notices of noncompliance, fines, citations or tickets issued directly to the CONTRACTOR by any federal, state, or local environmental protection, waste management, code enforcement, or fire, police, or public health agency.
- C. If the CONTRACTOR fails to comply, the FWC may order all WORK to cease until corrective action has been taken. No time extensions shall be granted or damages allowed for the suspension of WORK under this circumstance.
- D. A Notice of Termination (NOT) shall be sent to the applicable federal, state, and local permit-issuing authorities with a copy to the FWC within 14 days of final stabilization.

2.02 SUMMARY: The CONTRACTOR shall submit a written report within 30 days of Substantial Completion of the Project. This report shall delineate the absence, or occurrence, of reported or unreported environmental incidents during the course of the Project.

2.03 TRAINING:

- A. The CONTRACTOR shall train its personnel in relevant phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, and careful installation and monitoring of the Project to ensure continuous environmental pollution control.
- B. Due to the probability that wildlife species of concern, including but not limited to Threatened and/or Endangered species and Protected Migratory Bird species may be present within or adjacent to construction Sites, prior to initiation of construction activities, the CONTRACTOR(s) will be trained by the U.S. Fish & Wildlife Service on how to identify and implement appropriate protection measures for each species. The CONTRACTOR is responsible for arranging for this training from USFWS.

PART 3 - EXECUTION (PROTECTION OF ENVIRONMENTAL RESOURCES)

3.01 GENERAL: During the entire period of the Contract, the CONTRACTOR shall protect environmental resources within the Project boundaries and those affected outside the limits of construction. The CONTRACTOR shall confine its activities to the areas defined by the Drawings and Technical Specifications. Any deviations from the Drawings including, but not limited to borrow areas, disposal areas, staging areas, and alternate access routes will require additional review and approval by the FWC to ensure compliance with applicable environmental rules and regulations prior to implementation/or commencement of those deviations.

3.02 PROTECTION OF LAND RESOURCES: Prior to the beginning of any construction the CONTRACTOR shall delineate, install protection and be responsible for preservation of all land resources that are to be preserved or avoided within the WORK area. The CONTRACTOR shall not remove, cut, deface, injure, or destroy any land resources (trees, shrubs, vines, grasses, topsoil, or land forms) unless indicated in the Drawings or specifically authorized by the FWC. All damaged areas shall be restored to original or better condition, to the satisfaction to the FWC.

3.03 DISTURBED AREAS: The CONTRACTOR shall effectively prevent erosion and control sedimentation through approved materials and methods as identified in the Environmental Protection Plan. Disturbed areas will include all areas that have been disturbed during the performance of the Contract, ingress and egress, construction materials storage, staging, washdown areas, and toxic, hazardous, and solid materials/waste storage areas. Disturbed areas shall be temporarily stabilized within 7 days of cessation of phased construction activity and permanently stabilized within 14 days of cessation of all phases of construction activity. Disturbed areas including areas of the WORK that are in danger of being damaged from erosion as determined by the FWC, shall be immediately stabilized and protected by the CONTRACTOR as directed by the FWC. Temporary Best Management Practices (BMPs) shall remain in place and in effect until the final Site inspection is complete and Site is certified as stabilized.

3.04 PROTECTION OF WATER RESOURCES:

- A. The CONTRACTOR shall conduct all activities in a manner to avoid pollution of surface water, ground water and wetlands. The CONTRACTOR's construction methods shall protect wetland and surface water areas from damage due to mechanical grading, erosion, sedimentation and turbid discharges. No storage or stockpiling of equipment shall be allowed within any wetland area unless specifically authorized under a permit for the Project.
- B. Water directly derived from construction activities shall not be allowed to directly discharge to water areas, but shall be collected in retention areas to allow settling of suspended materials. The CONTRACTOR shall monitor water quality of dewatering discharge into water bodies or leaving the Site in accordance with applicable environmental permits. All monitoring of any water areas that are affected by construction activities shall be the responsibility of the CONTRACTOR.

3.05 OIL, FUEL AND HAZARDOUS SUBSTANCE SPILL PREVENTION:

- A. The CONTRACTOR shall prepare a Spill Contingency Plan in accordance with 40CFR, Part 109 as part of the Environmental Protection Plan. The CONTRACTOR shall prevent oil, fuel or other hazardous substances from entering the air, ground, drainage, and local bodies of water or wetlands. In the event that a spill occurs, despite design and procedural controls, the CONTRACTOR shall take

immediate action to contain and clean up the spill and report the spill immediately to the FWC and to other appropriate federal, state, and local agency contacts. Reportable quantities (greater than 25 gallons) of petroleum-based fluids must be reported within 1 hour to the National Response Center (800-424-8802) and State Warning Point (800-320-0519) if it reaches the waters of the state or, if not, within 24 hrs to State Warning Point. Toxic and hazardous substance spills directly into waters of the state, in any quantity, must be reported immediately to the FWC and those federal and state points of contact listed above. It is the CONTRACTOR's responsibility to report and provide notification of all spills. The FWC must be notified of all spills regardless of the quantity spilled.

- B. The CONTRACTOR shall submit a written report to the FWC and to the State of Florida Bureau of Emergency Response providing certification of commitment of manpower, equipment and materials necessary to prevent the spread and effect expeditious cleanup and disposal as required by applicable rules and regulations or as directed by FWC. This report shall be submitted within 48 hours of the spill event.

3.06 MATERIALS AND WASTE MANAGEMENT:

- A. For sanitary waste management, the CONTRACTOR shall ensure that portable restrooms will be anchored on level ground with at least a 15-foot set-back from water bodies or banks or slopes thereto. For solid waste management, dumpster(s) will either be outfitted with a water-tight cover or be covered with a tarpaulin when not in use to minimize infiltration and leaching of rain with at least a 15-foot set-back from water bodies, conveyances thereto, or banks or slopes thereto. Hazardous materials storage areas and liquid refuse and hazardous waste collection and storage areas shall be denoted on the Plan.
- B. The CONTRACTOR shall ensure toxic substances and hazardous materials are stored in a locked, blast-resistant shed anchored to a bermed concrete or asphalt pad on level ground with at least a 15-foot setback from any water bodies, conveyances thereto, or banks or slopes thereto.
- C. For solid and/or hazardous waste disposal involving lead-based paint, the CONTRACTOR shall ensure containers with Toxicity Characteristic Leaching Procedure – Tetraphenylborate (TCLP TPb) concentrations in excess of the Resource Conservation and Recovery Act (RCRA) action level will be transported by a licensed hazardous waste hauler to a licensed hazardous waste disposal facility within the time limit appropriate to the generation rate and accumulated volume of hazardous waste material. Containers with TCLP TPb concentrations less than the RCRA action level shall be transported by a licensed solid waste hauler to a licensed Class I solid waste disposal facility. In either case, the CONTRACTOR shall obtain and transmit signed and dated copies of the transport and disposal manifests to the FWC's for records retention.
- D. The CONTRACTOR is prohibited from the on-site burning of hazardous wastes (aerosol cans, oil filters, etc.). All hazardous wastes shall be disposed of as required by law. Copies of relevant Material Safety Data Sheets (MSDSs) shall be appended to the Environmental Protection Plan, Safety Plan, Spill Prevention Plan, and Stormwater Pollution Prevention Plan (SWPPP).
- E. The CONTRACTOR is responsible for the materials and processes where wastes may be generated under the contracted activities. The CONTRACTOR is responsible for providing the materials in order to implement the Contract and is responsible for operating and maintaining any processes from which waste material may be generated.
- F. The CONTRACTOR is deemed to be the "generator" as defined in 40 CFR 261.10 for any hazardous wastes or spill residue that is generated during the activities encompassed in this Contract. It is recognized that it is the CONTRACTOR's or a subcontractor of the CONTRACTOR whose act first causes a hazardous waste to become subject to regulation. The CONTRACTOR is a different legal entity from the owner/operator of the physical location/property where the contracted activities will be conducted. CONTRACTOR is a "person" within the meaning of Section 403.031(5), Florida Statutes.
- G. The CONTRACTOR is responsible for compliance with applicable standards of 40 CFR 260-268 and 40 CFR 273 and 279 and state regulations which adopt or reference these federal standards.
- H. The CONTRACTOR is responsible for the generation and retention of records associated with waste management practices and disposition. All records shall be maintained for a minimum of 3 years from

the date of generation. All records will be made available to the FWC or regulatory agencies upon request.

- I. In the event of any chemical discharges associated with CONTRACTOR's or subcontractor's activities, CONTRACTOR shall be responsible for reporting, assessment and remediation of such discharges in accordance with applicable federal, state or local regulations and/or guidelines including, but not limited to, 40 CFR 264/265, Chapter 62-770, Florida Administrative Code (F.A.C.) and Chapter 62-780, F.A.C.

3.07 FISH AND WILDLIFE RESOURCE PROTECTION: The CONTRACTOR shall control and minimize interference with, disturbance to, and damage of fish and wildlife resources.

- A. If adverse impacts occur to fish and wildlife species of concern, including but not limited to Threatened and/or Endangered Species and Protected Migratory Bird Species, the CONTRACTOR shall immediately notify the FWC and provide details of adverse impacts for determination of further action that may be required. Adverse impact is defined as any harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such activity. Threatened and/or Endangered Species that require specific protection measures as identified in the environmental permits shall be listed in the Environmental Protection Plan.
- B. In the event that the FWC determines that an adverse impact to species of concern, including but not limited to Threatened and/or Endangered Species and Protected Migratory Bird Species occur as a result of the construction activities, the FWC shall notify the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service for determination of further action and possibly to determine if seasonal or daily timing restrictions on construction activities is needed.
- C. The CONTRACTOR and all personnel shall be familiar with the Plan shall be able to identify the threatened and endangered species listed in the Plan. Any activity observed by the CONTRACTOR that may result in adverse impact to threatened or endangered species shall be reported immediately to the FWC, who shall have sole authority for any WORK stoppages, creation of a buffer area, or restart of construction activities.
- D. Any Threatened and/or Endangered Species and species of concern observed at the Site shall be recorded and logged by the CONTRACTOR. The logs shall be provided to the FWC on a bi-weekly basis. See attached Wildlife Log, Appendix A. If nesting activity is detected within and/or adjacent to the Site, the CONTRACTOR shall immediately contact the FWC for determination of further action and possibly to determine if seasonal or daily timing restrictions on construction activities is needed.
- E. The CONTRACTOR shall keep construction activities under surveillance, management, and control to prevent impacts to migratory birds and their nests. The CONTRACTOR may be held responsible for harming or harassing the birds, their eggs or their nests as a result of the construction. Any nesting activity observed by the CONTRACTOR shall be reported immediately to FWC who shall have sole authority for any WORK stoppages, creation of the buffer area, or restart of construction activities.

3.08 ENVIRONMENTAL PROTECTION RETENTION RECORD RETENTION: The CONTRACTOR shall retain a copy of all required permits, the Plan, the SWPPP, the Spill Prevention Plan, and all associated reports, records and documentation required by these permits or the Contract Documents at the construction Site or an appropriate alternative location as specified in the Notice of Intent (NOI) from NTP through Notice of Termination (NOT). Such documentation includes but is not limited to soil disturbance and stabilization logs, inspection and corrective action logs, turbidity monitoring logs, wildlife observation logs and reports, TCLP and Synthetic Precipitation Leaching Procedure (SPLP) assay results, sanitary, solid, and hazardous waste transport and disposal manifests, spill reports, material safety data sheets, and any warnings, citations or notices of noncompliance, or fees, levees, fines or penalties. A copy of all such records shall be submitted to the FWC at the time of Contract close-out.

3.09 PROTECTION OF AIR RESOURCES: The CONTRACTOR shall minimize pollution of air resources. All activities, equipment, processes and WORK operated or performed in accomplishing the specified construction shall be in strict accordance with the applicable air pollution standards of the State of Florida (F.S. Chapter 403 – Environmental Control and F.A.C. Section 200 – Recirculation Chiller) and all Federal emission and performance laws and standards as applicable. This includes, but is not limited to, control of particulates, dust generated by or incidental to construction activities, burning and odors.

- 3.10 PRESERVATION AND RECOVERY OF HISTORIC, ARCHEOLOGICAL, AND CULTURAL RESOURCES: If applicable, known historic, archeological and cultural resources within the CONTRACTOR's WORK area(s) will be designated as a "Sensitive Environmental Area" on the Drawings or other documents. If so designated, the CONTRACTOR shall install protection for these resources and shall be responsible for their preservation during the Contract's duration. The CONTRACTOR shall not distribute maps or other information on these resource locations except for distribution among the CONTRACTOR's staff with a "need to know" technical responsibility for protecting the resources.
- A. Inadvertent Discoveries: If, during construction or other activities, the CONTRACTOR observes items that may have historic or archeological value, such observations shall be reported immediately to the FWC and the Florida Division of Historical Resources so that the appropriate staff may be notified and a determination made for what, if any, additional action is needed. Examples of historic, archeological and cultural resources are bones, remains, artifacts, shell, midden, charcoal or other deposits, rocks or coral, evidences of agricultural or other human activity, alignments, and constructed features. The CONTRACTOR shall cease all activities that may result in the destruction of these resources and shall prevent his employees from further removing, or otherwise damaging, such resources.
- B. If any prehistoric or historic artifacts, such as pottery or ceramics, stone tools or metal implements, dugout canoes, or any other physical remains that could be associated with Native American cultures, or early colonial or American settlement are encountered at any time within the project site area, work involving subsurface disturbance in the immediate vicinity of such discoveries shall cease. The CONTRACTOR shall contact FWC and the Florida Department of State, Division of Historical Resources, Compliance and Review Section, at (850) 245-6333 or (800) 847-7278, as well as the FDEP permitting agency office. Such subsurface work shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and notification shall be provided in accordance with Section 872.05, F.S.
- C. Claims for Downtime due to Inadvertent Discoveries: Upon discovery and subsequent reporting of a possible inadvertent discovery of cultural resources, the CONTRACTOR shall seek to continue WORK well away from, or otherwise protectively avoiding, the area of interest, or in some other manner that strives to continue productive activities in keeping with the Contract. Should an Inadvertent Discovery be of the nature that substantial impact(s) to the WORK schedule are evident; such delays shall be coordinated with the FWC. Contractor must be able to show that the delay impacts the Critical Path noted in the Construction Schedule.

END OF SECTION

Appendix A Wildlife Log

For Threatened and/or Endangered Species and Species of Concern Listed in Permit

Wood Storks Sightings, since they are so abundant, will be logged on a bi-weekly basis in coordination with Bi-weekly Construction Progress Meetings and will be reported quarterly along with other sightings.

<input type="checkbox"/> Eastern Indigo Snake <input type="checkbox"/> Bald Eagle <input type="checkbox"/> Wood Stork <input type="checkbox"/> Florida Panther <input type="checkbox"/> Caracara <input type="checkbox"/> Gopher Tortoise <input type="checkbox"/> Other	
Project Name	
Date of Sighting	
Time of Sighting	
Temperature	
Wind (mph)	
Weather Conditions (ex: note sky cover, raining, humid, cloudy, sunny, cool, hot, etc)	
Construction Activity Occurring	
Equipment being Used	
Condition of Animal (ex: injured, unharmed, etc)	
Behavior of Animal (ex: disoriented, aggressive, etc)	
Actions taken after sighting	
Size of Animal	
GPS Coordinates/Specific Location	
Pictures Taken (Attach pictures)	
Date this form was completed	
Observers Company/Agency	
Observers Name	Print Name:
	Signature:
Observers Contact Info	Office:
	Cell:
	Email:

**EXAMPLE FORM
Wildlife Log**

For Threatened and/or Endangered Species and Species of Concern Listed in Permit

Wood Storks Sightings, since they are so abundant, will be logged on a bi-weekly basis in coordination with Bi-weekly Construction Progress Meetings and will be reported quarterly along with other sightings.

<input checked="" type="checkbox"/> Eastern Indigo Snake	<input type="checkbox"/> Bald Eagle	<input type="checkbox"/> Wood Stork	<input type="checkbox"/> Florida Panther
<input type="checkbox"/> Caracara	<input type="checkbox"/> Gopher Tortoise	<input type="checkbox"/> Other	
Project Name	C-44 Reservoir		
Date of Sighting	Tuesday, January 29, 2008		
Time of Sighting	0900		
Temperature	75°		
Wind (mph)	5-10 mph		
Weather Conditions (ex: note sky cover, raining, windy, humid, cloudy, sunny, cool, hot, etc)	Partial cloud/Sunny		
Construction Activity Occurring	Demobilization of Construction Trailers, nothing near the area snakes were sighted		
Equipment being Used	n/a		
Condition of Animal (ex: injured, unharmed, etc)	Good		
Behavior of Animal (ex: disoriented, aggressive, etc)	under a door in an abandoned citrus office		
Actions taken after sighting	Determined sex, took photos, estimated size		
Size of Animal	Approx 6'		
GPS Coordinates/Specific Location	N 27 05 33.59 W 80 26 59.90 NE Corner of Project along Eastern Levee		
Pictures Taken (Attach pictures)	Yes, attached		
Date this form was completed	Tuesday, February 5, 2008		
Observers Company/Agency	Land Clearing Inc.		
Observers Name	Print Name:		
	Signature:		
Observers Contact Info	Office:		
	Cell:		
	Email:		



Appendix B

Killing, harming, or harassing indigo snakes is strictly prohibited and punishable under State and Federal Law.

Only individuals currently authorized through an issued Incidental Take Statement in association with a USFWS Biological Opinion, or by a Section 10(a)(1)(A) permit issued by the USFWS, to handle an eastern indigo snake are allowed to do so.

LEGAL STATUS: The eastern indigo snake is classified as a Threatened species by both the USFWS and the Florida Fish and Wildlife Conservation Commission. "Taking" of eastern indigo snakes is prohibited by the Endangered Species Act without a permit. "Take" is defined by the USFWS as an attempt to kill, harm, harass, pursue, hunt, shoot, wound, trap, capture, collect, or engage in any such conduct. Penalties include a maximum fine of \$25,000 for civil violations and up to \$50,000 and/or imprisonment for criminal offenses, if convicted.



August 12, 2013

ATTENTION:

**THREATENED EASTERN INDIGO
SNAKES MAY BE PRESENT ON
THIS SITE!!!**



Please read the following information provided by the U.S. Fish and Wildlife Service to become familiar with standard protection measures for the eastern indigo snake.

**IF YOU SEE A LIVE EASTERN
INDIGO SNAKE ON THE SITE:**

- Cease clearing activities and allow the eastern indigo snake sufficient time to move away from the site without interference.
- Personnel must NOT attempt to touch or handle snake due to protected status.
- Take photographs of the snake, if possible, for identification and documentation purposes.
- Immediately notify supervisor or the applicant's designated agent, **and** the appropriate U.S. Fish and Wildlife Service (USFWS) office, with the location information and condition of the snake.
- If the snake is located in a vicinity where continuation of the clearing or construction activities will cause harm to the snake, the activities must halt until such time that a representative of the USFWS returns the call (within one day) with further guidance as to when activities may resume.

**IF YOU SEE A DEAD EASTERN
INDIGO SNAKE ON THE SITE:**

- Cease clearing activities and immediately notify supervisor or the applicant's designated agent, **and** the appropriate USFWS office, with the location information and condition of the snake.
- Take photographs of the snake, if possible, for identification and documentation purposes.
- Thoroughly soak the dead snake in water and then freeze the specimen. The appropriate wildlife agency will retrieve the dead snake.

USFWS Florida Field Offices to be contacted if a live or dead eastern indigo snake is encountered:

North Florida ES Office – (904) 731-3336
Panama City ES Office – (850) 769-0552
South Florida ES Office – (772) 562-3909

DESCRIPTION: The eastern indigo snake is one of the largest non-venomous snakes in North America, with individuals often reaching up to 8 feet in length. They derive their name from the glossy, blue-black color of their scales above and uniformly slate blue below. Frequently, they have orange to coral reddish coloration in the throat area, yet some specimens have been reported to only have cream coloration on the throat. These snakes are not typically aggressive and will attempt to crawl away when disturbed. Though indigo snakes rarely bite, they should NOT be handled.

SIMILAR SNAKES: The black racer is the only other solid black snake resembling the eastern indigo snake. However, black racers have a white or cream chin, thinner bodies, and WILL BITE if handled.

LIFE HISTORY: The eastern indigo snake occurs in a wide variety of terrestrial habitat types throughout Florida. Although they have a preference for uplands, they also utilize some wetlands and agricultural areas. Eastern indigo snakes will often seek shelter inside gopher tortoise burrows and other below- and above-ground refugia, such as other animal burrows, stumps, roots, and debris piles. Females may lay from 4 - 12 white eggs as early as April through June, with young hatching in late July through October.

Appendix C
STANDARD PROTECTION MEASURES FOR THE EASTERN INDIGO SNAKE
U.S. Fish and Wildlife Service
August 12, 2013



ATTENTION:
THREATENED EASTERN
INDIGO SNAKES MAY BE
PRESENT ON THIS SITE!!!

IF YOU SEE A LIVE EASTERN INDIGO SNAKE ON THE SITE:

- Cease clearing activities and allow the eastern indigo snake sufficient time to move away from the site without interference.
- Personnel must NOT attempt to touch or handle snake due to protected status.
- Take photographs of the snake, if possible, for identification and documentation purposes.
- Immediately notify supervisor or the applicant's designated agent, **and** the appropriate U.S. Fish and Wildlife Service (USFWS) office, with the location information and condition of the snake.
- If the snake is located in a vicinity where continuation of the clearing or construction activities will cause harm to the snake, the activities must halt until such time that a representative of the USFWS returns the call (within one day) with further guidance as to when activities may resume.

IF YOU SEE A DEAD EASTERN INDIGO SNAKE ON THE SITE:

- Cease clearing activities and immediately notify supervisor or the applicant's designated agent, **and** the appropriate USFWS office, with the location information and condition of the snake.
- Take photographs of the snake, if possible, for identification and documentation purposes.
- Thoroughly soak the dead snake in water and then freeze the specimen. The appropriate wildlife agency will retrieve the dead snake.

USFWS Florida Field Offices to be contacted if a live or dead eastern indigo snake is encountered:

North Florida Field Office – (904) 731-3336
Panama City Field Office – (850) 769-0552
South Florida Field Office – (772) 562-3909

Killing, harming, or harassing indigo snakes is strictly prohibited and punishable under State and Federal Law.

DESCRIPTION:	The eastern indigo snake is one of the largest non-venomous snakes in North America, with individuals often reaching up to 8 feet in length. They derive their name from the glossy, blue-black color of their scales above and uniformly slate blue below. Frequently, they have orange to coral reddish coloration in the throat area, yet some specimens have been reported to only have cream coloration on the throat. These snakes are not typically aggressive and will attempt to crawl away when disturbed. Though indigo snakes rarely bite, they should NOT be handled.
SIMILAR SNAKES:	The black racer is the only other solid black snake resembling the eastern indigo snake. However, black racers have a white or cream chin, thinner bodies, and WILL BITE if handled.
LIFE HISTORY:	The eastern indigo snake occurs in a wide variety of terrestrial habitat types throughout Florida. Although they have a preference for uplands, they also utilize some wetlands and agricultural areas. Eastern indigo snakes will often seek shelter inside gopher tortoise burrows and other below- and above-ground refugia, such as other animal burrows, stumps, roots, and debris piles. Females may lay from 4 - 12 white eggs as early as April through June, with young hatching in late July through October.
PROTECTION:	The eastern indigo snake is classified as a Threatened species by both the USFWS and the Florida Fish and Wildlife Conservation Commission. "Taking" of eastern indigo snakes is prohibited by the Endangered Species Act without a permit. "Take" is defined by the USFWS as an attempt to kill, harm, harass, pursue, hunt, shoot, wound, trap, capture, collect, or engage in any such conduct. Penalties include a maximum fine of \$25,000 for civil violations and up to \$50,000 and/or imprisonment for criminal offenses, if convicted.

Only individuals currently authorized through an issued Incidental Take Statement in association with a USFWS Biological Opinion, or by a Section 10(a)(1)(A) permit issued by the USFWS, to handle an eastern indigo snake are allowed to do so.

August 12, 2013

SECTION 02439 STORM DRAINAGE SYSTEM – CORRUGATED METAL PIPE

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide all labor, equipment and materials necessary to install corrugated aluminum pipe (CAP) indicated on the Drawings and as required to include appurtenances, excavation, backfilling and other incidental work in connection with this construction.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 02200 – Earthwork
 - 3. SECTION 02221 – Pipe Trenching, Backfilling, and Compacting
 - 4. SECTION 02401 – Dewatering and Cofferdam
 - 5. SECTION 02431 – Catch Basins, Frames and Grates

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Association of State Highway and Transportation Officials (AASHTO)
 - a. M196 – Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
 - b. M197 – Standard Specification for Aluminum Allow Sheet for Corrugated Aluminum Pipe
 - 2. American Society of Testing Materials (ASTM):
 - a. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³))
 - b. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Modified Effort (56,000 ft-lb/ft³ (2,700 kN-m/m³))
 - 3. Florida Department of Transportation (FDOT):
 - a. Standard Specifications for Road and Bridge Construction, Latest Edition
 - 4. Local City and County Codes

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: Submittals shall be in accordance with SECTION 01300.

- A. Submit shop drawings and data for pipe, flared end sections, coupling bands and all associated appurtenances.
- B. The CONTRACTOR shall submit a culvert installation plan including details on the placement of pipe and backfill to include the number and thickness of individual lifts, equipment to be utilized and methods to control floatation. Plan shall include identification of proposed aqueous construction along with all associated pertinent dewatering information and inspection and verification methods for obtaining foundation and backfill requirements per Contract Documents for FWC approval.

- 1.05 QUALIFICATIONS: (Not Applicable)
- 1.06 RESPONSIBILITIES: (Not Applicable)
- 1.07 CERTIFICATIONS AND TESTINGS: (Not Applicable)
- 1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The Contractor shall provide 48 hours advance notice of its intention to begin new WORK activities.
- 1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

- 2.01 PIPE: The CONTRACTOR shall install piping and appurtenances of the type and material specified in these Technical Specifications and as provided in the Drawings. All pipe, fittings, jointing materials, grates, manhole frames and covers, and other appurtenances and materials shall be new material to be included in the WORK and, if not specifically described herein, shall be of the best quality and entirely suitable for the service intended. The CONTRACTOR shall submit for the FWC's approval, prior to installation, all such materials. The CONTRACTOR shall provide pipe conforming to these specifications and of the type and size shown on the Drawings. The pipe supplied by the CONTRACTOR shall conform to the following:
- A. The CONTRACTOR shall furnish Corrugated Aluminum pipe (CAP) required by this SECTION and as shown on the Drawings. Corrugated Aluminum pipe shall conform to the requirements of AASHTO M197 and manufactured in accordance with the applicable requirements of AASHTO M196. Pipe shall have a full circular cross-section, with a single thickness of corrugated sheet, fabricated helical corrugations with a minimum of two annular corrugations formed into each end of each pipe to accommodate a coupling band. The pipes shall be, at minimum, of the metal gauge specified in FDOT Section 945.
 - B. The CONTRACTOR shall furnish pipe of the nominal diameter shown on the Plans. The pipe shall not vary more than one percent or one half inch, whichever is greater when measured on the inside crest of the corrugations.
 - C. The CONTRACTOR shall furnish Corrugated Aluminum pipe having corrugations 2-2/3 inches by one half inch for pipes less than 36 inches and three inches by one inch for all pipes 36 inches in diameter and larger.
- 2.02 COUPLING BANDS, GASKETS AND JOINTS:
- A. The CONTRACTOR shall provide pipe with coupling bands for joining pipe sections that meet the requirements of FDOT Section 430 and the following. Coupling bands shall be two-piece lap-type couplings with annular corrugations that match the corrugations of the pipe ends. The coupling bands shall be two feet in width and constructed to lap an equal portion of each culvert section being joined. All banded connections shall be wrapped in non-woven geotextile as specified in SECTION 02370. The CONTRACTOR shall furnish gaskets of either neoprene continuous bands or O-ring type gaskets as specified in FDOT Section 430. Joints shall be water tight per FDOT 945-1. Pipe joints shall be tested hydrostatically at the plant using testing methods in ASTM 3212.
- 2.03 CASTING: The CONTRACTOR shall provide inlet frames and grates and manhole frames and covers as specified on the Drawings.
- 2.04 FLASHBOARD RISERS: The CONTRACTOR shall construct flashboard risers at locations shown on the Drawings and in conformance with the Drawings and Technical Specifications. Castings shall be of the type and size shown on the Drawings for Corrugated Aluminum Pipe. Pipe connections to flashboard risers shall

be watertight and done in a manner acceptable to the FWC. Work incidental to this WORK shall be done in accordance with these Technical Specifications.

PART 3 - EXECUTION

3.01 DEWATERING, EXCAVATION AND BACKFILLING:

- A. Dewatering, excavation and backfilling shall be in accordance with SECTION 02401 Dewatering and Cofferdam, SECTION 02200 Earthwork, and SECTION 02221 Pipe Trenching, Backfilling and Compacting, the Technical Specifications and Drawings.
- B. Removal of Rock: Where rock is encountered, the CONTRACTOR shall remove the rock to the lines and grades shown on the Drawings and replace with bedding material as defined on the Drawings to the line and grades shown on the Drawings.
- C. Bedding: The CONTRACTOR shall provide bedding material for the pipe as specified on the Drawings that shall provide a firm foundation of uniform density throughout the entire length of the pipe. The pipe shall be carefully bedded in a soil foundation that has been accurately shaped and rounded to conform to the lowest quarter of the outside circular portion of the pipe for its entire length and bedding shall be tamped to secure uniform, firm support.

3.02 INSTALLATION OF PIPE:

- A. Handling and Storage: The CONTRACTOR shall protect the pipe and its coating during shipping, storage, handling, and installation against impact shocks, free fall or other damage. Any damaged pipe shall be removed from the Site immediately.
- B. The CONTRACTOR shall place the pipe in the dry unless prior approval is obtained from FWC for aqueous construction.
- C. Pipe Laying: The CONTRACTOR shall execute pipe laying as required and specified herein:
 - 1. The trench shall be prepared as specified herein and each pipe section shall be laid in strict conformance to the line and grade shown on the Drawings.
 - 2. As pipe laying progresses, the interior of the pipe shall be cleaned of all dirt and superfluous materials. The CONTRACTOR shall at all times take whatever measures are necessary to prevent the entrance of dirt and other foreign matter into the drainage system. In the event that it is necessary to clean the pipe before final acceptance, the CONTRACTOR shall do so without additional compensation in accordance with MANUFACTURER's requirements.
- D. The pipe shall be placed on the bedding material as specified in the Drawings. Field joints shall meet the requirements of FDOT Section 430 and engage the corrugations on both lengths of pipe with the pipe free of irregularities in the flow line.

3.03 BACKFILLING:

- A. The CONTRACTOR shall prevent pipe floatation and any pipe movement during the placement of the backfill.
- B. The backfill material shall be in accordance with SECTION 02200.
- C. Under Pipe: The CONTRACTOR shall pay special attention and use best practices to achieve compaction requirements below the centerline of the pipe. Placement and compaction of material from the bottom of the pipe to the centerline shall be in loose lifts no greater than six (6) inches and performed by hand or by FWC approved mechanical methods.
- D. Over Pipe: From the centerline of the pipe, fittings and appurtenances, to an elevation one foot above the top of the pipe, the CONTRACTOR shall backfill the trench in loose lifts no greater than six (6)

inches and by hand or by FWC approved mechanical methods. The backfill material above the pipe up to finished grade shall be compacted by use of hand tampers unless otherwise approved by FWC.

3.04 WATER CONTROL: The CONTRACTOR shall control water so that it does not interfere with the installation of piping and ability to achieve compaction. Dewatering shall be performed if required. Per SECTION 02200 all work shall be performed in the dry unless prior approval is obtained from FWC for aqueous construction. A Dewatering Plan shall be submitted by CONTRACTOR per SECTION 02401.

3.05 PIPE TESTING REQUIREMENTS:

- A. Conduct pressure and leakage tests on all newly installed pipelines. Furnish all necessary equipment and material and make all taps in the pipe, as required. Test pressure shall be as specified herein.
- B. All leak tests as required in other sections of this specification shall be completed and witnessed by FWC. CONTRACTOR shall present a letter of certification indicating completion of such tests signed by an authorized representative of the CONTRACTOR.
- C. Corrugated Aluminum pipe shall be air tested as follows:
 - 1. Time of Testing: Test pipe after backfilling has been completed. The CONTRACTOR, at his option and expense, may make other earlier tests to ensure compliance with the tests specified herein.
 - 2. Procedure:
 - a. After all plugs are in place and securely blocked, introduce air slowly into the pipe section to be tested until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. Allow a minimum of two (2) minutes for the air temperature to stabilize. Determine the height of the ground-water table, at the time of the test.
 - b. Pipe and joints being air tested shall be considered satisfactory when tested at an average pressure of 3.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe, when (1) the total rate of air loss from the section being tested does not exceed 2.0 cubic feet per minute, or (2) the section of line does not lose air at a rate greater than 0.0030 cubic foot per minute per square foot of internal pipe surface.
- D. Test Records: Records shall be made of each piping system installation during the test. These records shall include:
 - 1. Date of Test.
 - 2. Description and Identification of Piping Tested.
 - 3. Test Fluid.
 - 4. Test Pressure.
 - 5. Remarks, to include such items as:
 - a. Leaks (type, location).
 - b. Repairs made on leaks.
 - 6. Certification by CONTRACTOR and signed acknowledgement by the FWC.

END OF SECTION

SECTION 02455 ROUND TIMBER PILING

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work:

1. The CONTRACTOR shall furnish all labor, materials, and equipment, and perform all operations in connection with the installation of round treated timber piles in accordance with this SECTION of the specifications and the applicable drawings, and subject to the terms and conditions of the Contract.
2. The CONTRACTOR shall assume that all timber piles will be required to be installed into the limestone layer.

B. Related Work Specified Elsewhere:

1. SECTION 01300 - Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.

1. Federal Specifications (FS):
 - a. FF-B-575 - Bolts, Hexagonal and Square-Notice 1 Inactivation for New Design
 - b. FF-B-836 - Nut: Square, Hexagonal, Cap, Slotted, Castle, Knurled, Welded, and Single
 - c. RR-W-410 - Wire Rope and Strand
 - d. TT-W-572B - Wood Preservative, Water Repellent
2. American Society for Testing Materials (ASTM):
 - a. D25 - Standard Specification for Round Timber Piles
 - b. F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - c. F594 - Standard Specification for Stainless Steel Nuts
3. American Wood Preservative Association (AWPA):
 - a. Standard M2 - Standard for Inspection of Treated Wood Products
 - b. Standard T1 - Processing and Treatment Standard
 - c. Standard U1 -User Specification for Treated Wood

1.03 DEFINITIONS: (Not Used)

1.04 SUBMITTALS:

- A. The CONTRACTOR shall provide submittals on pile materials and driving apparatus for the approval of the FWC in accordance with SECTION 01300. Safety plans shall be submitted for the FWC's information along with the pile and driving apparatus submittals.

1.05 QUALIFICATIONS: (Not Used)

1.06 RESPONSIBILITIES: (Not Used)

1.07 CERTIFICATIONS AND TESTING: (Not Used)

1.08 INSPECTION COORDINATION:

- A. The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide at least 48-hour advance notice of its intention to begin new WORK activities.

1.09 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 TREATED TIMBER PILES: The CONTRACTOR shall provide piles conforming to the requirements of ASTM D25 with minimum butt diameters of 12". Treated piles shall be clean peeled and pressure treated in accordance with Federal Specification TT-W-572B, with minimum retention indicated for the environment and for the type of wood being treated.

A. Use Category Requirements:

1. Timber piles for foundations in fresh water environments shall be treated in accordance with AWPAs Standard U1 to the requirements of UC4C.
2. Timber piles for foundations in marine environments shall be treated in accordance with AWPAs Standard U1 to the requirements of UC5C.
3. Timber piles used to anchor floating trash barriers shall be treated in accordance with AWPAs Standard U1 to the requirements of UC4B.

B. Preservative Requirements:

1. Preservative: The following pressure treated wood formulations are acceptable:
 - a. Alkaline Copper Quaternary Type C (ACQ-C) and Type D (ACQ-D with carbonate)
 - b. Copper Azole Type B (CA-B)
2. The method of treatment for all timber materials shall be in accordance with Fed. Spec. TT-W-572B. Use of Chromated Copper Arsenate (CCA) treated timber shall only be permitted for marine (salt water) applications assigned in the Use Category 5 (UC5), as specified under Sub-Section 6 of the AWPAs Standard U1.
3. Pressure Treatment: Pressure treatment shall be in accordance with the requirements of American Wood Preserves Association (AWPA) Standard U1 and T1. Each piece of pressure preservative treated lumber shall bear the AWPAs stamp, indicating point of treatment, preservative symbol, symbol of standard, date of treatment, and moisture content after treatment.
4. Preservative Retention Rates: The minimum requirements for preservative retention shall be calculated as pounds of any preservative system per cubic feet (lbs/ft³) of wood as indicated in the AWPAs Commodity Specifications in Standard T1.
5. Preservative Penetration Depths: The minimum requirements for preservative penetration shall not be less than the predetermined values in AWPAs Standard U1.

C. Treated piles shall be carefully handled with no sudden dropping, breaking of outer fibers, bruising, or penetrating the surface with tools. Peaveys, cant hooks, pile, hooks, and other pointed tools shall not be used in handling treated piles. Cut or damaged surfaces of piles, including the tops of all piles after heading, and bolt holes shall be given after-treatment care as required by FS TT-W-572B, using one (1) application of a concentrated solution of the preservative used in the treatment.

2.02 HARDWARE: The CONTRACTOR shall provide and install stainless steel bolts conforming to the following requirements:

- A. Bolts and Nuts: Bolts shall conform to ASTM F593. Nuts shall conform to ASTM F594. Bolts and nuts shall be stainless steel and of the type, size, and dimensions shown on the Drawings.
- B. Washers: Plain or cut washers shall conform to the requirements of ANSI B27.2 heavy series, and lock washers shall conform to the requirements of ANSI B18 21.1 heavy series. Washers shall be

provided for applications specified on the Drawings. Washers shall be of the same material as the nut and bolt with which they are used.

2.03 NAILS, STAPLES, AND CABLE CLAMPS:

- A. The CONTRACTOR shall provide nails, staples, and cable clamps that are commercial grade, stainless steel, and of the size indicated on the Drawings.

2.04 OGEE WASHERS:

- A. The CONTRACTOR shall provide ogee washers that are stainless steel having a thickness not less than the diameter of the bolt.

2.05 WIRE ROPE:

- A. The CONTRACTOR shall provide stainless steel wire rope conforming to FS RR-W-410, Type I, Class 1 or 2. Core shall be wire strand or IWRC.

2.06 METAL SHOES:

- A. The CONTRACTOR shall furnish and install steel plate pile shoes on the tips of the piles. Shoes shall fit the piles snugly and shall be of the conical, box, or pyramid type with extended lugs to permit spiking to the pile. The FWC shall approve the design of the shoes which shall be provided as a submittal.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. The FWC will inspect the piles at the Site of the WORK. Facilities shall be made available to the FWC for proper inspection of each pile throughout its length. Piles damaged after inspection may be subsequently rejected if damage is deemed sufficient for rejection by the FWC. All rejected piles shall be removed as directed. Treatment of piles will be inspected in accordance with AWWA Standard M2.

3.02 LENGTH OF PILES:

- A. The CONTRACTOR shall provide piles of sufficient length to allow for "Heading" and cutting off square after driving. The CONTRACTOR shall furnish piles in lengths at least one foot greater than the lengths specified to be below the cut-off elevations.

3.03 FRAMING TREATED PILES:

- A. The CONTRACTOR shall bore bolt holes the same diameter as the bolt. Holes bored into piles shall be treated as specified in paragraph 2.01 and, when not used for bolts, shall be tightly closed by a treated plug. Holes shall not be bored or spikes driven into piles to support scaffolding. As soon as practicable after "Heading", the CONTRACTOR shall treat the tops of all piles as specified in paragraph 2.01.

3.04 DRIVING PILES: The CONTRACTOR shall adhere to the following regarding driving of piles.

- A. General:
 1. No piles shall be driven until the excavation or fill in the area, which they are to occupy, has been completed to elevation of grade indicated on the Drawings, nor within 100 feet of concrete less than seven (7) days old, unless authorized by the FWC.
 2. The CONTRACTOR shall carefully locate all piles to the lines and spacing shown on the Drawings and shall drive piles either to the vertical or batter lines indicated on the Drawings.
 3. The maximum permissible deviation for piles out of plumb or off batter shall be two (2) percent of the pile length as long as the platform can still be installed in accordance with the Drawings.
 4. The maximum permissible deviation from indicated locations shall be three (3) inches for each pile as long as the platform can still be installed in accordance with the Drawings.

5. The CONTRACTOR, when working in difficult alignment areas such as sloped surfaces, shall use appropriate means than may consist of templates or pilot holes to properly align piles.
- B. Driving Equipment:
1. Free-swinging leads will not be permitted.
 2. Pile drivers shall have fixed leads at the top and bottom, extending to the lowest point the hammer must reach.
 3. Pile-driving hammers shall be of a size and type able to deliver consistently effective dynamic energy suitable for the type and capacity of the piles to be driven and the material into which they are to be driven.
 4. Equipment for driving shall be in first class condition and shall be at all times maintained and operated at the efficiency and capacity required herein and as directed by the FWC.
- C. Driving:
1. Punching or drilling holes will be required to permit piles to pass through those strata and reach required penetration. The CONTRACTOR shall assume that each pile will be required to be installed through limestone.
 2. When necessary to assist in attaining the indicated penetration length without damage to piles, the CONTRACTOR shall be required to predrill and grout the pile. CONTRACTOR shall have equipment for predrilling available or on-site and the CONTRACTOR shall assume that that predrilling will be necessary to achieve sufficient embedment length to support uplift loads. The CONTRACTOR is reminded that the site has a layer of limestone. Predrilling will be performed at the CONTRACTOR's expense.
 3. Blasting of holes for the piles will not be permitted.
 4. The CONTRACTOR shall drive all piles continuously and without voluntary interruption. After driving and back-driving the CONTRACTOR shall cut piles at the cutoff grade line, and the surplus material shall be removed from the Site of the WORK.
 5. Any piles, requiring excessive bending in order to frame properly, shall be withdrawn and re-driven to the proper batter. Driving batter piles vertically and then pulling them into position will not be permitted.
- D. Special Precautions:
1. Long Piles: When handling and driving long piles of a high slenderness ratio, the CONTRACTOR shall take special precautions to ensure against overstress or leading away from a plumb or true position when driving.
 2. Water Jets:
 - a. Water jets may be used in driving only when specifically authorized in writing by the FWC. The FWC may require water jets where satisfactory penetration cannot be obtained otherwise.
 - b. Where jetting is allowed by the FWC, at least two (2) jets shall be used. All jetted piles shall be driven for the final five feet of penetration, unless otherwise directed by the FWC.
- E. Record of Driving: An accurate record of the driving of each pile shall be kept by the CONTRACTOR and given to the FWC. This record shall show the number of piles, the date and the time of driving, the size and length of the pile, the type and capacity of the hammer used, the number of blows per minute, and the number of blows for each foot or each part of a foot of penetration of the pile.

END OF SECTION

SECTION 02486 SEEDING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The WORK covered by this SECTION consists of furnishing all the necessary equipment, materials and labor associated with the establishment and maintenance of grass from seed in all areas as specified herein and in the drawings. These include, but are not limited to seeding, mulching and fertilizing newly grassed areas and maintenance. Refer to SECTION 02920 for sodding requirements.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Certificates: Seed and fertilizer shall be certified that they meet requirements of these specifications, stating botanical name, percentage by weight, percentage of purity, germination, and weed seed for each grass seed species.

1.03 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - MATERIALS:

2.01 GRASS SEED:

- A. Provide fresh, clean, new crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America and as required below.
- B. Seed shall be labeled according to the U.S. Department of Agriculture Federal Seed Act and shall be furnished in containers with tags showing seed mixture, purity, germination, weed content, name of seller, and date on which seed was tested.
 - 1. Seed Mixtures: Meet the following minimum weight of pure live seed per acre:

Seed Name	Pounds Pure Live Seed
Argentine Bahia	41
Bermudagrass	14
Brown Top Millet	21

NOTE: Pure live seed (PLS) is determined by multiplying the % pure seed by the % germination. Therefore, if the pure seed is 80% and the germination is 70% the PLS is .80 X .70 or 56%. At 56% it would take 53.5 pounds to equal 30 pounds of PLS.

- 2. Moldy seed or seed that has been damaged in storage will not be accepted.
- 3. When seasonal conditions mandate, substitute a winter grass such as rye grass for the brown top millet.

2.02 FERTILIZER:

- A. Commercial fertilizer shall be Ammonium Sulfate (21-0-0-24S) containing 21 percent nitrogen and 24 percent sulfur or as recommended by the seed supplier as long as compatible with the environment and acceptable to FWC. Fertilizer containing phosphorus is not acceptable.

- B. Deliver to Site in unopened, labeled bags or containers.

2.03 MULCH:

- A. Vegetative Anti-Erosion Mulch: Seed free, salt hay, rye or oats, or of pangola, peanut, coastal Bermuda or Bahia grass hay.
- B. Only undeteriorated mulch that can readily be cut into the soil shall be used.
- C. Green mulch will not be accepted.

PART 3 - EXECUTION

3.01 SOIL PREPARATION:

- A. Any growth, rocks, or other obstructions which might interfere with tilling, seeding, or later maintenance operations shall be removed and disposed of properly. Remove stones over 2 inches in any dimension and sticks, roots, rubbish and other extraneous matter.
- B. Areas to be seeded are to be graded to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions, to meet finish grades. Limit fine grading to areas which can be planted within immediate future.
- C. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting.
- D. If prepared areas are eroded or otherwise disturbed after fine grading and prior to planting they shall be restored to specified condition prior to planting.
- E. Immediately upon completion of construction, grass shall be planted in all disturbed areas and as designated in the drawings. Method of planting shall be either hydroseeding or dry seeding.

3.02 FERTILIZING:

- A. Apply fertilizer in accordance with MANUFACTURER's recommendations.
- B. Incorporate fertilizer into the soil to a depth of at least 2 inches by discing, harrowing or raking, except on slopes steeper than two (2) horizontal to one (1) vertical.

3.03 SEEDING:

- A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
- B. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.
- C. Sow not less than a rate of 76 pounds of pure live seed per acre.
- D. Rake seed lightly into top 1/8-inch of soil, roll lightly, and water with fine spray.
- E. Methods of Application:
 - 1. Dry Seeding: Spreader or seeding machine.

3.04 MULCHING:

- A. Apply a mulch covering to all seeded areas.
- B. Apply vegetative mulch to loose depth of 2 inches, by means of a mechanical spreader or other approved methods.

- C. Mulch material shall be cut into the soil so as to produce a loose-mulched thickness of 3 to 4 inches. The use of harrows will not be permitted.
- D. Immediately following the application of the mulch, water the seeded area in one (1) watering, in sufficient amount to penetrate the seedbed to a minimum depth of 2 inches. Perform so as not to cause erosion or damage to the seeded surface.
- E. Protect seeded areas against hot, dry weather or drying winds by applying mulch not more than 24 hours after completion of seeding operations.

3.05 MAINTENANCE:

- A. Perform maintenance until 8 weeks after all areas have been seeded.
- B. Requirements:
 - 1. The CONTRACTOR shall water all newly grassed areas a minimum of once a week until satisfactory grass growth is attained.
 - 2. Repair any portion of the seeded surface which becomes gullied or otherwise damaged, or the seeding becomes damaged or destroyed.
 - 3. Replace mulch when washed or blown away.
- C. If, at the end of the 8-week maintenance period, a satisfactory stand of grass has not been produced, renovate and reseed the grass or unsatisfactory portions thereof immediately.

3.06 ACCEPTANCE OF GRASSING:

- A. When grassing work is substantially completed, including maintenance, the FWC will, upon request, make an inspection to determine acceptability. Seeded areas may be inspected for acceptance in parts agreeable to the FWC, provided WORK offered for inspection is complete, including maintenance.
- B. Replant rejected WORK and continue specified maintenance until reinspected by the FWC and found to be acceptable.
 - 1. A satisfactory stand is defined as a grass or section of grass that has:
 - a. No bare spots larger than 3 square feet.
 - b. Not more than 5 percent of total area with bare spots larger than 6 inches.
 - c. Not more than 10 percent of total area with bare spots larger than 2 inches square.
 - 2. If the grassing is still unsatisfactory upon inspection of replanted area, the CONTRACTOR shall sod those areas that are unacceptable. Acceptance of the sodded areas is dependent upon satisfactory coverage criteria established in 3.06.B.1 above.

END OF SECTION

SECTION 02660 GROUNDWATER MONITORING WELLS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all necessary equipment, labor, and materials and perform all operations in connection with installation and development of groundwater monitoring wells as specified herein and as required on the Drawings.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Water Works Association (AWWA)
 - a. A100 - Water Wells
 - 2. Florida Department of Environmental Protection (FDEP), Latest Revision, 62-528 F.A.C.
- B. South Florida Water Management District Water Well Standards

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Prior to well construction, the CONTRACTOR shall submit product data sheets for all well components, the casing mill certificates, the well driller certification, and the well installation permit.
- C. After well construction, the CONTRACTOR shall submit a well completion report.

1.05 QUALIFICATIONS: The CONTRACTOR shall utilize the services of a certified water well driller licensed by the State of Florida for the construction of the groundwater monitoring well(s).

1.06 RESPONSIBILITIES: Requirements of Regulatory Agencies: The CONTRACTOR shall complete a well completion report on the Florida Department of Environmental Regulation (FDER, latest revision) Form 0124 and submit it to the FWC after the installation of the well.

1.07 CERTIFICATIONS: (Not Applicable)

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 MATERIALS: The products and materials required are indicated on the Drawings. The CONTRACTOR shall submit to FWC any changes in design for review and approval prior to installation of the well.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. The CONTRACTOR shall install the well(s) as indicated on the Drawings. Workmanship and materials not covered by the Technical Specifications or standards herein shall conform to AWWA A100.
- B. The CONTRACTOR shall install the groundwater monitoring well(s) at the location(s) indicated on the Drawings.
- C. The CONTRACTOR shall fully and properly develop the well(s) and place them in working order. The purging of the well(s) shall consist of surging or overpumping or by some other method approved by state and local regulations. Contaminated development water and cuttings shall be properly contained in product tight drums kept in containment so as not to cause a further spread of contaminants. Contaminated development water and cuttings shall be disposed of in an environmentally safe manner off-site as approved by state and local regulations.

END OF SECTION

SECTION 02781 STAFF GAUGES

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide all necessary equipment, labor and materials and perform all WORK necessary to complete installation of staff gauges, including concrete support piles for the staff gauges.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 01050 - Field Engineering and Surveying
 - 3. SECTION 02367 - Foundation Piling Prestressed Concrete
 - 4. SECTION 03600 - Grout

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society for Testing and Materials (ASTM):
 - a. A252 - Standard Specification for Welded and Seamless Steel Pipe Piles
 - 2. Federal Highway Administration (FHWA)
 - a. Standard Alphabets for Traffic Control Devices

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. All submittals shall be in accordance with SECTION 01300.
- B. The CONTRACTOR shall submit product data of all staff gauge materials including a visual representation of the staff gauge board.
- C. The CONTRACTOR shall submit Surveyor's Report in accordance with SECTION 01050 of the fully installed staff gauge.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS: (Not Applicable)

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide at least 48 hours advance notice of its intention for inspection or to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 DATUM SIGN, DATUM HEIGHT OFFSET, NUMBER FIGURES AND HASH MARKS: The CONTRACTOR shall furnish materials conforming to the following provisions:

- A. For concrete pile mounted staff gauges, staff gauge board shall be Tangent Technologies, LLC – PolyForce - color extruded structural recycled plastic lumber or FWC approved equal, 2 inches x 10 inches white skin over black core.
- B. Hash marks, number figures, and adjustment channel shall be routed into staff gauge board by use of a computer numerical control (CNC) machine to the depth where black core is clearly visible within the entire routed area. Hash marks shall be graduated in tenths of a foot.
- C. Datum sign (NAVD 88) panel with white and red color core material. Sign shall have a red border and be permanently mounted into routed cavity at the top off staff gauge board.

2.02 CONCRETE PILES: Concrete piles shall conform to Section 02367.

PART 3 - PERFORMANCE

3.01 CONCRETE PILES:

- A. Pre-punching or pilot-drilling holes shall be performed when necessary to allow piles to be driven through rock/limestone.
- B. Concrete piles shall be capped with a one (1) inch minimum thick layer of non – shrink epoxy grout (see SECTION 03600) applied after driving the pile. Prepare the surface of the pile in accordance with grout MANUFACTURER’s instructions.

3.02 STAFF GAUGES:

- A. The CONTRACTOR shall install permanent slide mounted staff gauge(s) on concrete pile(s) with elevations referenced to NAVD 88 as shown on the Drawings. A 5” high x 8.5” wide sign with 2 inch Series B alphabet height shall be permanently mounted into a routed cavity at the top off staff gauge board to identify the NAVD 88 reference datum.
- B. The CONTRACTOR shall level staff gauge elevations to within +/- 0.01 feet or less. All leveling will be performed under the direct supervision of a Professional Surveyor or Mapper licensed in the State of Florida in accordance with SECTION 01050. Leveling will meet or exceed the National Geodetic Survey Standards for third order leveling (12mm√k). Field notes for each Site shall be reviewed by surveyor and certified as meeting the leveling standards. Field notes shall be incorporated into a Surveyor’s Report and shall be submitted in accordance with SECTION 01050.

END OF SECTION

SECTION 02820 WIRE FENCES AND GATES

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, materials and equipment necessary to install woven-wire and/or barbed wire fencing and gates with wooden and/or steel posts as shown on the Drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Southern Pine Inspection Bureau, Standard Grading Rules, latest edition, (SPIB)
 - 2. American Wood Preservers Association (AWPA)
 - 3. American Society of Testing and Materials (ASTM):
 - a. A47 - Standard Specification for Ferric Malleable Iron Castings
 - b. A116 - Standard Specification for Metallic-Coated, Steel-Woven Wire Fence Fabric
 - c. A121 - Standard Specification for Metallic-Coated Steel Barbed Wire
 - 4. Florida Department of Transportation (FDOT)
 - a. Standard Specifications for Road and Bridge Construction, Latest Edition

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Shop Drawings: Submit shop drawings and installation drawings for the FWCs review prior to fabrication and delivery. These drawings shall provide detailed information and specifications for all materials, finishes, dimensions, and erection instructions.
- C. Like items of material provided hereunder shall be the end products of one MANUFACTURER in order to achieve standardization for appearance, maintenance, and replacement.
- D. See CONDITIONS OF THE CONTRACT and Division 1, General Requirements, which contain information and requirements that apply to the WORK specified herein and are mandatory for this project.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS AND TESTING: The CONTRACTOR shall submit certifications for the fencing materials indicating that they meet the requirements of the specifications. Certifications required shall include the following.

- A. Certifications that woven-wire and barbed wire fencing materials meet Specifications
 - B. Certification that wood posts are pressure-treated and conform to Specifications
- 1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.
- 1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

- 2.01 The CONTRACTOR shall provide materials of MANUFACTURER's standard products where such products conform to Specifications.
- A. The use of a MANUFACTURER's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other MANUFACTURERS will be considered in accordance with the General Conditions.
 - B. Fencing materials and gates shall be new products of recognized, reputable MANUFACTURERS. All fencing materials and gates shall carry a tag identifying the MANUFACTURER. Each roll of fencing material shall be legibly marked with the style, class of zinc coating, and other pertinent identifying information.
- 2.02 WOODEN POSTS AND BRACING: The CONTRACTOR shall furnish wooden posts conforming to the following:
- A. Posts shall be of the type and size shown. Southern Yellow Pine or Cypress, manufactured and graded in accordance with the current edition of the Standard Grading Rules for Southern Pine Timber, of the SPIB, pressure-treated with acceptable preservative in amounts acceptable for ground contact conforming to FDOT Section 954 and 955 except as may be modified herein. Wood posts and wood brace rails shall be of sound wood free from bark, and multiple crooks. Small surface seasoning checks will be permitted. All posts shall be dry and seasoned at the time they are set. Allowable crooks may be in one (1) plane only. A line drawn between the centers of the butt and tip of each post and brace rail shall not fall outside of the actual longitudinal centerline of the post or rail by more than 1.67 percent of its length with an allowable maximum of 2 inches.
 - B. Square members may be rough sawn, S4S or S2S. Sizes shown are minimum diameters for round or irregular size members and standard widths for square members.
 - C. Preservative:
 - 1. The following pressure treated wood formulations are acceptable:
 - a. Alkaline Copper Quaternary (ACQ-C and ACQ-D with carbonate)
 - b. Copper Azole (CBA-A and CA-B)
 - 2. The method of treatment for all timber materials shall be in accordance with ASTM D1760. Use of Chromated Copper Arsenate (CCA) treated timber is not permitted.
 - 3. Pressure Treatment: Pressure treatment shall be in accordance with the requirements of American Wood Preserves Association (AWPA) Standard C1, as well as AWPA Standard C2 for lumber and AWPA Standard C9 for plywood. Each piece of pressure preservative treated shall bear the AWPA stamp, indicating point of treatment, preservative symbol, symbol of standard, dated of treatment, and moisture content after treatment.

- 2.03 STEEL LINE POSTS: The CONTRACTOR shall furnish steel post conforming to the following unless otherwise specified on the Drawings:
- A. 1-3/8" by 1-3/8" by 7/64" tee line posts with anchor plates
 - B. Minimum length of 7 feet
 - C. Aluminum or baked-enamel finish
- 2.04 WIRE FABRIC: The CONTRACTOR shall furnish wire fabric conforming to the following:
- A. Conform to ASTM A116, Type I, Woven-Wire, Style 1, No. 11 Farm-Field Fencing
 - B. 47 inches height with 10 horizontal wires, and stays 6 inches on center
 - C. Top and bottom horizontal wires: No. 9 gauge
 - D. Intermediate and stay wires: No. 11 gauge
 - E. Zinc-coated, Class 3
- 2.05 BARBED WIRE: The CONTRACTOR shall furnish barbed wire conforming to the following:
- A. Conform to ASTM A121, 4-point pattern, round barbs spaced 5 inches on center
 - B. Strand Size: No. 12-1/2 gauge
 - C. Barb Size: No. 14 gauge
 - D. Zinc-coated, Class 3
- 2.06 GATES AND ACCESSORIES: The CONTRACTOR shall furnish gates and accessories conforming to the following:
- A. Gate: Unless otherwise specified on the Drawings, a Manual Swing Aluminum farm gate of standard manufacture in the widths indicated. The gates shall be constructed of 0.050-inch aluminum. Gates shall be made of roll-formed panels, four and one-half inches wide with curled edges, spaced as shown on the Drawings. Each gate shall be provided with two (2) latches, two (2) hinges, two five-eighths inch diameter, link galvanized steel chain, gate stay, and corrosion resistant padlocks. All gates shall be able to be hinged on either end.
 - B. Hinges:
 - 1. Heavy pattern, malleable, and of adequate strength for gate size, zinc-coated conforming to ASTM A47
 - 2. Arranged so gate may be swung back parallel with the fence
 - C. Vertical Fence Stays: Vertical fence stays shall be 9-1/2 gauge, galvanized wire, 40-inch.
 - D. Nails and Spikes: Zinc-coated and of the best commercial quality and of proper length.
 - E. Staples: Formed of No. 9-gauge zinc-coated steel wires one and one-half inch long.
 - F. Bracing Wire: Bracing wire shall be No. 9-gauge or heavier, zinc-coated soft, smooth wire.

PART 3 - EXECUTION

- 3.01 INSTALLATION: The CONTRACTOR shall install the fence, gates and accessories in accordance with the following:

- A. Posts: Set posts with large end down, plumb, and in good line on the side on which the wire is to be fastened. Set end posts into the ground a minimum of three and a half feet and line posts a minimum of 2 feet. Do not cut off post bottoms to avoid rock removal or additional excavation. Where the butt end of the post is not square, cut it off square. The diameter of postholes shall be not less than 6 inches larger than the diameter of the posts. After posts are placed and aligned, backfill holes with suitable earth material and compact with hand tampers. Mound excess earth about the post to provide natural drainage. Where anchors are indicated on the bottom of corner, brace, or gateposts, attach by notching the post and spiking the anchor and spikes as shown. Brace corner and gateposts as indicated.
1. Set end posts at the beginning and end of fence construction not terminating at gates. Set gate posts at each end of each gate opening. Set corner posts at angle points in fence alignment where the deflection angle between adjoining panels of fence is 15 degrees or more. The line posts shall be evenly spaced; the post spacing shall be not greater than 8 feet. All posts shall be set on lines and grades established or designated by the FWC. When posts are set, the grade line on the tops of the posts shall present a neat, uniform appearance.
 2. Line posts that are set by driving shall be free of damage when in place, and any driven post that is split, or which has a misshapen top shall be removed and replaced with a new post.
 3. Intermediate end posts shall be spaced at not more than 400 feet apart, but spacing shall be as such to use standard rolls of wire with a minimum of cutting and waste.

3.02 WOVEN FENCING:

- A. Attach woven-wire fence to outside of posts with not less than five heavy staples per wooden post, or five galvanized ties per steel line post.
- B. Mount one (1) strand of barbed wire 2 inches above the woven-wire fencing.
- C. Mount one strand of barbed wire below woven-wire fencing as indicated.
- D. Attach strands of barbed wire to the outside of posts with heavy staples to wooden posts, or galvanized ties to steel line posts.

3.03 INSTALLATION OF BARBED WIRE:

- A. Attach all barbed wire to the posts in accordance with recognized standard practice for first class fence construction and in conformance with these Technical Specifications. Attach strands of barbed wire to the outside of posts with heavy staples to wooden posts, or galvanized ties to steel line posts
- B. Terminate the barbed wire at each end post, gate post, corner post, and intermediate line post. Each line of barbed wire shall be wrapped around the terminating, corner or intermediate line post and shall be spliced back onto itself with at least four (4) turns.
- C. At each line post, each line of barbed wire shall be fastened to the post using staples as specified in this SECTION.
- D. Splices of barbed wire between posts will be permitted provided that no more than one (1) splice occurs in any one (1) run of fence. In final position, the barbed wire shall be free from sag.
- E. In crossing gullies, ditches, and abrupt depressions where the bottom line of the fence as normally constructed leaves an unfenced opening beneath it greater than 12 inches in height, an additional panel or additional panels of fence between line posts shall be provided across said opening with barbed wire, woven wire fabric, or combination thereof as may be approved by the FWC. The finished fence shall be so that at no point along the fence will there be side openings or bottom openings exceeding 4 inches in dimension. Along ground of minor surface irregularity where the bottom line of the fence as normally constructed leaves an unfenced opening beneath it of 12 inches or less, the normal fabric and wires shall be pulled down between posts and anchored by means of pins or posts, driven not less than

24 inches into the ground, so that at no point along the fence will there be any bottom opening exceeding 4 inches in height.

F. Upon completion, the fence shall be straight between corners. All posts shall be vertical and firmly set. All braces, fittings, and fixtures shall be tight and firm, and all barbed wire shall be free from wrap and sag.

G. Vertical Fence Stays: The CONTRACTOR shall install vertical fence stays midway between posts. The wire shall be twisted to permit weaving into the horizontal fence wires to provide rigid spacing. All barbed wires shall be woven into the stay.

3.04 GATE INSTALLATION: The CONTRACTOR shall install gates with the faces plumb and the top level. Install so that the gates will swing freely, without binding, through an arc of 90 degrees inward. If necessary, to prevent gates from dragging, trim the ground down within the area of the gate swing.

3.05 CLEANUP: The CONTRACTOR shall, upon completion of the fence and at such times during the construction as the FWC may direct, clean the fence construction area of trash, debris, and rock. Spread out excess excavated material from the fence postholes uniformly over the adjacent area.

END OF SECTION

SECTION 02920 SODDING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide all labor, equipment and materials necessary to establish a stand of grass within the specified areas by furnishing and placing sod, and rolling, fertilizing, watering and maintaining the sodded areas to ensure a healthy stand of grass.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 01600 - Equipment and Materials

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this section and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Florida Department of Transportation (FDOT):
 - a. Standard Specifications for Road and Bridge, Latest Edition

1.03 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Site-specific grassing and maintenance plan.
- C. Sod certification for grass species and location of sod source.

1.04 QUALITY ASSURANCE:

- A. Sod Producer: Company specializing in sod production and harvesting with minimum five (5) years' experience, and certified by the State of Florida.
- B. Installer: Company approved by the sod producer.
- C. Sod: Minimum age of 18 months, with root development that will support its own weight, without tearing, when suspended vertically by holding the upper two (2) corners.
- D. The FWC reserves the right to test, reject or approve all materials before application.
- E. The CONTRACTOR shall enlist the services of an experienced grassing firm with a minimum firm (5) years' experience in developing all-encompassing site specific plan for the soil preparation, soil amendment, grassing, fertilizer, watering and maintenance to insure a healthy strand of grass.

1.05 REGULATORY REQUIREMENTS: Comply with regulatory agencies for fertilizer.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to Site in accordance with the provisions of SECTION 01600.
- B. Store and protect products in accordance with the provisions of SECTION 01600.
- C. Deliver sod on pallets. Protect exposed roots from dehydration.

- D. Do not deliver more sod than can be laid within 48 hours.
- E. Deliver fertilizer in water proof bags showing weight, chemical analysis, and name of MANUFACTURER.
- F. The CONTRACTOR shall furnish the FWC with the MANUFACTURER's application/installation instruction for all materials received in order that the minimum application rate of materials may be determined.

1.07 MAINTENANCE SERVICE: Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

1.08 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Sod:
 - 1. The sod shall be Argentine Bahia, to closely match existing as directed, with well matted roots.
 - 2. The sod shall be commercial size rectangular measuring 12 inches by 24 inches or larger. Rolled sod is acceptable if approved by FWC.
 - 3. The sod shall be sufficiently thick to secure a dense stand of live grass, with a minimum thickness of 2 inches.
 - 4. The sod shall be live, fresh and uninjured at the time of planting.
 - 5. The sod shall have a soil matt of sufficient thickness adhering firmly to the roots to withstand all necessary handling and be reasonably free of weeds and other grasses.
 - 6. The sod shall be planted as soon as possible after being harvested, and shall be shaded and kept moist from the time of harvesting until it is planted.
 - 7. The source of the sod may be inspected for approval by the FWC prior to construction.
- B. Soil Amendment: Amendment compatible for the Site to assist in the growth and viability of the grassing installed.
- C. Fertilizer: Commercial fertilizer shall be Ammonium Sulfate (21-0-0-24S) containing 21 percent nitrogen and 24 percent sulfur or as recommended by the sod supplier as long as compatible with the environment and acceptable to FWC. Fertilizer containing phosphorus is not acceptable.
- D. Water: Clean, fresh, and free of substances or matter which could inhibit vigorous growth of grass.

PART 3 - EXECUTION

3.01 SOIL PREPARATION:

- A. Any growth, rocks, or other obstructions which might interfere with maintenance operations shall be removed and disposed of properly. Remove stones over 2 inches in any dimension and sticks, roots, rubbish and other extraneous matter.
- B. Areas to be sodded are to be graded to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions, to meet finish grades. Limit fine grading to areas which can be planted within immediate future.

- C. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting.
- D. If prepared areas are eroded or otherwise disturbed after fine grading and prior to planting they shall be restored to specified condition prior to planting.
- E. Immediately upon completion of construction, sod shall be planted in all disturbed areas and as designated in the Drawings.

3.02 FERTILIZING:

- A. Apply fertilizer in accordance with MANUFACTURER's instructions.
- B. Apply after smooth raking of graded surface and prior to installation of sod.
- C. Apply fertilizer no more than 48 hours before laying sod.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.03 LAYING SOD:

- A. Apply soil amendment in accordance with Site-specific grassing and maintenance plan.
- B. Moisten prepared surface immediately prior to laying sod.
- C. Lay sod tight with no open joints visible. Do not overlap. Stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.
- D. Do not use sod which has been cut for more than 48 hours
- E. Peg sod at locations where sod may slide, as directed by the FWC.
- F. Roll sod using a lightweight turf roller to provide a true and even surface.

3.04 MAINTENANCE:

- A. Water all newly grassed areas at least once a week, at a rate equivalent to 1/2-inch to 3/4-inch per week, to prevent grass and soil from drying out.
- B. Immediately replace sod in areas which show deterioration or bare spots.
- C. The CONTRACTOR shall include in pricing, water and equipment to insure adequate survival of the sod and such maintenance as filling, leveling and repairing of any washed or eroded areas as may be necessary, for 30 days after Substantial Completion.
- D. The CONTRACTOR is responsible to replace any sod that slides after installation at CONTRACTOR's expense.
- E. The CONTRACTOR shall mow the Site at the direction of the FWC once every three months including existing vegetation and grassing installed by CONTRACTOR.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Scope of Work

1. The WORK included in this Section consists of the furnishing and planting of a combination of the plant species indicated in this SECTION on top of the 50 foot wave bench as indicated on the Drawings.
2. The WORK shall include the maintenance of all plants and planting areas until Final Completion of the Project by the FWC.

1.02 SUBMITTALS:

- A. Prior to starting work, the CONTRACTOR shall submit a planting schedule showing scheduled dates for each type of planting in each area of the site. The CONTRACTOR shall submit revised schedules when departure from the schedule is necessary.
- B. Prior to starting work, the CONTRACTOR shall provide a list of all plant species to be utilized as indicated in this SECTION and indicate the proposed source of the plants, how they will be transported to the site, the method(s) to be used to install the plants, the location and spacing of each plant, and how each species will be maintained until accepted by the FWC.

1.03 DELIVERY, STORAGE AND HANDLING OF MATERIALS:

- A. Transportation and Inspection: Plant Transportation shall comply with all federal and state and local regulations, and upon delivery at the site, all plants shall be inspected for conformity to specifications and for handling damage. Rejected plants shall be immediately removed from the site by the CONTRACTOR. In addition, any required inspection certificates shall accompany each shipment, and shall be filed with the FWC.
- B. Balled and Burlapped: The Root Ball of these plants shall be properly protected until they are planted. The plant shall be handled and delivered with roots adequately protected against drying out by means of moist straw or other approved materials. Shipping containers shall be opened and inspected by the CONTRACTOR upon arrival and shall be dampened if necessary. Plants which are not immediately planted shall be "heeled-in" in an appropriate manner, in moist earth or other suitable medium, and shall be properly cared for until planting.

1.04 SUBSTITUTIONS / DEPARTURES:

- A. Plants specified in the plans shall be used unless sufficient evidence is submitted to the FWC indicating the plant is unavailable. Alternate material may be used as approved and directed by FWC.
- B. No substitutions shall be made without written approval of the FWC.

1.05 ADJUSTMENTS AND ALTERATIONS:

- A. Container grown material may be substituted for using any other root classification types of equal value with approval by the FWC. However, all other requirements and specifications must be adhered to.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General:

1. PLANTS REQUIRED: Acceptable plants types include any combination of the following as approved by FWC:
 - a. Thalia geniculata (Fireflag)
 - b. Eleocharis cellulose (Spike Rush)

- c. *Scirpus* spp (Bulrush)
 - d. *Pontederia cordata* (Pickerel Weed)
 - e. *Sagittaria latifolia* (Arrowhead)
 - f. *Canna flaccida* (Golden Canna)
 - g. *Iris virginicus* (Blue Flag Iris)
 - h. As approved by FWC
2. NOMENCLATURE: All herbaceous material shall be true to name as established by the American Joint Committee on horticultural nomenclature publication "Standard Plant Names." The designated authority for the identification of all material shall be the two publications of L.H. Bailey "Hortus II" and "Manual of Cultivated Plants", and all specimens shall be true to type, name, etc. as described therein.
 3. GRADE STANDARDS AND QUALITY: All nursery grown plants shall comply with all required inspection, grading, standards, and plant regulations as set forth in the Florida Department of Agriculture "Grades and Standards for Nursery Plants" or equivalent, including revisions, unless the CONTRACTOR can show plants taken from natural donor sites to be of equal vigor and more cost effective.
 - a. The minimum grade for all herbaceous plants shall be sound, healthy, vigorous and of proper color. They should have healthy, well developed root systems, and shall be free of disease and insect pests, eggs or larvae.
 - b. In the event that it becomes apparent that any nursery supplying plants for this work has knowingly and consistently represented the grade of plants as being higher than the actual grade as determined by the plant list according to "Grades and Standards for Nursery Plants", all plants already delivered from such source shall be removed from the Project site at the expense of the CONTRACTOR. No further plants will be acceptable from such nursery until written evidence is submitted and confirmed that all material for delivery has been inspected and approved by the FWC as being of the grade represented.
 4. Plant Material taken from natural or man-made wetlands other than previously identified donor sites must be approved by the FWC. The FWC shall be given at least fourteen (14) days notice before initiation of plant collections from the aforementioned sites. All plant material transplanted to the site must comply with the plans and specifications, and the CONTRACTOR shall be responsible for removing or assuring control of all extraneous, noxious, and nuisance plants introduced with transplanted wetlands material.
- B. Plant Materials
1. DESIGNATION: With reference to the method of cultivation, root system status, etc., plants shall be classified under the following designations:
 - a. Container Growth
 - b. Bare Root Equivalent
 2. CONTAINER GROWN PLANTS:
 - a. Container grown plants shall have been grown in a container large enough and for sufficient time for the root system to have developed enough to hold its soil together, firm and whole. No plants shall be loose in the container. Plants which have become pot bound or for which the top system is too large for the size of the container will not be accepted.
 - b. All containers shall be cut and opened fully, in a manner such as will not damage the root system. Container grown plants shall not be removed from the container until immediately before planting when all due care shall be taken to prevent damage and/or dehydration to the root system.
 3. BARE ROOT PLANTS:
 - a. Plant material removed from natural or man-made wetlands may be transported to the site as bare root plants. However, some provision must be made to protect this material, especially the roots, from desiccation. All plant material transported in this manner must be approved in writing by the FWC prior to installation. Otherwise, no bare root plants shall be used unless specifically required by the FWC.

- b. Plants designated as Bare-Root shall have a root spread at least 1/3 greater than the equivalent container grown plant. The root system shall be well spread, fibrous, and typical of a healthy specimen of the species. These plants shall be dug and delivered with roots adequately protected against drying out by means of moist straw or other approved materials. Shipping containers shall be opened and inspected by the CONTRACTOR upon arrival, and shall be dampened if necessary. Plants which are not to be immediately planted shall be "heeled-in" in an approved manner, in moist earth or other suitable medium, and shall be properly cared for until planted.

PART 3 - EXECUTION

3.01 PREPARATION: (NOT USED)

3.02 PLANTING:

- A. Time of planting: Planting should occur under favorable weather conditions. At the option of and under the full responsibility of the CONTRACTOR, planting operation may be conducted under unreasonable conditions without additional compensation.
- B. Removal from containers:
 - 1. All containers shall be cut and opened fully in a manner which will not damage the root system of the plant.
 - 2. Container grown plants shall not be removed from the container until immediately before planting, and with all due care to prevent damage to the root system.
 - 3. Watering: The CONTRACTOR shall continue watering for as long as necessary to properly establish the plants and maintain until Final Completion.
- C. Planting shall be performed on 3 foot centers or in accordance with written, submitted instructions by the SUPPLIER.

3.03 FIELD QUALITY CONTROL:

- A. CONTRACTOR's Responsibilities:
 - 1. The CONTRACTOR shall remove dead and unsatisfactory plants promptly upon discovery and shall mark locations clearly to facilitate future replacement as necessary.
 - 2. The CONTRACTOR shall store materials and equipment where directed and shall keep work areas clean and in an orderly condition.
 - 3. The CONTRACTOR shall protect work and materials from damage due to planting operations and shall maintain protection during installation and maintenance periods. The CONTRACTOR shall treat, repair or replace damaged work.

3.04 AFTER PLANTING:

- A. Maintenance:
 - 1. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.
 - 2. The CONTRACTOR shall repair, restore, or replace any plants or planting areas which might become damaged as a result of any negligence by him in complying with these requirements. As a specific requirement of these conditions, the CONTRACTOR shall be responsible for assuring that all plants at the time of final inspection exhibit the characteristics and qualifications required for the grade of plant as originally specified.
 - 3. Each plant shall be of proper type, etc., properly installed and maintained in good health through Final Completion.

END OF SECTION

SECTION 03050 CONCRETE ADMIXTURE WATERPROOFING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The WORK of this SECTION specifies crystalline waterproofing admixture for use with new concrete, cast-in-place concrete and/or self-consolidating concrete (SCC) required by the Contract Documents.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 03400 – Structural Precast Concrete for Above-Grade Construction

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Concrete Institute (ACI)
 - a. 117 - Specifications for Tolerance for Concrete Construction and Materials and Commentary
 - b. 212.3R - Report on Chemical Admixtures for Concrete
 - 2. American Society for Testing and Materials (ASTM):
 - a. C1202 - Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
 - b. C494 / C494M - Standard Specification for Chemical Admixtures for Concrete
 - c. D5084 - Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 - 3. US Army Corps of Engineers (USACE)
 - a. CRD-C48-92 Standard Test Method for Water Permeability of Concrete
 - 4. National Sanitation Foundation International/American National Standards Institute (NSF/ANSI)
 - a. 61 Drinking Water System Components - Health Effects
 - 5. Florida Building Code and Local Building Codes as applicable.
 - 6. Florida Department of Transportation (FDOT)
 - a. Standard Specifications for Road and Bridge Construction, latest edition

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. General: Submittals shall be in accordance with SECTION 01300, of the Technical Specifications and the General Terms and Conditions of the Contract.
- B. Product Data: Submit product data, including MANUFACTURER's product sheet, for specified products.

1. Material safety data sheets (MSDS)
- C. Quality Assurance:
1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties. Indicate volatile organic compounds (VOCs) during application.
 2. Certificates: Product certificates signed by MANUFACTURER certifying materials comply with specified performance characteristics and criteria and with physical requirements.
 3. MANUFACTURER's Instructions: MANUFACTURER's written installation instructions.
 4. The CONTRACTOR shall provide permeability test results using both the USACE CRD-C48-73 Method and ASTM C1202 Method, for each compressive strength test samples. The concrete shall have a permeability that meets Article 2.02 B.1 of this SECTION.
- D. MANUFACTURER's Field Reports: MANUFACTURER's field reports specified.
- E. Quality Assurance:
1. Qualifications:
 - a. Installer: Experienced in performing WORK of this SECTION who has specialized in installation of work similar to that required for this Project.
 - b. MANUFACTURER: Capable of providing field service representation during construction and approving application method.
 2. Regulatory Requirements: Provide admixture that complies with requirements as follows:
 - a. NSF/ANSI 61, Drinking Water System Components - Health Effects
 - b. USACE CRD-C48-73 Standard Test Method for Water Permeability of Concrete
 - c. D5084 - Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
 3. Preinstallation Meetings: Conduct preinstallation meeting to verify Project requirements, MANUFACTURER's installation instructions and MANUFACTURER's warranty requirements.
- F. Mix Designs: Prior to beginning the WORK and within fourteen (14) days of the Notice to Proceed, the CONTRACTOR shall submit preliminary concrete mix designs which shall show the proportions and gradations of all materials, including crystalline waterproofing admixture, proposed for each class and type of concrete. Mix designs shall be checked by an independent testing laboratory acceptable to the FWC. All costs related to such checking shall be CONTRACTOR's responsibility.

1.05 RESPONSIBILITIES: (Not Applicable)

1.06 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - MATERIALS

2.01 GENERAL: All materials shall be classified as acceptable for potable water use according to NSF Standard 61.

2.02 CRYSTALLINE WATERPROOFING:

A. MANUFACTURERS:

1. ICS Penetron International Ltd.

2. Xypex Chemical Corporation
 3. Kryton International Inc.
- B. The concrete with the crystalline waterproofing admixture shall have following properties:
1. Permeability: 1.2mm (3/64 inch) after 120 hours (5 days), USACE CRD C48 or ASTM D5084.
 2. Compressive Strength of Concrete: in accordance with SECTION 03400.
- C. A single MANUFACTURER for the crystalline waterproofing materials shall be used throughout the WORK, and prior to its use, the brand shall be accepted by the FWC.

PART 3 - EXECUTION

3.01 PERFORMANCE REQUIREMENTS:

- A. Provide concrete concentrate admixture that has been manufactured and added to concrete mix at time of concrete batching to maintain performance criteria stated by MANUFACTURER without defects, damage or failure.
- B. Coordinate and schedule addition of concrete admixture with concrete batching.

3.02 MANUFACTURER'S INSTRUCTIONS:

- A. Compliance: Comply with MANUFACTURER's written data, including product technical bulletins, product catalog installation instructions, product installation instructions and specifications.
- B. All concrete WORK shall be in accordance with SECTION 03400.
- C. Mix, apply, and cure per paragraphs 3.03 and 3.04 of this SECTION and MANUFACTURER's requirements. If any of the steps in paragraphs 3.03 and 3.04 of this SECTION conflict with the MANUFACTURER's instructions, notify FWC.

3.03 APPLICATION PROCEDURES:

- A. Add crystalline waterproofing admixture to concrete at time of batching at the dosage rate of 2% by weight of cement content. The cement content shall be the total cementitious material including silica fume, slag or fly ash. The procedure sequence for addition varies according to type of batch, plant operation and equipment.
 1. Ready-Mix Plant, Dry Batch Operation: Add crystalline waterproofing admixture in powder form to drum of ready-mix truck. Add 70% of required water along with 400 pounds (lbs) of aggregate. Mix materials for three (3) minutes minimum to ensure crystalline waterproofing admixture is distributed evenly throughout mix water. Add balance of materials in accordance with standard batch practices.
 2. Ready-Mix Plant, Central Mix Operation: Mix crystalline waterproofing admixture with water to form thin slurry in ratio fifteen (15) lb powder to three (3) gallons of water. Pour required amount of material into drum of ready-mix truck. Pour concrete into truck and mix for five (5) minutes minimum to ensure even distribution of crystalline waterproofing admixture throughout concrete.
 - a. Ensure aggregate, cement and water are batched and mixed in plant in accordance with standard practices and taking into account quantity of water that has already been placed in ready-mix truck.
 3. Precast Batch Plant, Pan-Type Mixer: Add crystalline waterproofing admixture to aggregate and mix thoroughly for three (3) minutes minimum prior to adding cement and water.
 - a. Ensure total concrete mass is blended using standard practices.

- b. Obtain homogeneous mixture of crystalline waterproofing admixture with concrete.
- c. Do not add dry crystalline waterproofing admixture directly to wet concrete.

3.04 CURING: Curing shall be in accordance with SECTION 03400.

3.05 FIELD QUALITY CONTROL:

- A. The MANUFACTURER of the crystalline waterproofing admixture supplied under this SECTION shall be involved in handling, installation, application and protection of products, and submit written report in acceptable format to verify compliance of WORK.
- B. MANUFACTURER's Field Services: Have MANUFACTURER's technical representative schedule Site visits to review WORK during delivery and pouring of concrete.

END OF SECTION

SECTION 03100 CONCRETE FORMWORK AND ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide all labor, materials and equipment for the following:
 - 1. Design and construction of all necessary formwork including the required bracing, supports, scaffolding, shoring, and other falsework to produce cast-in-place concrete in the finished structure within the required tolerances for line, grade dimension and detail.
 - 2. Joints in concrete, complete and in place, in accordance with the Contract Documents. Joints in concrete structures shall be the types defined below and will be permitted only where indicated, unless specifically accepted by the FWC.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 03300 - Cast-in-Place Concrete
 - 3. SECTION 07920 - Sealants and Caulking

1.02 APPLICABLE STANDARDS AND PUBLICATIONS: The following standard specifications shall apply to the WORK of this SECTION:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Concrete Institute (ACI)
 - a. 347 - Guide to Formwork for Concrete
 - b. 117 - Specification for Tolerances for Concrete Construction and Materials
 - 2. American Society of Testing and Materials (ASTM)
 - a. A775 – Standard Specification for Epoxy Coated Reinforcing Steel Bars
 - b. C920 – Standard Specification for Elastomeric Joint Sealant
 - c. D412 - Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension
 - d. D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
 - e. D638 - Standard Test Method for Tensile Properties of Plastics
 - f. D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
 - g. D747 - Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
 - h. D1056 – Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
 - i. D1752 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

- j. D2000 - Standard Classification System for Rubber Products in Automotive Applications
 - k. D2240 - Standard Test Method for Rubber Property - Durometer Hardness
 - l. D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
3. US Product Standards (PS)
 - a. PS-1 - Construction and Industrial Plywood for Concrete Forms
 - b. PS-20 - American Softwood Lumber Standard
 4. NSF International
 - a. 61 - Drinking Water System Components - Health Effects
 5. United States Army Corps of Engineers (USACE)
 - a. CRD-C572 - PVC Waterstops
 6. Federal Specifications
 - a. TT-S-0227 E(3) - Sealing Compound, Elastomeric Type, Multicomponent, for Caulking, Sealing, and Glazing Buildings and Other Structures
 7. Occupational Safety and Health Association (OSHA)
 - a. CFR Title 29 Part 1926 - Safety and Health Regulations for Construction

1.03 DEFINITIONS:

A. Construction Joints:

1. When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. If indicated on the drawings, joints in water bearing members shall be provided with a waterstop and/or sealant groove of the shape indicated. The surface of the first pour may also be required to receive a coating of bond breaker as indicated.

B. Contraction Joints: Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the earlier pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint, which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the later pour. Waterstop and/or sealant groove shall also be provided when indicated.

C. Expansion Joints:

1. To allow the concrete to expand freely, a space is provided between the two pours, and the joint shall be formed as indicated. The space is obtained by placing a filler joint material against the earlier pour, to act as a form for the later pour. Unless otherwise indicated, expansion joints in water bearing members shall be provided with a center-bulb type waterstop as indicated.
2. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.
3. The space so formed shall be filled with a joint sealant material as indicated herein. In order to keep the two walls or slab elements in line the joint shall also be provided with a sleeve-type dowel as indicated.

D. Control Joints: The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions indicated, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material.

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Falsework Calculations and Drawings: The CONTRACTOR shall submit calculations and drawings prepared and sealed by a Professional Civil Engineer registered in the State of Florida, which indicate the falsework complies with the requirements of OSHA Title 29, Part 1926.703. The submission of design details and calculations for falsework is for information only.
- C. The plans of falsework proposed to be used shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the falsework, means of protecting existing construction which supports falsework, and typical soil conditions.
- D. The CONTRACTOR shall submit placement drawings showing the location and type of all joints for each structure.
- E. Prior to production of the waterstop materials required under this SECTION, qualification samples of waterstops shall be submitted which represent in all respects the material proposed. Such samples shall consist of extruded or molded sections of each size or shape to be used. The balance of the material to be used shall not be produced until after the FWC has reviewed the qualification samples.
- F. Prior to use of the waterstop material in the field, a sample of a prefabricated (shop made fitting) mitered cross and a tee constructed of each size or shape of material to be used shall be submitted. These samples shall be prefabricated (shop made fitting) so that the material and workmanship represent in all respects the fittings to be provided. Field samples of prefabricated (shop made fitting) fittings (crosses, tees, etc.) may also be selected at random by the FWC for testing by a laboratory at the FWC's expense. When tested, tensile strength across the joints shall be at least 1120 psi.
- G. The CONTRACTOR shall submit MANUFACTURER's information demonstrating compliance with requirements for the following:
 - 1. Form ties and related accessories, including taper tie plugs, if taper ties are used
 - 2. Form gaskets
 - 3. Form release agent, including NSF certification if not using mineral oil
 - 4. List of form materials and locations for use
 - 5. Bearing Pads
 - 6. Neoprene Sponge
 - 7. Preformed Joint Filler
 - 8. Backing Rod
 - 9. Bond Breaker
 - 10. Waterstops
 - 11. Slip Dowels
 - 12. PVC Tubing

1.05 QUALIFICATIONS: Every person responsible for waterstop installation is required to have a current individual Certification from the waterstop MANUFACTURER on file with the FWC, which states said individuals are certified and trained to install waterstop per MANUFACTURER's recommendations and specifications.

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR is fully responsible for the design and construction of all forms and falsework to be in compliance with all applicable OSHA requirements, and the requirements of all agencies having jurisdiction on the project. The submission of design details and calculations for falsework is for information only.
- B. The CONTRACTOR shall prepare adhesion and cohesion test specimens for construction joint sealant as required herein, at intervals of 5 working days while sealants are being installed.
- C. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:
 - 1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1-inch. Coated spacers (2-inch by 1-1/2-inch by 1/2-inch) shall be used to insure sealant cross-sections of 1/2-inch by 2 inches with a width of 1-inch.
 - 2. Sealant shall be cast and cured according to MANUFACTURER's recommendations except that curing period shall be not less than 24 hours.
 - 3. Following curing period, the gap between blocks shall be widened to 1-1/2-inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.07 CERTIFICATIONS:

- A. Form materials, which may remain or leave residues on or in the concrete, shall be certified as compliant with NSF 61.
- B. Joint materials shall be certified as compliant with NSF 61.
- C. The CONTRACTOR shall submit certified test reports from the sealant MANUFACTURER on the actual batch of material being supplied indicating compliance with requirements herein before the sealant is used on the job.
- D. The CONTRACTOR shall provide copies of the Waterstop Welding Certifications provided by MANUFACTURER or authorized agent of MANUFACTURER for every person who is to be involved with waterstop installation.

1.08 INSPECTIONS:

- A. Falsework shall be inspected for conformance with the accepted submittal. No workers will be allowed to use falsework for access and no concrete placement to related forms will be permitted until the falsework is inspected by the CONTRACTOR for conformance with the submittals and appropriately tagged. No variations or alterations to falsework, as compared to the reference submittal, will be allowed without certification of the variation by the original Professional Engineer.
- B. All waterstop field joints shall be subject to rigid inspection, and no such WORK shall be scheduled or started without having made prior arrangements with the FWC for the required inspections. Not less than 24 hours advance notice shall be given for scheduling such inspections.
- C. Field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects, which would reduce the potential resistance of the material to water pressure at any point. Defective joints shall be replaced with material, which passes inspection; faulty material shall be removed from the site and properly disposed of.
- D. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:
 - 1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less

2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16-inch or 15 percent of material thickness, at any point, whichever is less
3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less
4. Misalignment of joint which results in misalignment of the waterstop in excess of 1/2-inch in 10 feet
5. Porosity in the welded joint as evidenced by visual inspection
6. Bubbles or inadequate bonding which can be detected with a penknife test (If, while prodding the entire joint with the point of a penknife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)
7. Visible signs of separation when the cooled splice is bent by hand at any sharp angle
8. Any evidence of burned material

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 FORM AND FALSEWORK MATERIALS:

- A. Except as otherwise expressly accepted by the FWC, lumber brought on the Site for use as forms, shoring, or bracing shall be new material. Forms shall be smooth surface forms and shall be of the following materials:
 - Walls - Steel, fiberglass, or plywood panel
 - Columns - Steel, plywood, PVC, fiberglass, or spiral wound fiber forms
 - Roof and floor - Plywood
 - All other work - Steel panels, fiberglass, or plywood
- B. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:
 1. Plywood shall be new, waterproof, synthetic resin bonded, exterior type, manufactured especially for concrete formwork and shall conform to Plyform Class I, B-B EXT, of PS-1, and shall be edge sealed.
 2. Lumber shall be Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with PS 20.
 3. Form materials shall be metal, wood, plywood, or other material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade indicated. Metal forms shall accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO EXT Grade.
- C. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4-inch chamfers or be tooled to 1/2-inch radius. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.
- D. Forms and falsework to support the roof and floor slabs shall be designed in accordance with ACI 347.

2.02 FORM TIES:

- A. Ties shall be standard crimped snap ties with one-inch (1") snapback. Ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or

of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form ties for water-retaining structures shall have integral waterstops that tightly fit the form tie so that they cannot be moved from mid-point of the tie.

- B. Removable taper ties may be used when approved by the FWC. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

2.03 FORM RELEASING AGENT: Form release agent shall be non-staining and shall leave no residues on or in the concrete unless certified as compliant with NSF 61 and shall not adversely affect the adhesion of paint or other coatings.

2.04 WATERSTOPS:

A. PVC Waterstops:

1. PVC Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of this SECTION. No reclaimed or scrap material shall be used. The CONTRACTOR shall obtain from the waterstop MANUFACTURER and shall furnish to the FWC for review, current test reports and a written certification of the MANUFACTURER that the material to be shipped to the job meets the physical requirements as outlined in the USACE CRD-C572, and those listed herein.
2. Flatstrip and Center-Bulb Waterstops: The thickness of waterstops, including the center bulb, shall not be less than 3/8-inch. Waterstop shall be provided with factory installed hog rings at 12 inches on centers along the waterstop.
3. Multi-Rib Waterstops: Multi-rib waterstops where required shall have prefabricated (shop made fitting) joint fittings at all intersections of the ribbed-type waterstops.
4. Retrofit Waterstops: Retrofit waterstops and batten bars shall be manufactured as a complete system including waterstop, SS batten bar, SS anchor bolts, and epoxy gel.
5. Waterstop Testing Requirements: When tested in accordance with the test standards, the waterstop material shall meet or exceed the following requirements:

<u>Property</u>	<u>Value</u>	<u>ASTM Standard</u>
<u>Physical Property, Sheet Material</u>		
Tensile Strength-min (psi)	2000	D 638, Type IV
Ultimate Elongation-min (percent)	350	D 638, Type IV
Low Temp Brittleness-max (degrees F)	-35	D 746
Stiffness in Flexure-min (psi)	600	D 747
<u>Accelerated Extraction (CRD-C572)</u>		
Tensile Strength-min (psi)	1500	D 638, Type IV
Ultimate Elongation-min (percent)	300	D 638, Type IV
<u>Effect of Alkalies (CRD-C572)</u>		
Change in Weight (percent)	+ 0.25/- 0.10	-----
Change in Durometer, Shore A	+/- 5	D 2240
<u>Finish Waterstop</u>		
Tensile Strength-min (psi)	1400	D 638, Type IV
Ultimate Elongation-min (percent)	280	D 638, Type IV

B. Pre-formed Hydrophilic Waterstops:

1. Hydrophilic (bentonite-free) waterstops shall be the type that expands in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.
2. Waterstop shall be manufactured from chloroprene rubber and modified chloroprene rubber with hydrophilic properties. Waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete. The minimum expansion ratio of modified chloroprene shall be not less than 2 to 1 volumetric change in distilled water at 70 degrees F (21 degrees C).
3. Hydrophilic Waterstop shall meet the following minimum requirements:

Property	Value	ASTM Standard
<u>Physical Property, Chloroprene</u>		
Tensile Strength-min (psi)	1275	D 412
Ultimate Elongation-min (percent)	350	D 412
Hardness, Shore A	55 +/- 5	D 2240
<u>Physical Property, Modified Chloroprene</u>		
Tensile Strength-min (psi)	300	D 412
Ultimate Elongation-min (percent)	600	D 412
Hardness, Shore A	55 +/- 5	D 2240

4. Bonding agent for hydrophilic waterstop shall be the MANUFACTURER's recommended adhesive for wet, rough concrete.

C. Other Types of Waterstops:

1. When types of waterstops not listed above are indicated, they shall be subjected to the same requirements as those listed herein.

2.05 JOINT SEALANT FOR WATER BEARING JOINTS:

- A. Joint sealant shall be polyurethane polymer designed for bonding to concrete, which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.

- B. Joint sealant material shall meet the following requirements (73 degrees F and 5percent R.H.):

Requirement	Value	ASTM Standard
Work Life (minutes)	45 - 180	-----
Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity) - max (hours)	24	-----
Ultimate Hardness	20 - 45 Shore "A"	D 2240
Tensile Strength - min (psi)	175	D 412
Ultimate Elongation - min (percent)	400	D 412
Tear Resistance - min (pounds per inch of thickness)	75	D 624 (Die C)
Color	Light Gray	-----

- C. Polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:

1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ASTM C 920, or TT-S-0227 E(3) for 2-part material, as applicable.
2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ASTM C 920 Class 25, Grade NS, or TT-S-0227 E(3), Type II, Class A.

3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ASTM C 920 Class 25, Grade P, or TT-S-0227 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.
 4. Primer materials, if recommended by the sealant MANUFACTURER, shall conform to the printed recommendations of the MANUFACTURER.
- D. Sealants for non-waterstop joints in concrete shall conform to SECTION 07920.

2.06 JOINT MATERIALS:

- A. Bearing Pad: Bearing pad shall be neoprene conforming to ASTM D 2000, BC 420, 40 durometer hardness unless otherwise indicated.
- B. Neoprene Sponge: Sponge shall be neoprene, closed-cell, expanded, conforming to ASTM D 1056, Type 2C5-E1.
- C. Joint Filler
 1. Joint filler for expansion joints in waterholding structures shall be neoprene conforming to ASTM D1056, Type 2C5-E1.
 2. Joint filler material in other locations shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752, for Type I, except as otherwise indicated.

2.07 BACKING ROD: Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at eight (8) psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.08 BOND BREAKER:

- A. Bond breaker shall contain a fugitive dye so that areas of application will be readily distinguishable.
- B. Bonding agent for hydrophilic waterstop shall be the MANUFACTURER's recommended adhesive for wet, rough concrete.

2.09 SLIP DOWELS: Slip dowels in joints shall be smooth epoxy-coated bars, conforming to ASTM A 775.

2.10 PVC TUBING: PVC tubing in joints shall be Schedule SDR 13.5, conforming to ASTM D 2241.

2.11 CHAMFER STRIP: Provide three quarter inch triangular fillets, milled clear straight grained wood, surfaced each side, or extruded vinyl type, with or without nail flange to form all exposed concrete edges such as columns, pilasters, beams, curbs, equipment pads, tops of walls, and as indicated. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4" chamfers. Re-entrant corners in concrete members shall not have fillets, unless otherwise indicated.

PART 3 - EXECUTION

3.01 FORMS:

- A. Forms shall conform to the shape, lines, and dimensions as shown on the Drawings and shall be substantial and sufficiently tight to prevent leakage. Forms shall be properly braced or tied so as to maintain position and shape. Plumb and string lines shall be installed before concrete placement and

shall be maintained during placement. Such lines shall be used by CONTRACTOR's personnel and by the FWC and shall be in sufficient number and properly installed. During concrete placement, the CONTRACTOR shall continually monitor plumb and string line form positions and immediately correct deficiencies.

- B. The CONTRACTOR shall be fully responsible for the adequacy of the formwork in its entirety and any forms that are unsafe or inadequate in any respect shall promptly be removed from the WORK and replaced. The CONTRACTOR shall provide worker protection from protruding reinforcement bars in accordance with applicable safety codes.
- C. The CONTRACTOR may reuse forms only if in good condition and only if acceptable to the FWC. Reused forms shall be thoroughly cleaned and may require light sanding between uses to obtain a uniform surface texture on all exposed concrete surfaces. Forms shall not be reused if they have developed defects that would affect the surface texture of exposed concrete. Exposed concrete surfaces are defined as surfaces, which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the FWC.
- D. Forms shall be sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.
- E. Immediately before the placing of reinforcing, faces of all forms in contact with concrete shall receive a thorough coating of form release agent. Any excess agent shall be satisfactorily removed before placing concrete. If using mineral oil, the CONTRACTOR shall oil the forms at least two weeks in advance of their use. Care shall be exercised to keep oil/release agent off the surfaces of steel reinforcement and other items to be embedded in concrete.
- F. The CONTRACTOR shall supply sufficient number of forms of each kind to permit the required rate of progress to be maintained.
- G. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state, and Federal regulations.

3.02 WATERSTOPS:

- A. Waterstops shall be embedded in the concrete across joints as indicated. Waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of MANUFACTURER of the waterstops. The CONTRACTOR shall take suitable precautions and means to support and protect the waterstops during the progress of the WORK and shall repair or replace at its own expense any waterstops damaged during the progress of the WORK. Waterstops shall be stored so as to permit free circulation of air around the waterstop material.
- B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.03 SPLICES IN PVC WATERSTOPS:

- A. Splices in PVC waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the MANUFACTURER's printed recommendations. It is essential that:
 - 1. The material not be damaged by heat sealing.
 - 2. The splices have a tensile strength of not less than 80 percent of the unspliced material tensile strength.

3. The continuity of the waterstop ribs and of its tubular center axis be maintained. No edge welding is allowed.
- B. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.
- C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated (shop made fitting) prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated (shop made fitting) waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.
- D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.04 FORM DESIGN:

- A. Forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete.
- B. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement, and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1- to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form.
- C. The CONTRACTOR shall provide adequate clean-out holes at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the FWC. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, form windows shall be provided in the size and spacing needed to allow placement of concrete to the requirements of SECTION 03300. The size, number, and location of such form windows shall be as acceptable to the FWC.

3.05 FORM CONSTRUCTION:

- A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is indicated. Not less than 1-inch of concrete shall be added to the indicated thickness of a concrete member, where concrete is permitted to be placed against trimmed ground, in lieu of forms. Permission to do this on other concrete members will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.
- B. Construction Joints: Concrete construction joints will not be permitted at locations other than those indicated, except as may be acceptable to the FWC. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.
- C. Form Ties
 1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with

mortar. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties, which cause spalling of the concrete upon form stripping or tie removal, will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls, which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout, which shall match the color and texture of the surrounding wall surface.

3.06 JOINT CONSTRUCTION:

A. Setting Waterstops:

1. In order to eliminate faulty installation that may result in joint leakage, the CONTRACTOR shall be particularly careful to get the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during the progress of the WORK and to insure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints.
2. In placing PVC waterstops in the forms, the CONTRACTOR shall provide means to prevent the waterstop from being folded over by the concrete as it is placed. Waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through hog rings at the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, the CONTRACTOR shall work concrete under the waterstops by hand so as to avoid the formation of air and rock pockets.
3. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.
4. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to a future concrete placement.

B. Joint Location:

1. Construction joints and other types of joints shall be provided where indicated. When not indicated, construction joints shall be provided at 25-foot maximum spacing for all concrete construction. Where joints are indicated spaced greater than 40 feet apart, additional joints shall be provided to maintain the 25-foot maximum spacing. The location of all joints, of any type, shall be submitted for acceptance by the FWC.

C. Joint Preparation:

1. The CONTRACTOR shall take special care in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required. Unless otherwise indicated, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with

the requirements of SECTION 03300. Except on horizontal wall construction joints, wall to slab joints, or where otherwise indicated, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as indicated herein.

D. Retrofit Joint Preparation:

1. Existing surfaces to receive a retrofit waterstop shall be clean and free from any loose or foreign material. Surface shall be given a light sandblast or hydroblast finish to 1/8-inch amplitude prior to application of epoxy and waterstop.

E. Construction Joint Sealant:

1. Construction joints in water-bearing floor slabs, and elsewhere as indicated, shall be provided with tapered grooves which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sandblasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. The primer shall be furnished by the sealant MANUFACTURER. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.
2. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the MANUFACTURER, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. Sealant shall achieve final cure at least 7 days before the structure is filled with water.
3. Sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations.
4. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, the CONTRACTOR shall arrange to have the crew doing the WORK carefully instructed on the proper method of mixing and application by a representative of the sealant MANUFACTURER.
5. Any joint sealant which fails to fully and properly cure after the MANUFACTURER's recommended curing time for the conditions of the WORK hereunder shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the indicated joint sealant. Costs of such removal, joint treatment, re-sealing, and appurtenant WORK shall be the CONTRACTOR's responsibility.

F. Hydrophilic Waterstop

1. Where a hydrophilic waterstop is called for in the Contract Documents, it shall be installed with the MANUFACTURER's instructions and recommendations except as modified herein.
2. When requested by the FWC, the CONTRACTOR shall arrange for the MANUFACTURER to furnish technical assistance in the field.
3. Hydrophilic waterstop shall only be used where complete confinement by concrete is provided. Hydrophilic waterstop shall not be used in expansion or contraction joints or in the first 6 inches of any non-intersecting joint.
4. The hydrophilic waterstop shall be located as near as possible to the center of the joint and it shall be continuous around the entire joint. The minimum distance from the edge of the waterstop to the face of the member shall be 5 inches.

5. Where the thickness of the concrete member to be placed on the hydrophilic waterstop is less than 12 inches, the waterstop shall be placed in grooves formed or ground into the concrete. The groove shall be at least 3/4 inch deep and 1-1/4 inches wide. When placed in the groove, the minimum distance from the edge of the waterstop to the face of the member shall be 2.5 inches.
6. Where a hydrophilic waterstop is used in combination with PVC waterstop, the hydrophilic waterstop shall overlap the PVC waterstop for a minimum of 6 inches and shall be adhered to PVC waterstop with single component water-swelling sealant as recommended by MANUFACTURER.
7. The hydrophilic waterstop shall not be installed where the air temperature falls outside the MANUFACTURER's recommended range.
8. The concrete surface under the hydrophilic waterstop shall be smooth and uniform. The concrete shall be ground smooth if needed. Alternately, the hydrophilic waterstop shall be bonded to the surface using an epoxy grout which completely fills all voids and irregularities beneath the waterstop material. Prior to installation, the concrete surface shall be wire brushed to remove any laitance or other materials that may interfere with the bonding of epoxy.
9. The hydrophilic waterstop shall be secured in place with concrete nails and washers at 12-inch maximum spacing. This shall be in addition to the adhesive recommended by the MANUFACTURER

G. Retrofit Waterstop:

1. Retrofit waterstops shall be set in a bed of epoxy over a sandblasted surface with stainless steel batten bars and 1/4-inch diameter stainless steel anchors at 6 inches on center, staggered, and in accordance with the MANUFACTURER's written recommendations.

3.07 REMOVAL OF FORMS:

- A. Careful procedures for the removal of forms shall be strictly followed, and this WORK shall be done with care so as to avoid injury to the concrete or workers. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength (0.75f'c) in SECTION 03300. No forms shall be disturbed or removed under an individual panel or unit before the concrete in all the adjacent panels or units have attained 0.75f'c strength and have been in place for a minimum of 7 days. The time required to establish said strength shall be determined by the FWC, who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time shall be used as the minimum length of time. Forms for vertical walls of waterholding structures shall remain in place at least 36 hours after the concrete has been placed.
- B. Forms for parts of the WORK not specifically mentioned herein shall remain in place for periods of time as recommended in ACI 347.

3.08 FALSEWORK:

- A. The CONTRACTOR shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements herein.
- B. The CONTRACTOR shall design and construct falsework to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.

- C. The CONTRACTOR shall place falsework upon a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, the maximum calculated pile loading shall be as recommended by the CONTRACTOR's geotechnical engineer and shall not exceed 20 tons. When falsework is supported on any portion of the structure which is already constructed, the load imposed by the falsework shall be spread, distributed, and braced in such a way as to avoid any possibility of damage to the structure.

3.09 TOLERANCES:

- A. The variation from plumb, level and required lines shall not exceed 1/4-inch in any ten feet (10') of length, non cumulative, and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the tolerances of ACI 117 - Standard Tolerances for Concrete Construction and Materials.

END OF SECTION

SECTION 03200 CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, materials and equipment to provide and properly place all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in the reinforced concrete and masonry construction and all appurtenant work, including all the wires, clips, supports, chairs, spacers, and other accessories as shown on the Drawings and as specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Concrete Institute (ACI):
 - a. 318 - Building Code Requirements for Reinforced Concrete
 - b. SP-66 - Detailing Manual
 - 2. American Society of Testing and Materials (ASTM):
 - a. A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
 - b. A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
 - c. A555 - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods]
 - d. A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - e. A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars
 - f. A955/A955M - Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement]
 - 3. Concrete Reinforcing Steel Institute (CRSI):
 - a. Recommended Practice for Placing Reinforcing Bars
 - 4. Florida Building Code, Latest Edition

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: Submittals shall be in accordance with SECTION 01300. The CONTRACTOR shall submit the following:

- A. Mill Certifications of Grade 60 reinforcing steel or stainless steel, as required
- B. Complete bar schedule, bar details and erection drawings in conformance with ACI SP-66
- C. Mill certificates shall be delivered with each shipment of reinforcing bars.

1.05 QUALIFICATIONS: (Not Applicable)

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall perform Pull tests to 50 percent of five percent of drilled dowels, randomly selected by the FWC. If any tested dowels slip or yield, an additional five percent of drilled dowels shall be tested until an entire five percent sample is tested without slipping or yielding.

1.07 CERTIFICATIONS:

- A. International Code Council Evaluation Service (ICC-ES) Certifications for mechanical couplers, if allowed
- B. Mill Certifications of Grade 60 reinforcing steel

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide sufficient notice and opportunity to the FWC to review the placement of the reinforcing steel before the concrete is placed. The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 REINFORCING BARS:

- A. Metal reinforcement shall be deformed type bars conforming to ASTM A615, Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Grade 60, unless otherwise specified. Reinforcing steel shall be fabricated for the shapes and dimensions indicated on the Drawings and in compliance with ACI 318. All bars shall be bent cold.
- B. Replace all reinforcement with bends and kinks not shown on fabrication Shop Drawings. Remove from job Site all such reinforcing and replace with new fabricated steel. Field bending of reinforcement at the work Site is prohibited.
- C. Welded wire fabric reinforcement shall conform to the requirements of ASTM A185, and the details indicated. Do not use fabric that has been rolled. Install flat sheets only.
- D. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A82.
- E. Mechanical couplers shall be provided where indicated and where approved by the FWC. The couplers shall develop a tensile strength that exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be provided. This shall apply to all mechanical splices, including those splices intended for future connections. Reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.
- F. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements in SECTION 03600.
- G. Reinforced concrete construction in marine or coastal areas, or any location with high chloride exposure, shall use Grade 60 stainless steel reinforcing bar, which shall conform to the requirements of ASTM A955 and applicable UNS designation (see Table 03200-1 for approved alloys).

**Table 03200-1
Approved Stainless Steel Alloys for Reinforcing Bars**

Common or Trade Name	Type 316, Low Carbon, Nitrogen Added	Type 2205 Duplex	Nitronic 50
AISI Type	316LN	2205	XM-19
UNS Designation	S31653	S31803	S20910
Required Minimum Tensile Strength	90 ksi	90 ksi	90 ksi
Required Minimum 0.2% Offset Yield Strength	60 ksi	60 ksi	60 ksi
Required Minimum Elongation in 2-inches	25%	25%	25%
Required Condition	As Rolled	As Rolled	As Rolled
Required Finish	Per ASTM A955, descaled and white pickled	Per ASTM A955, descaled and white pickled	Per ASTM A955, descaled and white pickled

2.02 ACCESSORIES: All chairs and bolsters shall conform to ACI SP-66 and the CRSI Manual of Standard Practices and shall have galvanized or plastic legs.

PART 3 - EXECUTION

3.01 PLACEMENT AND ANCHORAGE:

- A. Bar supports shall be spaced in accordance with CRSI.
 - 1. Reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers that are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. Concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties that are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall provide concrete, metal, plastic, or other acceptable bar chairs and spacers.
 - 2. Limitations on the use of bar support materials shall be as follows.
 - a. Concrete Dobbies: permitted at all locations except where architectural finish is required.
 - b. Wire Bar Supports: permitted only at slabs over dry areas, interior non-hydraulic wall surfaces, and exterior wall surfaces.
 - c. Plastic Bar Supports: permitted at all locations except on grade.
- B. Reinforcement shall be accurately placed in accordance with the Drawings and shall be adequately secured in position with not less than 16-gauge annealed wire. The placement tolerances shall be in accordance with ACI 318, paragraph 7.5, Placing Reinforcement and the CRSI Manual of Standard Practices.
- C. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.
- D. Bars additional to those indicated which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at its own expense.

- E. Additional reinforcement around openings:
 - 1. Place an equivalent area of steel around pipe or opening and extend on each side and top and bottom sufficiently to develop bond in each bar.
 - 2. Refer to details on Drawings for bar extension length on each side of opening.
 - 3. Where welded wire fabrics are used, provide extra reinforcing using fabric or deformed bars.
- F. Unless otherwise indicated, reinforcement placing tolerances shall be within the limits in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.
- G. Bars may be moved as necessary to avoid interference with other reinforcement steel continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane indicated.
- H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than three (3) feet on centers in any direction. Welded wire fabric shall not be placed on the ground and hooked into place in the freshly placed concrete.
- I. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters. Slab bolsters shall be spaced not more than 30-inches on center. The construction practice of placing welded wire fabric on the ground and hooking it into place in the freshly placed concrete shall not be used.
- J. Stainless steel reinforcing bar shall be shipped, handled, and placed such that it does not come into direct contact with carbon steel. Tie wires and bar chairs shall be stainless steel or non-metallic. Nylon, PVC, or polyethylene spacers shall be used where stainless steel bar must be attached to carbon steel, to maintain a minimum 1-inch clearance.

3.02 CONCRETE COVER: The concrete cover over reinforcement shall conform to ACI 318, paragraph 7.7, Concrete Protection for Reinforcement, unless otherwise indicated. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.

3.03 SPLICING:

- A. All lap splices of bar reinforcement shall be as indicated and conform to Chapter 12 of ACI 318 or as otherwise approved by the FWC. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.
- B. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each two running feet. Wires shall be staggered and tied in such a manner that they cannot slip.
- C. Splices in column spiral reinforcement, when necessary, shall be made by a lap of 1-1/2 turns.
- D. Reinforcing shall not be straightened or rebent in a manner which will injure the material. Bars shall be bent or straight as indicated. Do not use bends different from the bends indicated. Bars shall be bent cold, unless otherwise permitted by the FWC. No bars partially embedded in concrete shall be field-bent except as indicated or specifically permitted by the FWC.
- E. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as indicated. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of 1/2-inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged.

3.04 CLEANING AND PROTECTION:

- A. Unless indicated otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing indicated for the adjacent section.
- B. Reinforcement shall be free of all materials that will reduce bond.
- C. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.
- D. The surfaces of reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be re-inspected and, if necessary, re-cleaned or sandblasted.
- E. Properly cap all vertical reinforcement steel if area is subject to having workers above the reinforcement area.

3.05 INSTALLATION OF DRILLED REINFORCING STEEL DOWELS: For drilling and grouting information see SECTION 03600.

END OF SECTION

SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE:

- A. The WORK of this SECTION consists of furnishing all labor, equipment, supplies, and materials necessary for the proper placement, curing, finishing, protection, and repair of the cast-in-place concrete required by the Contract Documents.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 01410 – Testing and Quality Control
 - 3. SECTION 02200 – Earthwork
 - 4. SECTION 03050 – Concrete Admixture Waterproofing
 - 5. SECTION 03100 – Concrete Formwork and Accessories
 - 6. SECTION 03200 – Concrete Reinforcement
 - 7. SECTION 03600 – Grout

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Concrete Institute (ACI)
 - a. 117 - Specification for Tolerances for Concrete Construction and Materials
 - b. 301 – Specifications for Structural Concrete for Buildings
 - c. 304.2R - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
 - d. 305 - Committee Report on Hot-Weather Concreting
 - e. 306 - Committee Report on Cold-Weather Concreting
 - f. 308 - Standard Practice for Curing Concrete
 - g. 309 – Guide for Consolidation of Concrete
 - h. 318 - Building Code Requirements for Reinforced Concrete
 - i. 350 – Code Requirements for Environmental Engineering Concrete Structures
 - 2. American Society for Testing and Materials (ASTM):
 - a. C31 - Making and Curing Concrete compression and Flexure Test Specimens in the Field
 - b. C33 – Standard Specification for Concrete Aggregates
 - c. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - d. C94 - Standard Specification for Ready-Mixed Concrete
 - e. C127 – Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate

- f. C128 – Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate
 - g. C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
 - h. C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
 - i. C150 – Standard Specification for Portland Cement
 - j. C156 - Test Method for Water Retention by Concrete Curing Materials
 - k. C157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
 - l. C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
 - m. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 - n. C260 – Standard Specification for Air Entraining Admixtures for Concrete
 - o. C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - p. C494 - Standard Specification for Chemical Admixtures for Concrete
 - q. C566 – Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
 - r. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
 - s. C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 - t. C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Laboratory Evaluation
 - u. C1157 – Standard Performance Specification for Hydraulic Cements
 - v. C1240 - Standard Specification for Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
 - w. D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
 - x. D2419 – Standard Test Methods for Sand Equivalent Value of Soils and Fine Aggregate
 - y. E96 - Standard Test Methods for Water Vapor Transmission of Materials
 - z. E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
3. Federal Specifications
 - a. UU-B-790A - Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant)
 4. Florida Building Code and Local Building Codes as appropriate
 5. Florida Department of Transportation (FDOT)
 - a. Standard Specifications for Road and Bridge Construction, latest edition.

1.03 DEFINITIONS:

- A. Structural Concrete: Concrete to be used in all cases except where indicated otherwise in the Contract Documents.

- B. Pea Gravel Concrete: Concrete in thin sections and areas with congested reinforcing, at the option of the CONTRACTOR and with written approval of the FWC for the specific location.
- C. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground pipe encasement, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise indicated.
- D. Lean Concrete: Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles that are indicated on the Drawings as unreinforced. Lean concrete shall be used as protective cover for dowels intended for future connection.
- E. Tremie Concrete: Concrete placed underwater.
- F. Hydraulic Structure: A concrete structure for the containment, treatment, or transmission of water, wastewater, other fluids, or gases.

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. Mix Designs:
 - 1. Prior to beginning the WORK and within 14 days after issuance of the Notice to Proceed, the CONTRACTOR shall submit preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete. Mix designs shall be tested by an independent testing laboratory acceptable to the FWC. All costs related to such testing shall be CONTRACTOR'S responsibility. Since laboratory trial batches require 35 calendar days to complete, the CONTRACTOR shall test a minimum of two mix designs for each class of concrete.
 - 2. Test data relating to the cement, aggregate, and admixtures shall be less than six months old. Furnish the submittals in accordance with ACI 301 for the following:
 - a. Mill tests for cement
 - b. Admixture certification. Chloride ion content shall be included.
 - c. Aggregate gradation test results and certification
 - 3. Where ready-mix concrete is used, the CONTRACTOR shall furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the Site for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the Site, when unloading began, and when unloading was finished.
- C. Other
 - 1. The CONTRACTOR shall submit materials and methods for curing.
 - 2. The CONTRACTOR shall submit product specifications, data, and installation instructions for all miscellaneous products called for in this specification.
 - 3. Tremie Concrete:
 - a. Placement Plan: The CONTRACTOR shall submit detailed plans for concrete placement, which shall include method and equipment used, pipe spacing, and location throughout the duration of placement, and the planned locations to be used for relocating pipes as placement progresses. The plan shall be submitted at least 20 days prior to

commencing of concrete placement. No concrete shall be placed until the CONTRACTOR has received written approval from the FWC.

- b. Placement Procedures: The CONTRACTOR shall submit placement procedures which include details of stable platform for support of tremie operations, and procedures for preventing water flowing across or through the underwater placement site during concreting.

1.05 QUALIFICATIONS: Truck mixers shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 CERTIFICATIONS AND TESTING:

A. General

1. Concrete and other materials for testing shall be furnished by the CONTRACTOR, and the CONTRACTOR shall assist the FWC in obtaining samples for QA testing at the discretion of the FWC, and disposal and cleanup of excess material.
2. The CONTRACTOR shall provide documentation for a testing laboratory that meets or exceeds the requirements of ASTM C1077.
3. The CONTRACTOR is responsible for all trial batch, laboratory, and shrinkage tests on cement, aggregates, and concrete.
4. The CONTRACTOR shall perform a minimum of one cylinder test set per every 150 cubic yards of concrete per day, one air test per cylinder test set, and one slump test per truck load of concrete.

B. Trial Batch and Laboratory Tests

1. Tests for determining slump shall be in accordance with the requirements of ASTM C143.
2. Testing for aggregate shall include sand equivalence, reactivity, organic impurities, abrasion resistance, and soundness, according to ASTM C33.
3. A testing laboratory approved by the FWC shall prepare a trial batch of each class of concrete, based on the preliminary concrete mixes submitted by the CONTRACTOR. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments will be considered refinements to the mix design and will not be the basis for extra compensation to the CONTRACTOR. Concrete shall conform to the requirements of this SECTION, whether the aggregate proportions are from the CONTRACTOR'S preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement, and admixture proposed for the Project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage, and 6 compression test specimens from each batch.
4. The determination of compressive strength shall be made in accordance with ACI 318, Section 5.3.
5. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C136. Values shall be given for percent passing each sieve.
6. The final selection of the Tremie Concrete mix design shall be based upon test placements underwater in a placement box or in a pit that can be de-watered after placement. Test

placements shall be examined for concrete flatness, amount of laitance present, quality of concrete at the extreme flow distance of the test. The FWC shall determine the acceptance or rejection of the mix based on the results of the test.

C. Shrinkage Tests:

1. Drying shrinkage tests shall be performed for the trial batches, the first placement of each class of structural concrete, and during construction to insure continued compliance with these Specifications.
2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gauge length of 10-inches; fabricated, cured, dried, and measured in accordance with ASTM C157, modified as follows: specimens shall be removed from molds at an age of 23 plus or minus one (1) hours after trial batching, shall be placed immediately in water at 70 degrees F plus or minus three (3) degrees F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F plus or minus three (3) degrees F. Measurement to determine expansion expressed as a percentage of original length shall be made at age seven (7) days. This length at age seven (7) days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F plus or minus three (3) degrees F and 50 percent plus or minus four (4) percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after seven (7) days of moist curing.
3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the Project.
4. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21 day drying age or at 28 day drying age shall be 0.036 percent or 0.042 percent, respectively. Standard deviation will not be considered. The CONTRACTOR shall only use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to structural concrete.
5. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.
6. If the required shrinkage limitation is not met during construction, the CONTRACTOR shall take any or all of the following actions to reestablish compliance. These actions may include changing the source of aggregates, cement and/or admixtures; reducing water/cement ratio; washing of coarse and/or fine aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

D. Field Tests

1. The responsibility to retain the services of an independent testing laboratory shall be as defined in SECTION 01410.
2. The CONTRACTOR shall pay the cost of any additional tests and investigation on WORK that does not meet the specifications.
3. Tests on pumped concrete shall be taken at the point of final placement.

4. Compressive Test: Compressive test specimens shall be taken during construction from the first placement of each class of concrete placed each day and for each 150 cubic yards or fraction thereof each day.
 - a. Each set of test specimens shall consist of five (5) cylinders. Specimens shall be made in accordance with ASTM C31. Specimens shall be 6-inch diameter by 12-inch high cylinders.
 - b. Compression tests shall be performed in accordance with ASTM C39. Two (2) cylinders shall be broken at seven (7) days and two (2) at 28 days, and the remaining cylinder shall be held to verify test results, if needed.
 - c. The acceptance of the test results shall be the average of the strengths of the two specimens tested at 28 days as per ACI 318. Evaluation and acceptance of the concrete shall be per ACI 318, Chapter 5.
5. Slump Tests: One (1) slump test shall be taken per truckload in accordance with ASTM C143.
6. Air Content: Air content shall be determined for each compressive test taken in accordance with ASTM C231 or by ASTM C173.
7. Aggregate testing shall be made every 12 months during construction to insure continued compliance with these Specifications.
8. Concrete that fails to meet the ACI requirements and these Specifications is subject to removal and replacement.
9. Temperature: Concrete temperature shall be recorded in accordance with ASTM C1064.
10. During placement of concrete underwater, sampling and testing of slump, air content, and temperature shall be taken every hour, or for every 200 cubic yards of concrete placed. Sounding in various locations shall also be conducted at the same interval.

1.08 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - MATERIALS

2.01 GENERAL:

- A. All materials shall be classified as acceptable for potable water use according to NSF Standard 61.
- B. Cement for concrete that will contact potable water shall not be obtained from kilns that burn metal rich hazardous waste fuel.
- C. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Cement reclaimed from cleaning bags or leaking containers shall not be used. Cement shall be used in the sequence of receipt of shipments.
- D. Materials shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.
- E. Storage of materials shall conform to the requirements of Section 205 of ACI 301.

2.02 CEMENT:

- A. Cement shall be standard Portland Cement Type II conforming to ASTM C150 and C1157.
- B. A minimum of 85 percent of cement by weight shall pass a 325 screen.
- C. A single brand of cement shall be used throughout the WORK, and prior to its use, the brand shall be accepted by the FWC.

- D. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the FWC, if requested, regarding compliance with these Specifications.

2.03 AGGREGATES:

- A. Aggregates shall be obtained from pits acceptable to the FWC, shall be non-reactive, and shall conform to the requirements of ASTM C33.
- B. When tested in accordance with ASTM C33, the loss resulting after five (5) cycles of the soundness test, shall not exceed ten (10) percent for fine aggregate and twelve (12) percent for coarse aggregate, when using sodium sulfate.
- C. When tested in accordance with ASTM C33, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.
- D. Course Aggregates:
 - 1. Coarse aggregates shall be crushed stone, gravel or other approved inert material having clean, hard, durable, uncoated particles conforming to ASTM C33.
 - 2. The coarse aggregates shall be prepared and handled in two (2) or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete, the 2 size groups shall be combined.
 - 3. When tested in accordance with ASTM C33, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.
- E. Fine Aggregates:
 - 1. Fine aggregates shall be clean sand conforming to ASTM C33.
 - 2. When tested in accordance with ASTM D2419, the sand equivalency shall not be less than 75 percent for an average of three (3) samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C33 when tested in accordance with ASTM C136 for the fineness modulus of the sand used, including the optional grading in Section 6.2. The fineness modulus of sand used shall not be over 3.1.
 - 3. When tested in accordance with ASTM C33, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.

2.04 WATER:

- A. The water used in the concrete mix and for curing shall be clean, potable, and in accordance with ACI 318. Water shall be free from objectionable quantities of silty organic matter, alkali, salts, and other impurities.
- B. The water shall be considered potable, for the purposes of this SECTION only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.

2.05 ADMIXTURES:

- A. General: All admixtures shall be compatible and be furnished by a single MANUFACTURER capable of providing qualified field service representation. Admixtures shall be used in accordance with MANUFACTURER's recommendations. If the use of an admixture is producing an inferior end result, the CONTRACTOR shall discontinue use of the admixture. Admixtures shall not contain thiocyanates or more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.
- B. Air Entraining Admixtures:

1. Air entraining admixture shall conform to ASTM C260. Air content shall be tested at the point of placement.
 2. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.
 3. Sufficient air-entraining agent shall be used to provide a total air content of 4 percent. Concrete floors to receive a shake-on floor hardener shall have an air content not to exceed three (3) percent or as recommended by the hardener MANUFACTURER. Tremie Concrete shall have an air content of 3 percent plus or minus 1 1/2 percent.
- C. Set Controlling and Water Reducing Admixtures:
1. Admixtures may be added at the CONTRACTOR'S option, subject to the FWC's approval, to control the set, effect water reduction, and increase workability. The cost of adding an admixture shall be the CONTRACTOR'S responsibility. Concrete containing an admixture shall be first placed at a location determined by the FWC. Admixtures shall conform to the requirements of ASTM C494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.
 2. Concrete shall not contain more than one water-reducing admixture.
 3. Set retarding admixture may be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently greater than 80 degrees F, a set retarding admixture shall be used. Set retarding admixture shall conform to ASTM C494 Type B or D.
 4. Set accelerating admixture may be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently less than 40 degrees F, a non-corrosive set accelerating admixture shall be used. Set accelerating admixture shall conform to ASTM C494 Type C or E.
 5. Normal range water reducer shall conform to ASTM C494, Type A. The quantity of admixture used and the method of mixing shall be in accordance with the MANUFACTURER's instructions and recommendations.
 6. High range water reducer shall conform to ASTM C494, Type F or G. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than fourteen (14) ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating the water/cement ratio.
 - a. If the high range water reducer is added to the concrete at the Site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of three (3) inches plus or minus 1/2-inch prior to adding the high range water reducing admixture at the Site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the primary system.
 - b. Concrete shall be mixed at mixing speed for a minimum of 70 mixer revolutions or five (5) minutes after the addition of the high range water reducer, unless recommended otherwise by the MANUFACTURER.
- D. Crystalline Capillary Waterproofing Admixture (in accordance with SECTION 03050):
1. Crystalline Capillary Waterproofing (CCW) admixture shall be added to concrete structures in submerged conditions up to an elevation of 2 feet above the design high water level in accordance with SECTION 03050.
- F. Anti-washout admixture may be used for concrete placed underwater. The admixture shall be added at the MANUFACTURER's recommended dosage rate. The admixture shall be an aqueous solution and

the water in such solution shall be counted as mixing water for the purpose of determining the water cement ratio of the concrete. Trial batches shall be made to verify compatibility of the materials and mix design performance.

2.06 CURING MATERIALS:

- A. Curing compound shall conform to ASTM C309, Type I. Curing compound shall be white pigmented, resin based and compliant with local VOC requirements. When curing compound must be removed for finishes or grouting, it shall be of a dissipating type. Sodium silicate compounds shall not be allowed.
- B. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 grams per square centimeter of surface.
- C. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, have a minimum thickness of two (2) mils, and be permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.
- D. Polyethylene-coated burlap for use as concrete curing blanket shall be minimum 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 grams per square centimeter of surface.
- E. Curing mats for use in Curing Method 6 below, shall be heavy shag rugs or carpets or cotton mats quilted at 4-inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

2.07 MISCELLANEOUS MATERIALS:

- A. Damp proofing agent shall be an asphalt emulsion conforming to ASTM D1227, Type III, Class 1.
- B. Evaporation retardant shall create a monomolecular film on the concrete. The retardant shall have no effect on cement hydration and shall meet local VOC requirements. Evaporation retardant shall not affect adhesion of curing compounds or other treatments and shall not affect the color of the concrete.
- C. Reinforcement shall be per SECTION 03200.
- D. Water Stops shall be per SECTION 03100.
- E. Damp proofing agent shall be a waterborne emulsified-asphalt. Damp proofing shall be suitable for "green" or slightly damp surfaces and shall withstand normal expansion and contraction of the concrete. Damp proofing agent shall breath to allow vapors to escape. Damp proofing agent shall meet local VOC requirements.
- F. Bonding agents shall be 100% solids, epoxy adhesives conforming to the following:
 - 1. For bonding freshly-mixed, plastic concrete to hardened concrete, bonding agent shall be a medium viscosity adhesive conforming to ASTM C881 Type II, Grade 2, Class C,
 - 2. For bonding hardened concrete or masonry to steel, bonding agent shall be a non-sagging gel adhesive conforming to ASTM C881 Type I or IV, Grade 3, Class C.
- G. Vapor Barrier:
 - 1. Vapor Barrier shall consist of a composite of heavy kraft paper, asphalt, fiberglass reinforcement, and polyethylene film. The composite shall be laminated under heat and pressure.

2. Vapor Barrier shall comply with federal specification UU-B-790A, Type I, Grade A, Style 4. Vapor Barrier shall have a water vapor permeance of less than 0.30 perms when tested per ASTM E96.
3. Vapor Barrier shall be installed under concrete slabs of all habitable spaces. Barrier shall be installed per the MANUFACTURER recommendations and per ASTM E1643.

H. Non-Waterstop Joint Material:

1. Preformed Joint Material: Preformed asphalt-impregnated fiber conforming to ASTM D1751.
2. Bond Breaker: All bond breakers shall be roofing felt or 15 mils minimum dry film thickness of bituminous paint as indicated.

I. **Flyash for Tremie Concrete**

1. Flyash shall be Class F pozzolan conforming to the requirements of ASTM C618. The pozzolan shall be obtained from a single source and shall comprise 15 percent of the volume of the cementitious material in the Tremie Concrete. The remaining 85 percent of the cementitious material volume shall be Portland cement conforming to ASTM C150 Type II

2.08 CONCRETE DESIGN REQUIREMENTS:

A. General: Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated. The exact proportions in which these materials are to be used for different parts of the WORK will be determined during the trial batch process. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage, and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results. All changes shall be subject to review by the FWC.

B. Fine Aggregate Composition:

1. In mix designs for structural concrete, the percentage of fine aggregate in total aggregate by weight shall be as indicated in the following table.

Fine Aggregate	
Fineness Modulus	Maximum Percent
2.7 or less	41
2.7 to 2.8	42
2.8 to 2.9	43
2.9 to 3.1	44

2. For other concrete, the maximum percentage of fine aggregate of total aggregate, by weight, shall not exceed 50.
3. Fine aggregate shall be 50 percent, plus or minus five (5) percent by volume of total aggregates for Tremie Concrete

C. High range water reducer shall not be used in Tremie Concrete except in conjunction with an anti-washout admixture to provide the degree of workability required for proper placement and consolidation.

D. Duct bank concrete shall contain an integral red-oxide coloring pigment. Concrete shall be dyed red throughout. Surface treatment to color duct banks will not be acceptable.

E. Water/Cement Ratio and Compressive Strength:

1. Water/cement ratio is given for aggregates in saturated-surface dry condition, and total moisture of all aggregates, calculated by ASTM C566, less the absorption of the aggregate as calculated by ASTM C127 and C128, shall represent total free moisture in the aggregate to determine the water/cement ratio. Total free moisture of aggregates shall be added to batch water to estimate water content of concrete. Concrete shall have the following minimum properties:

F. Concrete Proportions:

Type of Work	Min 28-Day Compressive Strength (psi)	Maximum Size Aggregate (in)	* Cement Content per cubic yd (lbs)	* Maximum W/C Ratio (by weight)
Structural Concrete				
Roof, floor slabs, columns, walls, and all other concrete items not indicated elsewhere.	4,500	1	564 to 600	0.45
12-inch and thicker walls, slabs on grade, and footings (optional)	4,500	1-1/2	564 to 600	0.45
Tremie Concrete	4,000	3/4	658 (min)	0.45
Pea Gravel Concrete				
Thin sections and areas with congested reinforcing, at the CONTRACTOR'S option and with the written approval of the FWC for the specific location.	4,500	3/8	752 to 788	0.40
Sitework concrete	3,000	1	470 (min)	0.50
Lean concrete	2,000	1	376 (min)	0.60

* The cement content and water cement ratio are based on total cementitious material including silica fume, slag or flyash.

NOTE: The CONTRACTOR is cautioned that the limiting parameters above are not a mix design. Admixtures may be required to achieve workability required by the CONTRACTOR'S construction methods and aggregates. The CONTRACTOR is responsible for providing concrete with the required workability and strength.

- G. Adjustments to Mix Design: The CONTRACTOR may elect to decrease the water/cement ratio to achieve the strength and shrinkage requirements and/or add water reducers, as required to achieve workability. The mixes shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish, and the CONTRACTOR shall be entitled to no additional compensation because of such changes. Any changes to the accepted concrete mix design shall be submitted to the FWC for review and shall be tested again in accordance with these Specifications.

H. When using a floor hardener, the water/cement ratio shall not be greater than specified by the hardener MANUFACTURER.

2.09 CONSISTENCY: The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation and which can be compacted by vibratory methods to give the desired density, impermeability, and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C143. The slumps shall be as follows:

Part of Work	Slump (in)
All concrete, unless indicated otherwise	3-inches plus or minus 1-inch
With high range water reducer added	7-inches plus or minus 2-inches
Pea gravel mix	7-inches plus or minus 2-inches
Ductbank and pipe encasement	5-inches plus or minus 1-inch
Concrete with hardener	Per Hardener MANUFACTURER
Tremie Concrete	7-inches plus or minus 1 1/2-inches

2.10 MEASUREMENT:

A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the FWC.

B. Weighing tolerances:

Material	Percent of Total Weight
Cement	1
Aggregates	3
Admixtures	3

C. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the FWC and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any required amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism shall prevent leakage when the valves are closed.

PART 3 - EXECUTION

3.01 PROPORTIONING AND MIXING:

A. Proportioning of the mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.

B. Mixing shall conform to the requirements of Chapter 7 of ACI 301.

C. Slumps shall be as indicated herein.

D. Retempering of concrete or mortar that has partially hardened shall not be permitted.

3.02 PREPARATION OF SURFACES FOR CONCRETING:

- A. General: Earth surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- B. Vapor Barrier
 - 1. Vapor Barrier shall be installed under on-grade building floor slabs of occupiable (non-hydraulic) structures and at other locations indicated.
 - 2. Base shall be leveled, compacted, and tamped per SECTION 02200. Remove sharp edges, projection materials and roughness that might penetrate vapor barrier. Install barrier with width parallel with the direction of the pour of the concrete.
 - 3. Place, protect, and repair defects in sheet according to ASTM E1643, and the MANUFACTURER's written instructions. Seams shall be lapped and sealed in accordance with ASTM E1643.
 - 4. The CONTRACTOR shall exercise care to avoid puncturing or tearing the vapor barrier during installation. Patch punctures and tears as they occur.
- C. Joints in Concrete:
 - 1. All joints shall be installed where indicated on the Drawings or where otherwise approved by the FWC. The surface of the construction joint shall be rough and prior to placement shall be cleaned and moistened with water.
 - 2. Concrete surfaces upon or against which new concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the FWC, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bonding. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and be roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting, sandblasting or chipping (exposing aggregate) followed by thorough washing. Pools of water shall be removed from the surface of construction joints before the new concrete is placed.
 - 3. After the surfaces have been prepared, all approximately horizontal construction joints shall be covered with a 6-inch lift of a pea gravel mix. The mix shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix. If high range water reducer is used in the wall concrete, then the pea gravel joint topping does not need to be used.
- D. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the FWC.
- E. Embedded Items:
 - 1. No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the FWC at least four (4) hours before placement of concrete. Surfaces of forms and embedded items that have become encrusted with dried grout from previous usage shall be cleaned before the surrounding or adjacent concrete is placed.
 - 2. Inserts or other embedded items shall conform to the requirements herein.
 - 3. Reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations indicated on the Drawings or shown by Shop Drawings and shall be

acceptable to the FWC before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

- F. Placing New Concrete Against Old: Where new concrete is to be placed against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydroblasting, sandblasting or chipping to expose aggregate. The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the FWC.
- G. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the WORK. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, shall be the CONTRACTOR's responsibility and shall be subject to the review of the FWC.
- H. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.
- I. Openings for pipes, inserts for pipe hangers and brackets, and anchors shall, where practicable, be provided during the placing of concrete.
- J. Anchor bolts shall be accurately set and shall be maintained in position by templates while being embedded in concrete.
- K. Cleaning: The surfaces of metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.03 CONVEYING:

- A. Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent separation or loss of material.
- B. No aluminum materials shall be used in conveying any concrete.
- C. Ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting, and placing system shall be designed and arranged so that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the FWC. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.
- D. Pumping:
 - 1. If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
 - 2. The pumping equipment shall have two (2) cylinders and be designed to operate with one cylinder in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the Site during pumping.

3. The minimum diameter of the hose conduits shall be in accordance with ACI 304.
4. Pumping equipment and hose conduits that are not functioning properly shall be replaced.
5. Aluminum conduits for conveying the concrete shall not be permitted.
6. Concrete samples for slump, air content, and test cylinders will be taken at the placement end of the hose.

E. Tremie Equipment

1. Tremie pipes shall be fabricated of heavy gauge steel pipe to withstand all anticipated handling stresses, and shall be sized to prevent aggregate-caused locking. Pipes shall be fabricated in sections such that the upper sections can be removed as the placement progresses. The pipe sections shall be joined with flanges and gasket to prevent water being sucked in the concrete during placement. The tremie pipe shall be marked to facilitate quick determination of the distance from the water surface to the mouth of the tremie.
2. Suitable sized funnel or hopper shall be provided for the tremie to allow transfer of adequate volume of concrete from the delivery device to the tremie. A stable platform shall be provided for the tremie support during the placement operation.

3.04 DELIVERY:

A. Ready-mixed concrete shall be batched, mixed, transported and delivered in accordance with these specifications and ASTM C94 including the following supplementary requirements.

1. Concrete shall be discharged within 90 minutes from the time concrete was mixed, if centrally mixed, or from the time the original water was added, if transit-mixed, or before the drum has been revolved 300 revolutions, whichever is first. The CONTRACTOR shall consult with the Concrete Supplier and Manufacturer to develop a field procedure for the addition of the high range water reducer on site. That procedure shall be provided by the CONTRACTOR to the FWC as a submittal. Any amount of high range water reducer added on site shall be documented on the batch ticket given to the FWC on site. The CONTRACTOR shall have sufficient amounts of high range water reducer as approved on site in the amount as specified by the concrete supplier for the capability of maintaining concrete workability. It is recommended that water not be added onsite for this purpose. Addition of the high range water reducer shall be under the direction of the Concrete Supplier and in accordance with the Manufacturer recommendations.
2. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one-inch when the required slump is 3-inches or less, or if they differ by more than 2-inches when the required slump is more than 3-inches, the mixer shall not be used on the WORK unless the causative condition is corrected and satisfactory performance is verified by additional slump tests. Mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.
3. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the FWC.
4. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the MANUFACTURER of equipment. Additional mixing, if any, shall be at the speed designated by the MANUFACTURER of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

3.05 PLACING:

- A. Non-Conforming Work or Materials: Concrete which during or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the WORK. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced.
- B. Unauthorized Placement: No concrete shall be placed except in the presence of a duly authorized representative of the FWC. The CONTRACTOR shall notify the FWC in writing at least 24 hours in advance of placement of any concrete.
- C. Concrete shall not be dropped more than four (4) feet without use of chutes or tremies. Concreting shall be a continuous operation until placement of the section is complete. All concrete shall be worked around reinforcement and embedded items. If vibrators are used, care shall be taken not to segregate concrete. Vibrators will not be allowed to move concrete within the form. All forms and subgrade shall be dampened prior to placement and excess water removed.
- D. Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this SECTION.
- E. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the WORK progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.
- F. Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, means such as hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6-feet in horizontal direction. Concrete in wall forms shall be deposited in uniform horizontal layers not deeper than 2-feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in wall forms shall not exceed 5-feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.
- G. Concrete with hardener shall be placed per the hardener MANUFACTURERs written recommendations.
- H. Placing New Concrete Against Old: Epoxy adhesive bonding agent shall be applied to the old surfaces according to the MANUFACTURER's written recommendations. This provision shall not apply to joints where waterstop is provided, see SECTION 03100.
- I. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F or less than 55 degrees F for sections less than 12-inches thick, nor less than 50 degrees for all other sections. The CONTRACTOR shall be entitled to no additional compensation on account of the temperature requirements.
- J. Concrete of structure slab shall be poured immediately on top of tremie concrete if tremie is selected for dewatering. No stone or any other materials shall be filled in between the tremie and the structure slab.
- K. Hot Weather Placement
 - 1. Placement of concrete in hot weather shall conform to ACI 305 and the following:

2. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 60 minutes.
3. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as pre-cooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete below 90 degrees F as it is placed.

L. Cold Weather Placement

1. Placement of concrete in cold weather shall conform to ACI 306.1, and the following:
2. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the minimum temperature.
3. Remove all ice and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6-inches. Reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.
4. Maintain the concrete temperature above 50 degrees F for at least 72 hours after placement.

M. Order of Placing Concrete

1. The order of placing concrete in all parts of the WORK shall be acceptable to the FWC. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints at the indicated locations. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least five (5) days for hydraulic structures and two (2) days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the two (2) adjacent wall panels have cured at least ten (10) days for hydraulic structures and 4 days for all other structures.
2. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and laitance shall be removed.

N. Placing Concrete Underwater

1. Tremie Concrete shall be placed per ACI 304.2 Chapter 8 for placing concrete underwater.
2. Starting Placement
 - a. Prior to Tremie Concrete placement, the CONTRACTOR shall use proper means to prevent flow of water across or through the placement site.
 - b. The CONTRACTOR shall determine the spacing of tremie pipes for concrete placement, but shall maintain a minimum of one pipe for each 300 square feet of concrete placed.
 - c. Tremie started using the end plate, dry pipe technique shall be filled with concrete before being raised off the bottom. The pipe shall be initially raised sufficiently to establish a mound around the mouth of the tremie pipe.
 - d. Tremie started using a go-devil shall be lifted a maximum of 6-inches to allow water to escape, then concrete shall be added to the tremie slowly to force the go-devil downward. Once the go-devil reaches the mouth of the tremie, the tremie shall be lifted to allow the escape of the go-devil, and the forming of a mound around the mouth of the pipe.
 - e. Tremie pipe shall be adequately embedded in the fresh concrete, and slowly raised so as to prevent "loss of seal". Should a "loss of seal" occur in a tremie, placement through

that tremie must be terminated immediately, and the tremie pipe removed. The flow must be restarted with the end plate, dry pipe technique, a go-devil shall not be used to restart a tremie after loss of seal.

- f. The CONTRACTOR shall frequently verify the depth of the excavation. Remove any accumulated sediments before placing tremie concrete to ensure design thickness for tremie concrete is achieved.

3. Placing

- a. Placement of concrete shall be as continuous as possible through the tremie. Placement interruptions less than 30 minutes are allowed to restart without any special procedure. Placement interruptions between 30 minutes and the initial setting time shall be treated by removal, resealing, and restarting the tremie.
- b. Placement interruptions longer than the initial setting time are to be treated as horizontal construction joints. The concrete surface shall be "green cut" by a diver after it sets. The concrete surface shall be water jetted immediately prior to resuming concrete placement.
- c. The rate of concrete rise shall be established based on the concrete production of the local area and the spacing of the pipes. The volume of concrete shall be monitored throughout the placement to detect placement problems, such as underrun or overrun. Should underrun or overrun occur, corrective actions such as readjusting the rate of concrete rise, and alternating the pipe spacing shall be taken to ensure proper placement.
- d. Tremie blockage shall be cleared with caution to prevent "loss of seal".
- e. The pipe delivering concrete must be secured and remain fixed horizontally while concrete is flowing, so as not to damage the concrete surface, and create additional laitance, and lead to "loss of seal".

4. Post-Placement Evaluation

- a. Concrete placed underwater shall be evaluated after completion of placing with, but not limited to the methods below.
- b. Coring in area of maximum concrete flow, or in area where "loss of seal" occurred during placement.
- c. After de-watering, accurately surveying the entire concrete surface to evaluate the adequacy of the concrete placement, such as cracks, voids, and honeycomb. The defects shall be clearly marked for repair. The concrete shall be protected from dryness, or damages until repairs are completed.
- d. As determined by the FWC, the area of questionable concrete quality shall be cored and tested for compressive strength.

3.06 TAMPING AND VIBRATING:

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete. Vibrators shall be Group 3 per ACI 309, high speed power vibrators (8,000 to 12,000 rpm) of an immersion type in sufficient number and with at least one standby unit as required. Group 2 vibrators may be used only at specific locations when accepted by the FWC. Tremie concrete shall not be vibrated.
- B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that air and rock pockets have been eliminated. Concrete surrounding the waterstops shall

be given additional vibration over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the required results within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall not contact the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.07 **CURING AND DAMPPROOFING:** Concrete shall be cured for a minimum of five (5) days after placement in accordance with the methods indicated below for the different parts of the WORK.

Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Wall sections with forms removed	6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement and ductbank concrete and thrust blocks	3
All concrete surfaces not specifically indicated in this Paragraph	4
Floor slabs on grade in hydraulic structures	5
Slabs on grade to receive an adhered floor finish	6 (Omit curing compound)
Slabs not on grade	6
Concrete with hardener	Per MANUFACTURER's written recommendations
Tremie Concrete	8

- A. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removal. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 7 days of placing the concrete, curing shall be continued in accordance with Method 6 below.
- B. Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.
- C. Method 3: The surface shall be covered with moist earth not less than 4 hours or more than 24 hours after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.
- D. Method 4: The surface shall be sprayed with a liquid curing compound.
 1. It shall be applied in accordance with the MANUFACTURER's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film that will seal thoroughly.
 2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the 7-day curing period. If the seal is damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
 3. Wherever curing compound has been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.

4. Curing compound shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces and within two (2) hours after removal of forms. Repairs to formed surfaces shall be made within the two (2) hour period; provided, however, that any such repairs which cannot be made within the said two (2) hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound.
 5. At locations where concrete is placed adjacent to a panel which has been coated with curing compound, the panel shall have curing compound reapplied to an area within 6-feet of the joint and to any other location where the curing membrane has been disturbed.
 6. Prior to final acceptance of the WORK, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage the surface finish.
- E. Method 5:
1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4 above. Not less than one hour or more than four (4) hours after the curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting, or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3-inches and fastened together with a waterproof cement to form a continuous watertight joint.
 2. The curing blankets shall be left in place during the seven (7) day curing period and shall not be removed until after concrete for adjacent work has been placed. If the curing blankets become torn or otherwise ineffective, the CONTRACTOR shall replace damaged sections. During the first three (3) days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The CONTRACTOR shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.
- F. Method 6: This method applies to both walls and slabs.
1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least seven (7) consecutive days beginning immediately after the concrete has reached final set or forms have been removed.
 2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.
 3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held substantially in contact with the concrete surface to prevent being dislodged by wind or any other causes. Edges shall be continuously held in place.
 4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.
 5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, the entire concrete surface shall be wetted, and curing compound shall be immediately applied to the entire surface in accordance with Method 4 above.

6. The CONTRACTOR shall dispose of excess water from the curing operation to avoid damage to the WORK.
- G. Method 8: This method applies to Tremie Concrete. Concrete shall be cured for not less than 14 days after placing, by continuous submerging of the top surface with a minimum of 6-inches of water for the full duration of curing period. Curing compound shall not be used for curing. If a reinforced slab is to be placed over the Tremie Concrete, then the concrete surface shall be kept damp by applying of water using nozzles, or extending the submerging period until the placement of the slab
- H. Damp proofing
1. The exterior surfaces of backfilled dry well walls and buried roof slabs shall be damp proofed as follows.
 2. Immediately after completion of curing the surface shall be sprayed with a damp proofing agent consisting of an asphalt emulsion. Application shall be in 2 coats. The first coat shall be diluted to one-half strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the undiluted material, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Damp proofing material shall be as indicated above.
 3. As soon as the material has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used if it produces a uniformly coated white surface and remains until placing of the backfill. If the whitewash fails to remain on the surface until the backfill is placed, the CONTRACTOR shall apply additional whitewash.

3.08 CONCRETE FINISHES:

- A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions indicated are defined as tolerances and are indicated herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used
- B. Formed Surfaces:
1. No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as indicated.
- C. Unformed Surfaces:

<p>After proper and adequate vibration and tamping, unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each WORK operation as necessary to prevent drying shrinkage cracks. The classes of finish for unformed concrete surfaces are designated and defined as follows: Unformed Surface Finish Schedule</p>	
Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Water bearing slabs with slopes 10 percent and less	U3
Water bearing slabs with slopes greater than 10 percent	U4
Slabs not water bearing	U4
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U3

Top surface of walls subject to foot traffic	U4
Top surface of walls not subject to foot traffic	U3
Floors to receive surface hardener	U5

1. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
2. Finish U2 - (Float Finish)
 - a. Compact, accurately screed and float to a true uniform surface.
 - b. Surfaces shall be floated with wood or metal floats or a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted.
 - c. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Test surface with straightedge and eliminate high and low spots of more than 1/8-inch in ten (10) feet. Surface irregularities shall not exceed 1/4-inch.
 - d. Joints and edges shall be tooled where indicated or as determined by the FWC.
3. Finish U3 - (Hand-Troweled Finish)
 - a. Finish surface as in Finish U2 - Float Finish and after the surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, trowel with steel trowel to obtain a smooth dense finish after concrete has hardened to ring under the trowel.
 - b. The finish shall produce a smooth dense uniform surface free of all irregularities, blemishes, ripples, and trowel marks.
4. Finish U4 - (Nonskid Finish)
 - a. Trowel the Finish U3 - Hand-trowel Finish surface to remove local depressions or high points. In addition, the surface shall be given a light broom finish with brooming perpendicular to drainage unless otherwise indicated.
 - b. The resulting surface shall be rough enough to provide a nonskid finish.
5. Finish U5 - (Surface hardener)
 - a. Immediately after screeding, shake on hardener shall be applied per the MANUFACTURER's written recommendations.
 - b. Surface shall receive a minimum of two coats of a liquid hardener per the MANUFACTURER's written recommendations.
 - c. CONTRACTOR shall notify hardener MANUFACTURER three (3) working days prior to hardened concrete floor being placed.
 - d. Hardener MANUFACTURER shall provide continuous supervision of concrete and hardener placements, supplying FWC with a report of each day's placement. Cost of supervision is to be borne by CONTRACTOR.

3.09 ARCHITECTURAL FINISH:

- A. General: Architectural finishes shall be provided only where specifically indicated below. In all other locations, the paragraph entitled Concrete Finishes shall apply.

Location	Finish
all formed and unformed surfaces above grade and exposed to view	Smooth

- B. Immediately after the forms have been stripped, the concrete surface shall be inspected and any poor joints, voids, rock pockets, or other defective areas shall be repaired and form-tie holes filled as indicated herein.
- C. Architectural finishes shall not be applied until the concrete surface has been repaired as required and the concrete has cured at least 14 days.
- D. Architecturally treated concrete surfaces shall conform to the accepted sample in texture, color, and quality. It shall be the CONTRACTOR'S responsibility to maintain and protect the concrete finish.

3.10 PROTECTION:

- A. The CONTRACTOR shall protect concrete against damage until final acceptance.
- B. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever precipitation is imminent or occurring.

3.11 DEFECTIVE SURFACE TREATMENTS:

A. Patching Concrete:

1. Patch all tie holes, honeycombs or other defects with a Portland Cement and sand grout.
2. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, plus not less than 1/32-inch depth of the surface film from all hard portions by means of an efficient sandblast.
3. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces underneath will remain moist but not so wet as to overcome the suction upon which a good bond depends.
4. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. Holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section and other imperfections having a depth greater than their least surface dimension shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.
5. The grout shall not be richer than one (1) part cement and three (3) parts sand with the amount of mixing water enough to produce a workable mix. For exposed walls, the cement shall contain such a proportion of white Portland cement as is required to make the color of the patch match the color of the surrounding concrete. The patch shall be finished in such a manner as to match the adjoining surfaces.
6. Surfaces of repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

B. Defective Concrete:

1. Any concrete which is not formed as shown on the Drawings or does not conform to the Contract tolerances or shows defects which reduce its structural adequacy, shall be removed from the job by the CONTRACTOR at his expense unless the FWC grants written permission to patch the defective area.

C. Exposed Concrete Surfaces:

1. As soon as forms are removed, exposed surfaces shall be carefully examined and all ridges, ribs and other imperfections shall be rubbed with an abrasive stone or ground in a satisfactory

manner in order to secure a smooth, uniform and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted

2. No repairs shall be made until after inspection by the FWC.
3. In no case will extensive patching of honeycombed concrete be permitted
4. Concrete containing minor voids, pinholes, honeycombing, or similar depression defects shall be repaired as indicated below.
5. Concrete containing extensive voids, holes, honeycombing, or similar depression defects shall be completely removed and replaced. Repairs and replacements shall be performed promptly.

D. Cracks in Hydraulic Structures:

1. Prior to filling any structure with water, cracks shall be "vee'd" to 1/2-inch deep and 1/4" wide with bond breaker tape applied to the bottom of the "vee" and filled with sealant conforming to the requirements of SECTION 03100. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill which are not covered with a waterproofing membrane shall also have cracks repaired as indicated herein.

E. Repairs to Tremie Concrete

1. After the post-placement evaluation, and with the defects clearly identified, and inspected by the FWC, repair can proceed prior to or after the curing period. Concrete must be prevented from dryness before the starting of repair, and if repair is to be completed after curing, the repaired area and the total surface are shall be cured in accordance with these specifications. Plastering or coating of surfaces will not be permitted.
2. Defective surfaces to be repaired shall be cut back from true line a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted.
3. Cracks 1/16-inch or wider shall be repaired by injection of epoxy grout, injection procedures shall be as recommended by the grout MANUFACTURER.
4. Laitance, soft materials, voids, and honeycombs shall be completely removed, and cut back to a minimum of 1/2-inch below the sound concrete surface.
5. Depressions greater than 3-inches, including those formed as a result of cut backs of laitance, voids, and honeycombs, shall be repaired with concrete. Depressions less than 3-inches shall be filled with non-shrink grout per SECTION 03600. Depressions less than 3-inches can be filled with concrete when the top slab is poured.
6. When the compressive strength of the cored concrete specimens failed to meet the acceptance criteria of this SECTION, the FWC may require the CONTRACTOR to take additional cores for further testing, repair, remove, or replace part or all of the concrete at no additional cost to the FWC. All cored holes shall be filled with concrete.

3.12 REINFORCEMENT: Reinforcement shall be in accordance with SECTION 03200, of these Specifications. Concrete protection for the reinforcement shall conform to the requirements ACI 318, paragraph 7.7.1.

3.13 CONSTRUCTION TOLERANCES:

- A. The CONTRACTOR shall set and maintain concrete forms and perform finishing operations to ensure that the completed WORK is within tolerances. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated on the Drawings. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 117.

- B. The following non-cumulative construction tolerances apply to finished walls and slab unless otherwise indicated:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch
Variation from the level or from the grades indicated.	In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch
Variation from plumb	In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 1/4-inch
Tremie Concrete	Plus or Minus 3-inches

- 3.14 CARE AND REPAIR OF CONCRETE: The CONTRACTOR shall protect concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed WORK, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete.

END OF SECTION

SECTION 03375 EXCAVATABLE FLOWABLE FILL

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION specifies the requirements for excavatable flowable fill used for trenches, support for pipe structures, culverts, utility cuts and other works where cavities exist and where firm support is needed for pavements and structural elements. Flowable fill may also be used to fill water and sewer lines, and fuel tanks placed out of service, and at other locations approved by FWC.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 02434 - HDPE Culverts
 - 2. SECTION 02439 - Storm Drainage System – Corrugated Metal Pipe

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. ASTM C403/C403M, Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance, latest edition.

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: (Not Applicable)

1.05 QUALIFICATIONS: (Not Applicable)

1.06 INSPECTION AND COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hour advance notice of its intention to begin new WORK activities.

1.07 WARRANTY: The CONTRACTOR shall warranty the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. The CONTRACTOR shall furnish materials conforming with the requirements specified in Division III of the F.D.O.T. Standard Specifications for Road and Bridge Construction, latest edition, and herein. Specific references are as follows:
 - 1. Portland Cement (Types I, II or III) Section 931.
 - 2. Flu Ash, Slag and other Pozzolanic Materials for Portland Cement Concrete Section 929.
 - 3. Fine Aggregate (Sand)* Section 902.
 - 4. Water Section 923.

* Any clean sand with 100% passing 3/8" sieve and not more than 10% passing with 200 mesh may be used.

2.02 MIX PROPORTIONS:

- A. The CONTRACTOR shall be responsible for producing a flowable mixture using these guidelines and by adjusting his mixture design as called for by circumstances or as may be directed by the Engineer of Record.
- B. Flowable fill material shall be proportioned to produce a 28-day compressive strength of approximately 50-150 psi.
- C. General mix quantities are as follows:

<u>Components</u>	<u>Pounds per Cubic Yard</u>
Cement	50-100*
Fly Ash or Granulated Blast Furnace Slag	0-600
Fine Sand	2,750 (Adjust to yield one cubic yard of flowable fill)
Water	500 (Maximum)

* The percentage of cement may be increased above these limits only when early strength is required and future removal is unlikely.

- D. Weights for fine aggregate and water shall be adjusted according to cementitious content. The mix proportions shall be adjusted for removability, pumpability and flowability. If required, strength test data shall be provided prior to batching.
- E. If required by the Engineer of Record, the flowability can be measured by afflux time determined in accordance with ASTM C 939 and shall be 30 seconds \pm 5 seconds as measured on mortar passing the No. 4 sieve. The equipment required to perform this test shall be provided by the CONTRACTOR.

PART 3 - EXECUTION

3.01 PRODUCTION AND PLACING: Flowable fill shall be produced and delivered using concrete construction equipment. Placing flowable fill shall be done by chute, pumping or other methods approved by the Engineer of Record.

3.02 CONSTRUCTION REQUIREMENTS: The flowable fill shall be placed to the designated fill line without vibration or other means of compaction. Placement shall be avoided during inclement weather, e.g. rain or ambient temperatures below 40 degrees F. The CONTRACTOR shall take all necessary precautions to prevent any damages caused by the hydraulic pressure of the fill during placement prior to hardening. Also, necessary means to confine the material within the designated space shall be provided by the CONTRACTOR.

3.03 ACCEPTANCE:

- A. The flowable shall be proportioned and placed as specified herein. In general, the strength desired is the maximum hardness that can be excavated at a later date using conventional excavating equipment. No curing protection is required.
- B. The fill shall be left undisturbed until material obtains sufficient strength. Sufficient strength is 35 psi penetration resistance as measured using a hand held penetrometer, in accordance with ASTM C403/C403M. The penetrometer shall be provided by the CONTRACTOR.
- C. All flowable fill areas subject to traffic loads must have a durable riding surface.

END OF SECTION

SECTION 03400 STRUCTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The WORK of this SECTION consists of furnishing all labor, materials, supplies and equipment necessary for design, construction, delivery, and installation of the structural precast concrete work for below-grade, at-grade and above-grade construction, including connections, required by the Drawings or as specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 03200 - Concrete Reinforcement

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Association of State Highway and Transportation Officials (AASHTO)
 - a. Standard Specification for Highway Bridges
 - 2. American Concrete Institute (ACI)
 - a. 301 - Specifications for Structural Concrete
 - b. 315 - Details and Detailing of Concrete Reinforcing
 - c. 318 - Building Code Requirements for Reinforced Concrete
 - d. 350 – Code Requirements for Environmental Engineering Concrete Structures
 - 3. American Society of Testing and Materials (ASTM)
 - a. A36 - Standard Specification for Carbon Structural Steel
 - b. A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - c. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - d. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - e. A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
 - f. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High-Temperature or High-Pressure Service and Other Special Purpose Applications
 - g. A194 - Standard Specification for Carbon Steel, Alloy Steel and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
 - h. A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - i. F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

- j. A416 - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete
 - k. A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - l. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - m. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - n. A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
 - o. A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - p. C33 - Standard Specification for Concrete Aggregates
 - q. C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - r. C127 - Standard Test Method for Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
 - s. C128 - Standard Test Method for Relative Density (Specific Gravity), and Absorption of Fine Aggregate
 - t. C150 - Standard Specification for Portland Cement
 - u. C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
 - v. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 - w. C260 - Standard Specification for Air-Entraining Admixtures for Concrete
 - x. C494 - Standard Specification for Chemical Admixtures for Concrete
 - y. D2240 - Standard Test Method for Rubber Property - Durometer Hardness
4. American Welding Society (AWS)
 - a. A5.4 - Filler Metal Specifications
 - b. B2.1 - Specification for Welding Procedures and Performance Qualifications
 - c. D1.1 - Structural Welding Code
 - d. D1.4 - Structural Welding Code – Reinforcing Steel
 - e. D1.6 - Structural Welding Code - Stainless Steel
 5. Precast/Prestressed Concrete Institute (PCI)
 - a. MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products
 - b. MNL-120 - Design Handbook
 - c. MNL-127 – Erector’s Manual: Standards and Guidelines for the Erection of Precast Concrete Products

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300.
- B. The CONTRACTOR shall divide the submittals into complete separate submittals for each structure. Each submittal shall include design calculations, concrete mix designs, erection drawings, and production drawings. Drawings and calculations shall be stamped and signed by a Professional Engineer registered in the State of Florida.
- C. Data
 - 1. Design Calculations: A Professional Engineer registered in the State of Florida and experienced in precast/prestressed concrete designs shall perform all designs. Calculations shall show all product design criteria, stress calculations, and complete camber calculations showing initial camber, and estimated long term camber and deflection. Design analysis shall indicate which codes the design was based on.
 - 2. Test Results: Tests for compressive strength of concrete shall be performed by an independent commercial testing laboratory. Copies of test reports including all test data and all test results shall be submitted with the concrete mix design.
 - 3. Concrete Mix Design: Prior to commencing operations, including fabrications of the precast for any samples, the CONTRACTOR shall submit a statement giving the nominal maximum aggregate size and proportions of all ingredients that will be used in the manufacture of concrete. The statement shall include test results from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made in materials used in the concrete mix without approval and additional tests to verify that the concrete properties are satisfactory. A copy of the concrete mix shall be submitted with each sample.
- D. Drawings
 - 1. Erection and Production drawings shall show details in accordance with ACI 315 and ACI 318. Drawings shall be sealed by a Florida registered Professional Engineer.
 - 2. Erection drawings shall include the following:
 - a. Precast unit identification marks, dimensions, and shape of each unit
 - b. Plans and/or elevations showing the location of all units in the WORK
 - c. Sections and details showing connections, openings, inserts, reinforcing, anchoring devices, cast-in items, and their relation to the structure, including fabrication and welding details
 - d. Interface with adjacent members
 - e. Special handling instructions in sufficient detail to cover manufacture, handling, and erection
 - f. Joints and openings between members and between members and structure
 - g. Description of all loose, cast-in, and field hardware
 - h. Field installed anchor location drawings.
 - i. All dead, live and other applicable loads used in the design, and the governing codes.
 - 3. Production drawings shall include the following
 - a. Elevation view of each member
 - b. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.

- c. Handling devices
- d. Dimensions and finishes
- e. Prestress for strand
- f. Concrete strengths
- g. Estimated cambers
- h. Methods for storage and transportation

1.05 QUALIFICATIONS:

- A. The precast concrete manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute Plant Certification Program. The MANUFACTURER shall be certified at the time of bidding and at the time of product fabrication. Certification shall be in following groups and categories: C1 (Precast Concrete Products (non-prestressed) and C2 (C2 - Prestressed Hollow-Core and Repetitive Products).
- B. Precast Erectors shall be regularly engaged for at least 5 years in the erection of precast structural concrete similar to the requirements of this Project.
- C. Welders shall be qualified in accordance with AWS B2.1.
- D. Precast and/or prestressed members shall be produced under plant-controlled conditions conforming to PCI MNL-116.

1.06 RESPONSIBILITIES:

- A. It shall be the CONTRACTOR'S responsibility to assure that all precast concrete conforms to the specified requirements for quality and appearance. The appearance criterion is that all precast architectural finishes provided for this Project shall conform in appearance, when viewed from a distance of 20 feet, to the design, color, and texture as represented by the sample. As defined by PCI MNL-116 Appendix C, all surfaces exposed to view shall conform to Finish Grade B and those not exposed shall conform to Standard Grade.
- B. Trial mixes and testing to meet requirements of the strengths of concrete specified is the CONTRACTOR'S responsibility.
- C. The CONTRACTOR shall provide for erection procedures and induced loads during erection, maintain temporary bracing in place until final support is provided, provide necessary hoisting equipment, and safety and protective devices.

1.07 CERTIFICATIONS: The CONTRACTOR shall submit to the FWC a certification that all precast members are manufactured in accordance with the requirements of PCI MNL-116 and designed per ACI 318.

1.08 INSPECTIONS:

- A. Compression tests shall be made for each day's pour of each class of concrete. Not less than three specimens shall be made for each test. Specimens shall be made, cured, and tested in accordance with ASTM C39. The standard age of tests shall be 28 days, but 7-day tests may be used, provided the relation between the 7- and 28-day strength of the concrete has been established by tests for materials and proportions used. Additional cylinders shall be made to determine strength for transfer of prestress and shall be cured under the same conditions as the concrete to be checked.
- B. The CONTRACTOR shall verify that building structures, anchors, devices, and openings are ready to receive the precast work.

- C. All precast members shall be in place, properly and completely connected and approved before any finishes are applied. Any damaged or defaced units where, in the opinion of the FWC, suitable and adequate repairs cannot be made will be rejected, whether or not delivered or erected; and whole, replacement units shall be provided at no additional cost to the FWC.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS:

- A. Portland Cement: Portland Cement shall conform to ASTM C150, Type I, II, or III, or AASHTO M85 Type I or II. Only one brand of cement shall be used throughout the WORK. "Low alkali" requirement may be waived if aggregates are not reactive as defined in Appendix to ASTM C 33. Submit laboratory test reports.
 - 1. Admixtures:
 - a. General: No admixture may contain chlorides, bromides, fluorides, or other corrosive chemicals.
 - b. Air-entraining admixtures shall conform to ASTM C260.
 - c. Water reducing, accelerating, and set retarding admixtures may be used provided cement content is not reduced. Admixtures must have been used in the mix design studies. Admixtures shall conform to ASTM C494, Type A, C, D, or F/G.
 - d. Fly ash content shall not exceed 22 percent by weight of total cementitious materials, or conform to FDOT 346. Fly ash shall conform to ASTM C618 Class F or C with loss on ignition less than 3 percent
- B. Aggregates: All aggregates shall conform to ASTM C33. Maximum coarse aggregate size shall be 1/2-inch, unless approved in writing by the FWC. Water absorption for coarse aggregate shall meet ASTM C127. Water absorption for fine aggregate shall meet ASTM C128.
- C. Water: Water shall be clean and potable. The CONTRACTOR shall provide tests to assure that no more than 200 parts per million total aggregated content of chlorides, bromides, and fluorides are present.
- D. Reinforcing Steel:
 - 1. Deformed billet steel bars shall conform to ASTM A615, Grade 60.
 - 2. Plain Cold Drawn steel wire shall conform to ASTM A82.
 - 3. Plain Welded Wire Fabric shall conform to ASTM A185. Deformed Welded Wire Fabric shall conform to ASTM A497. Fabricated Steel Bar or Rod Mats shall conform to ASTM A184. Use only welded wire fabric that has been fabricated and shipped as flat sheets.
 - 4. Tie wires shall conform to 03200, "Reinforcing Steel".
 - 5. Strands: Uncoated, 7-wire stress-relieved strands shall conform to ASTM A416, Grade 250 or 270

2.02 ANCHORS AND INSERTS:

- A. Connecting and Support Devices: All connection and support devices that are exposed shall conform to ASTM A 666, Type 316L stainless steel.
- B. Bolts: Bolts that are exposed shall conform to ASTM A193, Grade B8M (Type 316).

- C. Nuts and Washers: Nuts and washers that are exposed shall conform to ASTM A194, Grade 8M (Type 316).
- D. Welded-headed studs shall conform to AWS D1.1, Type B.
- E. Deformed bar anchors shall conform to ASTM A496 or A706
- F. Reglets shall be plastic, shaped and flanged to remain in place once cast; tape closed to prevent concrete intrusion.
- G. Weld Filler Metal for Stainless Steel: Stainless steel to stainless steel shall conform to AWS A5.4, Grade 316L filler metal. Stainless steel to carbon steel shall conform to AWS A5.4, Grade 309 filler metal, and 3/32-inch diameter.
- H. Primer: Primer shall be Zinc-dust, zinc oxide primer in a phenolic resin spare varnish vehicle, TT-P-641 Type III (for galvanized surfaces).

2.03 MISCELLANEOUS MATERIALS:

- A. Grout shall be per specification SECTION 03600, "Grout".
- B. Bearing pads shall be chloroprene (Neoprene) molded to size or cut from molded sheet conforming to ASTM D2240, 70-80 Type A durometer.
- C. Sealant shall be tested by the CONTRACTOR proved compatible with the surface sealer.
- D. Form release agent shall be MANUFACTURER's standard, nonstaining, nonpetroleum based; compatible with concrete surface sealer.
- E. Surface sealer shall be clear, flat, penetrating, nonyellowing, nonclouding solution; high concentration of organosilane in an aqueous alcoholic vehicle which is designed to provide water repellent concrete surfaces from which graffiti can be easily removed. Oil-type silicones, paraffins, waxes, vinyls, modified urethanes, or acrylics shall not be used.

2.04 CONCRETE MIX:

- A. The concrete mix shall be designed by the CONTRACTOR and approved by the FWC. The minimum compressive strength of the structural precast concrete shall not be less than 5,000 psi at 28 days and release strength (as defined by PCI) of not less than 3,500 psi.
- B. The cement content shall be not less than 470 pounds per cubic yard. The water-cement ratio shall be not greater than 0.45.
- C. The concrete mix shall be proportioned by weight except water and admixtures may be batched by volume if desired. Design mix shall contain the same materials as those proposed for use in the WORK.
- D. Concrete topping reinforced with welded wire fabric shall be applied to tops of units continuous over the entire span. The concrete topping shall be a minimum of 2 inches thick and have a minimum 28-day compressive strength of 3,000 psi.
- E. Minimum thickness of face mix in architectural applications, after consolidation, shall be 2-inches with a minimum 28-day compressive strength of 3,000 psi.

2.05 DESIGN REQUIREMENTS:

- A. The precast member and connection design and construction shall conform to all applicable codes, ACI 318, and PCI MNL 120. Design shall include evaluations of the effects of connections, holes, discontinuities, concentrated loads, and joints.

- B. The precast concrete and connections shown on the drawings represent minimum precast construction requirements. The CONTRACTOR shall design the members and connections for all handling, erection, service conditions, and loadings specified herein, and shall provide any additional materials necessary to meet the design conditions.
- C. The precast members and connections shall be designed for the following loads in addition to initial handling and erection loads.
- D. Dead load: The member dead load plus a superimposed dead load of 25 psf. Loading resulting from roofing, insulation, and miscellaneous light hangers is included in the above value. Where topping is required, the dead load for the topping shall be in addition to the above loads.
- E. Live load: 20 psf (no reduction)
 - 1. Wind Loads per FBC
 - 2. Exposure Category: C
 - 3. Basic Wind Speed: 149 mph (3-second gust wind speed)
 - 4. Importance Factor: $I = 1.10$
- F. The design shall be based on a differential temperature of 50 degrees F between interior and exterior faces of the units and an 80 degrees +40 degrees from erected temperature) average member temperature differential.
- G. Stresses due to restrained volume changes caused by shrinkage and temperature differentials shall be included in the design.
- H. Concentrated and Special Loads:
 - 1. The size and location of concentrated loads from monorails, and any structural attachments shall be as shown on the Drawings.
 - 2. The size and location of loads resulting from equipment, either supported above or suspended from the members shall be coordinated with the mechanical, HVAC, and electrical drawings and the MANUFACTURER's shop drawings. The weight of any support pad or framework associated with the equipment shall be included. All equipment loads shall be in operating condition and shall be increased by 10 percent for design.
 - 3. The design shall compensate for the weight of the additional topping required by the camber in order to achieve the minimum topping thickness used in the design.
- I. Shear Loads:
 - 1. The diaphragm shear load shall be as indicated on the Drawings.
 - 2. The given shear loading shall be assumed to be distributed uniformly along the length of the connection between roof member and the structure wall and along the joint between roof members.
 - 3. Shear connectors shall be located as indicated. Additional connectors shall be provided where required by calculations. The maximum spacing of shear connectors shall be 4 feet at joints with all structural elements. The minimum allowable capacity of individual shear connectors shall be 10 lbs.
- J. Minimum Reinforcing:
 - 1. Adequate reinforcing steel shall be provided to control cracking. Maximum permissible crack width:
 - a. Surfaces exposed to weather: 0.005-inch.
 - b. Surfaces exposed to view but not weather: 0.01-inch

2. The flange slab of double tee sections shall contain reinforcing steel necessary to carry the specified loading and to meet the minimum requirements of ACI 318 but shall not be less than 0.087 square inches per foot for reinforcing spanning perpendicular to the tee stems.

K. Camber:

1. Prestressing eccentricity and force applied shall be adjusted to the extent possible so that the camber provided is the minimum amount needed to produce an approximate level slab after dead loads are applied.

PART 3 - EXECUTION

3.01 FABRICATION:

- A. Fabrication of members shall be in accordance with the requirements of PCI MNL-116.
- B. Forms: Forms shall be steel and constructed to produce precast units uniform in shape, size, and finish, free from castings and dents, gouges, oil canning, or other irregularities that will adversely affect appearance or strength of units. Consistent quality shall be maintained during manufacture. Formwork shall be designed to withstand high-frequency vibration.
- C. Reinforcing:
 1. Reinforcement shall be in accordance with SECTION 03200, "Concrete Reinforcement", of these Specifications. Concrete protection for the reinforcement shall conform to the requirements ACI 318. Reinforcement shall be fabricated and placed in conformance with ACI 318.
- D. Embedded items:
 1. Reinforcing steel, anchors, inserts, plates, angles, and other cast-in-place items shall be placed and embedded as indicated on shop drawings, accurately positioned in their designed location and anchored to prevent dislocation during member construction. No tack welding of or to reinforcement shall be permitted. Welding, when allowed, shall conform to AWS D1.4 requirements. No carbon steel chairs, spacers, nails or tie wire shall be used in positioning reinforcing and embedments.
 2. Connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories shall be fabricated to permit initial placement and final attachment.
 3. Flashing reglets shall be placed and embedded continuous and straight. Pickup points, boxouts, and inserts on member faces and surfaces to be exposed are prohibited except as approved.
 4. Any product within 1½-inches of the surface is to be non-corrosive, either plastic or 316 stainless steel.
- E. Fabrication and Tooling of Stainless Steel Connections and Embedments:
 1. Welding of stainless steel shall conform to AWS A5.4, AWS B2.1 and AWS D1.6, using tungsten inert gas procedures. Surfaces shall be sanded smooth (do not grind), and oxidized discoloration removed (blue heat tint).
 2. Threaded parts of stainless steel bolts shall be lubricated with an antisieze compound per SECTION 05600 Miscellaneous Metals, every time the nut is run on or off the threads.

- 3.02 CONVEYING: Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent segregation or loss of material.

3.03 PLACING:

- A. Concrete shall not be dropped more than four (4) feet beyond the bottom of chutes or tremies. Concreting shall be a continuous operation until placement of the section is complete. All concrete shall be worked around reinforcement and embedded items. All forms and subgrade shall be dampened prior to placement and excess water removed.
- B. All concrete shall be consolidated in the form by approved high frequency vibration. This vibration may be either internal or external or a combination of both. Where external vibration is used, forms must be of a design adequate to withstand such external vibration without distortion or failure.

3.04 CURING: The concrete shall be cured in accordance with ACI 308, ACI 517.1R, ACI 517, or ACI 516R.

3.05 CONCRETE FINISHES:

- A. Patching Concrete: Patch all tie holes, honeycombs or other defects with a Portland cement and sand grout. The grout shall not be richer than one (1) part cement and three (3) parts sand with the amount of mixing water enough to produce a workable mix. The patch shall be finished in such a manner as to match the adjoining surfaces. All corrective work shall be performed by experienced personnel skilled in this phase of the WORK.
- B. Defective Concrete: Any concrete which is not formed as shown on the drawings, or does not conform to the contract tolerances, or shows defects which reduce its structural adequacy, shall be removed from the job by the CONTRACTOR at his expense unless the FWC grants permission to patch the defective area.
- C. Exposed or Painted Concrete Surfaces: Surfaces shall be smooth, free of form marks and shall have surface blemishes filled and finished to match adjoining concrete in color and texture. As soon as practicable after stripping, all ridges, ribs and other imperfections shall be rubbed with an abrasive stone. Surfaces to be painted/coated shall be free of any coatings that would interfere with the adhesion or bond of coatings.
- D. Concealed Surfaces: Surface shall have all air and rock pockets over 1/4-inch in diameter, and chipped corners patched and cleaned by accepted methods. All form offsets or fins over 1/8-inch shall be ground smooth.
- E. Top surfaces which are to receive concrete topping shall be roughened to a full amplitude of approximately 1/4-inch. Surface shall be clean and free of any material that would reduce adhesion or bond of the concrete topping.
- F. No rock pocket or other voids reaching into the prestressing steel shall be patched without permission of the FWC.
- G. Roof and wall members shall be finished to provide proper bond for the insulating materials utilized in the Project.

3.06 WELDING:

- A. Welding for reinforcing steel bars, inserts, anchors, and anchorage details shall be in accordance with AWS D1.4, except that low hydrogen electrodes shall be used for welding of all reinforcing steel. Welding at bends in reinforcing steel shall be avoided.
- B. Welding for structural steel shall be in accordance with AWS D 1.1
- C. All welding shall be performed by AWS certified welders.

- 3.07 REMOVAL FROM FORMWORK: Precast units shall be removed from formwork using procedures conforming to PCI MNL-116. Each precast unit shall be identified with corresponding code on erection drawings, in location not visible to finished work.
- 3.08 DETENSIONING:
- A. Transfer of prestress shall be after test cylinders indicate an ultimate compressive strength of 3,500 psi minimum or greater if required by design. Detensioning sequence shall be such as to prevent severe unbalance of the loading. Prior to transfer or prestress, forms shall be loosened or removed if necessary to allow free movement of the casting.
- 3.09 JOINTS: Joints shall be as shown on the Drawings and approved Shop Drawings. Joint sealing shall be as specified in SECTION 03650, Sealants and Caulking.
- 3.10 CLEANING:
- A. Not sooner than 72 hours after joints are sealed, faces and other exposed surfaces of precast units shall be cleaned using a cleaning detergent recommended by the sealer MANUFACTURER and water applied with a stiff bristle brush, and thoroughly rinsed using clean water or other approved procedures.
- B. Discoloration, which cannot be removed by these procedures, shall be considered defective work, and repaired or replaced at the option of the FWC.
- 3.11 PROTECTION: Adjacent surfaces shall be protected from damage during sealing and cleaning operations and against damage, disfiguration or discoloration from subsequent operations. Noncombustible shielding shall be used during welding operations.
- 3.12 ERECTION:
- A. The units shall be erected in accordance with approved shop/erection drawings without damage to shape, finish or adjacent work. Damaged members shall be replaced or repaired at the option of the FWC. Unless otherwise shown, members shall be erected level and plumb within allowable tolerances. Sequence of erection shall be thoroughly outlined prior to starting and any special sequence outlined by the FWC shall be strictly adhered to.
- B. The CONTRACTOR shall align and maintain uniform horizontal and vertical joints as erection progresses, provide approved shims and wedges as required, and when members require adjustment beyond design or tolerance criteria, discontinue affected work. Units shall be secured in place and field welds, scratches, and otherwise damaged steel surfaces shall be touched up.
- C. Unless flexible connections are provided, prestressed concrete members shall not be permanently connected to the structure until a period of 28 days after transfer of prestress has elapsed.
- D. Field fabrication and erection of stainless steel shall conform to the procedures outlined in the paragraph entitled "Fabrication and Tooling of Stainless Steel Connectors and Embedments."
- E. Welding of all bearing plates and side connections shall be made carefully and in such a manner as not to spall the adjacent concrete.
- F. Vertical units shall be set dry, without grout, attaining joint dimension with plastic shims and spacers.
- G. Pickup points, boxouts, inserts and bearing surfaces shown shall be grouted with non-shrink grout in accordance with SECTION 03600 Grout. The color and texture of concrete surfaces of adjacent areas shall be finished to match in the same plane.
- H. Field-cut alterations will not be permitted unless approved in writing by the precast MANUFACTURER.

- I. Bearing surfaces shall be level and free from irregularities.

3.13 TRANSPORTATION AND STORAGE:

- A. During curing, form removal, storage, transportation, and erection, precast members shall not be overstressed, warped, or otherwise damaged or have the camber adversely affected. Members shall be adequately braced and supported during erection to insure proper alignment and structural integrity until permanent connections are completed. Precast units shall be stored off the ground and protected from weather.
- B. All prestressed members shall be handled and transported with the supports or pick-up devices located as near as practicable to the location of final supports. Pick-up points shall be shown on shop drawings. Lifting inserts shall have a minimum safety factor of four (4). Reusable lifting hardware and rigging shall have a minimum safety factor of five (5).
- C. Blocking and supports, lateral restraints and protective materials during transport and storage shall be clean, nonstaining, without causing harm to exposed surfaces, including temporary support to prevent bowing and warping. Lateral restraints shall be provided to prevent undesirable horizontal movement. Edges and exposed faces of members shall be protected to prevent straining, chipping, or spalling of concrete.
- D. Battens shall separate stacked members across the full width at bearing points.
- E. Hardware shall be transported, handled, stored, and protected in wood crates.

3.14 TOLERANCES:

- A. Manufacturing tolerances shall be in accordance with requirements of PCI MNL-116 unless otherwise indicated.
- B. Erection Tolerances shall be in accordance with the requirements of PCI MNL-127, unless indicated otherwise.

3.15 INSTALLATION:

- A. Site Access - Provide adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete products.
- B. General Requirements
 - 1. Install precast concrete products to the lines and grades shown in the contract documents or otherwise specified.
 - 2. Lift products by suitable lifting devices at points provided by the precast concrete producer.
 - 3. Install products in accordance with the precast concrete producer's instructions. In the absence of such instructions, install underground utility structures in accordance with ASTM C891. Install pipe, inlets, manholes and drainage structures in accordance with the procedures outlined by the American Concrete Pipe Association and Sections 425 and 430 of the FDOT Specifications.
- C. Water Tightness - Where water tightness is a necessary performance characteristic of the precast concrete product's end use, watertight joints, pipe-entry connectors and inserts should be used to ensure the integrity of the entire system.

END OF SECTION

SECTION 03600 GROUT

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all equipment, labor and material for the proper placement and curing of grout as indicated on the Drawings and as specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 03300 - Cast-in-Place Concrete

1.02 APPLICABLE STANDARDS AND PUBLICATIONS: The following standard specifications shall apply to the WORK of this SECTION:

- A. American Society of Testing and Materials (ASTM)
 - 1. C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or [50-mm] Cube Specimens)
 - 2. C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
 - 3. C496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
 - 4. C531 – Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - 5. C579 – Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - 6. C580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - 7. C827 – Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
 - 8. C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 - 9. C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
 - 10. C939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
 - 11. C1090 – Standard Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout
 - 12. C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)
 - 13. C1339 - Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts
 - 14. D648 – Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
 - 15. D695 – Standard Test Method for Compressive Properties of Rigid Plastics
- B. International Concrete Repair Institute (ICRI)
 - 1. Technical Guide for Selecting and Specifying Concrete Surface preparation for Sealers, Coatings, and Polymer Overlays
- C. American Institute of Steel Construction (AISC)
 - 1. Manual of Steel Construction
- D. American Concrete Institute (ACI)
 - 1. Building Code Requirements for Structural Concrete (ACI 318, latest edition)

E. International Code Council (ICC), formerly the International Conference of Building Officials (ICBO)

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS: The CONTRACTOR shall submit the following:

- A. Submittals shall be in accordance with SECTION 01300.
- B. MANUFACTURER's literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the WORK, and location of use.
- C. Name and telephone number of grout MANUFACTURER's representative, who will give on-site job service. The representative shall have at least one (1) year of experience with the chosen grouts.

1.05 QUALIFICATIONS:

- A. Pre-installation Demonstration and Training:
 - 1. The grout MANUFACTURER shall give a demonstration and training session for all the cement based non-shrink and epoxy grouts to be used on the Project, before any installation of grout is allowed.
 - 2. Training session shall use a minimum of five (5) bags of Cement Based Non-Shrink Class I Grout mixed to fluid consistency. Tests shall be conducted for flow cone and bleed tests. Six (6) cubes for testing at 1, 3, and 28 days shall be made. The remaining grout shall be placed, and curing initiated on actual project placements such as baseplates and tie holes to provide on-the-job training for the CONTRACTOR and FWC. The CONTRACTOR shall have the employees who will be doing the actual WORK participate in this training and demonstration session. The training session shall include methods for curing the grout.
 - 3. The MANUFACTURER shall mix enough Cement Based Non-Shrink Class II Grout for a minimum of 15 tie holes and shall train the CONTRACTOR's employees in how to perform the WORK and cure the grout. The CONTRACTOR shall have the employees assisting in the mixing and sealing of the tie holes.
 - 4. If the Project includes patching, throughbolt holes, epoxy anchors, and/or blockouts, the MANUFACTURER shall also train the CONTRACTOR's employees in the mixing and curing of the epoxy grouts for each of these applications.
 - 5. The CONTRACTOR shall transport the test cubes to an independent test laboratory, obtain the test reports, and report these demonstration and training test cube strengths to the FWC.
- B. Adhesive anchor installers shall be trained and qualified at the Site by MANUFACTURER's representative before installing any adhesive anchors. Training and qualification for each installer shall include, but not be limited to:
 - 1. Anchors installed in both the vertical and horizontal positions in a mock-up concrete panel of adequate size and thickness. Anchors shall be tested in tension and shear loading. A minimum of three anchors shall be tested for each installation position.
 - 2. Anchors shall be tested at two times the published allowable load in tension and in shear as indicated by the AISC Manual of Steel Construction.
 - 3. If any of the three test bolts in any installation position fail to reach the test loads, the installer shall be re-tested with the same procedure. Re-testing is required only for the failed installation position.
 - 4. An installer who has three consecutive successful bolt tests in the first or second trial is considered qualified for adhesive anchor installation for this Project. The MANUFACTURER's representative shall issue a certificate to the qualified installer, and a copy of the certificate shall be filed with the CONTRACTOR and be submitted to the FWC.
 - 5. The test anchor size shall be the maximum size adhesive anchor used on the Project. The embedment length shall be long enough to develop the allowable steel strength per AISC Manual of Steel Construction and ACI 318, Appendix D.

6. Each installer shall be re-qualified every six (6) months for the duration of the Project, by the same qualifying procedure.
7. The certification of each qualified installer shall be available for verification at the Special Inspector's request.
8. All defective anchors noted by the Special Inspector shall be replaced and re-installed by the CONTRACTOR without any additional compensation.

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall assist the FWC in obtaining specimens for testing and shall furnish all materials necessary for fabricating the test specimens.
- B. The cost of laboratory tests on grout will be paid by the FWC except where test results show the grout to be defective. In such case, the CONTRACTOR shall pay for the tests, removal and replacement of defective WORK, and re-testing all at no increased cost to the FWC.
- C. The MANUFACTURER of prepackaged grouts shall provide on-site technical assistance within 72 hours of request at no cost to the FWC.

1.07 CERTIFICATIONS AND TESTING: The CONTRACTOR shall provide to the FWC three (3) copies of certified test results for all tests required herein.

- A. Test results and service report from the field tests and the demonstration and training session verifying the requirements indicated herein.
- B. Certification that all grout used on the Project contains no chlorides or other chemicals that cause corrosion.
- C. MANUFACTURER's certification that their non-shrink grout does not contain aluminum, zinc, or magnesium powders, used as a method of expansion.
- D. ICC certifications for all adhesive anchors.

1.08 INSPECTION COORDINATION: All adhesive anchor installations shall have special inspections as recommended by the ICC report on the adhesive anchors and local codes.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 APPLICATION:

- A. Unless indicated otherwise, grouts shall be provided as listed below whether indicated on the Drawings or not:

TYPE OF GROUT	APPLICATION
Cement Grout	Surface repairs
Non-Shrink - Class I	All anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F, or in high fire risk areas.
	Beam and column (1 or 2 story) base plates less than 16 inches in the least dimension.
	Storage tanks and other non-motorized equipment and machinery under 30 horsepower
	Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc. (Where placement time is less than 20 min.)
	Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material

TYPE OF GROUT	APPLICATION
	Any application not listed, where grout is called for on the Drawings
Non-Shrink - Class II	Column base plates (greater than 2 story or larger than sixteen (16) inches in the least dimension)
	Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc. (where placement time exceeds 20min.)
	Under precast concrete elements
	Repair of holes and defects in concrete members which are water bearing or in contact with soil or other fill materials
Non-Shrink Epoxy	Machinery over 30 horsepower and equipment under 30 horsepower but subject to severe shock loads and high vibration
Epoxy Anchor Grout	All anchor bolts and reinforcing steel required to be set in grout that are not in high temperature or high fire risk areas.
Topping Grout	Toppings and concrete/grout fill less than three (3) inches thick
Structural Concrete per 03300	Toppings and concrete/grout fill greater than three (3) inches thick

2.02 MATERIALS:

A. Cement Grout:

1. Cement grout shall be composed of one (1) part cement, three (3) parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi, unless indicated otherwise.
2. Cement grout materials shall be as indicated in SECTION 03300 – Cast-in-Place Concrete.

B. Non-Shrink Grouts (Cement Based):

1. General:

- a. Cement Based Non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas-liberating, non-ferrous, grout, requiring only the addition of water.
- b. MANUFACTURER's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout indicated herein shall be that recommended by the MANUFACTURER for the particular application.
- c. Grout shall not contain chlorides or additives, which may contribute to corrosion.
- d. Grout shall be formulated to be used at any consistency from fluid to plastic.
- e. Non-Shrink grout shall have the following minimum properties when tested at a fluid consistency at 28 days:

Tensile Splitting Strength	ASTM C496	500 psi minimum
Flexural Strength	ASTM C580	1000 psi minimum
Bond Strength (concrete to grout)	ASTM C882 modified	1900 psi minimum

2. Class I Non-Shrink Grout:

- a. Class I Non-Shrink Grout shall have a minimum 28-day compressive strength of 5000 psi, when mixed at a fluid consistency.
- b. Class I Non-Shrink grout shall meet the requirements of ASTM C1107, Grade B or C, when mixed to fluid, flowable and plastic consistencies.
- c. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C827. The grout when tested shall not bleed or segregate at maximum allowed water.

- d. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C1090.
 - e. Provide certification together with independent test data that the expansion at 3 or 14 days does not exceed the 28-day expansion and that its non-shrink property is not based on gas production or gypsum expansion.
3. Class II Non-Shrink Grout:
- a. Class II Non-Shrink grout shall be a high precision, fluid, extended working time grout. The minimum 28-day compressive strength shall be 7500 psi, when mixed at a fluid consistency.
 - b. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C827.
 - c. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C1090.
 - d. Class II grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C1107.
 - e. Class II Non-Shrink grouts shall meet the requirements of ASTM C1107; Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C939.
 - f. The grout when tested shall not bleed or segregate at maximum allowed water.
 - g. Provide certification that its non-shrink property is not based on gas production or gypsum expansion.

C. Non-Shrink Epoxy Grout:

- 1. Non-Shrink Epoxy grout shall be a flowable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the MANUFACTURER. MANUFACTURER's instructions shall be printed on each container in which the materials are packaged.
- 2. Epoxy grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C827, (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1).
- 3. Epoxy grout shall have a negligible (less than 0.0006 in/in) length change after hardening, and a coefficient of thermal expansion less than 0.00003 in/in F when tested according to ASTM C531.
- 4. The epoxy grout shall develop a minimum compressive strength of 9000 psi in 24 hours and 13,000 psi in seven days when tested in accordance with ASTM C579, method B.
- 5. The mixed epoxy grout shall have a minimum working life of 90 to 120 minutes at 70 degrees F.
- 6. The effective bearing area shall be a minimum of 95% EBA in accordance with ASTM C1339.
- 7. The chemical formulation of the epoxy grout shall be that recommended by the MANUFACTURER for the particular application. Do not reduce aggregate loading or add solvents to increase flowability.
- 8. Non-Shrink Epoxy grout shall have the following minimum properties when tested at seven (7) days:

Bond Strength to Concrete	ASTM C882 modified	3000 psi minimum
Bond Strength to Steel	ASTM C882 modified	1700 psi minimum
Flexural Strength	ASTM C580	2500 psi minimum
Tensile Strength	ASTM C307	2000 psi minimum

D. Epoxy Anchor Grout:

Class C - for use above 60 degrees F

1. Epoxy anchor grout shall be a non-sag paste conforming to ASTM C881 Type IV, Class C, Grade 3 with the exception of gel time.
2. Heat deflection temperature per ASTM D648 shall be a minimum 120 degrees F.
3. MANUFACTURER shall certify that the epoxy grout will maintain 90 percent of its strength up to a temperature of 125 degrees F.
4. Grout shall come in a two-chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.
5. Epoxy anchor grout shall be capable of being used in submersed applications once cured.
6. Compressive strength per ASTM D695 shall be 10,000-psi minimum.
7. In vertical and overhead locations, anchor seal plugs shall be used.
8. If the average working or operating temperature will be over 100° F or in a high fire risk area, use cement based non-shrink grout and oversized holes.
9. Embedment of adhesive anchors/rebar shall be deep enough to develop the anchor/rebar. Embedment shall not exceed 67% of the member depth.

E. Topping Grout and Concrete/Grout Fill:

1. Where fill is thicker than three (3) inches, sitework concrete, as specified in SECTION 03300, may be used if approved by the FWC.
2. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All materials and procedures indicated for normal concrete in SECTION 03300, shall apply unless indicated otherwise.
3. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45.
4. Coarse aggregate shall be graded as follows:

U.S. STANDARD SIEVE SIZE	PERCENT BY WEIGHT PASSING
1/2"	100
3/8"	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

5. Final mix design shall be as determined by trial mix design as indicated in SECTION 03300, except that drying shrinkage tests are not required.
6. Strength: Minimum compressive strength of topping grout and concrete/grout fill at 28 days shall be 4000 psi.

2.03 CURING: Curing materials shall be as specified in SECTION 03300, and as recommended by the MANUFACTURER of prepackaged grouts.

2.04 CONSISTENCY:

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.
- B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed four (4) inches.

2.05 MEASUREMENT OF INGREDIENTS:

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurements shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the MANUFACTURER.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by the FWC.
- B. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of saturation period excess water shall be removed with clean, oil free compressed air prior to grouting. Concrete substrate shall not be wet prior to placement of epoxy grouts.
- C. Surface preparation, curing, and protection of cement grout shall be in accordance with SECTION 03300. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.
- D. All surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete or other deleterious materials.
- E. Shade the WORK Sites from sunlight for at least 24 hours before and 48 hours after grouting.
- F. Contact the grout MANUFACTURER's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

3.02 GROUTING PROCEDURES:

- A. General: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the MANUFACTURER.
- B. All structural, equipment, tanks, and piping support bases shall be grouted, unless indicated otherwise.
 - 1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout, or a thickness as indicated on the Drawings.
 - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against all surfaces, and joints shall be sealed as recommended by the grout MANUFACTURER to be liquid-tight. Forms shall be coated as recommended by the grout MANUFACTURER for easy form release. Where this method of placement is not practical or where required by the FWC, alternate grouting methods shall be submitted for acceptance by the FWC.
- C. Drilled anchors and Reinforcing Bars:
 - 1. General: Drilled anchors and reinforcing bars shall be installed in strict accordance with the MANUFACTURER's instructions. Holes shall be roughened with a brush on a power drill, and cleaned. Drilled anchors shall not be installed until the concrete has reached the required 28-day compressive strength. Anchors shall not be loaded until the grout has reached its indicated strength in accordance with the MANUFACTURER's instructions.
 - 2. Epoxy Adhesive Anchors:
 - a. Grout shall be proportioned and mixed with automatic equipment.

- b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the AISC Manual of Steel Construction and ACI 318, Appendix D., but shall not be less than eight (8) diameters for threaded rod, or 12 diameters for reinforcing or smooth bars.
 - c. The hole diameter shall be as recommended by the epoxy MANUFACTURER but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the bolt threads or the reinforcing bar deformations.
 - d. Holes shall be drilled by methods that do not interfere with the proper bonding of the epoxy.
 - e. Existing reinforcing steel in the vicinity of the proposed holes shall be located prior to drilling. The location of holes shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.
 - f. Holes shall be blown clean with clean, dry compressed air to remove all dust and loose particles. Holes shall be dry.
 - g. Reinforcing bars and anchors shall be installed per the MANUFACTURER's written installation instructions.
3. Cement Based Non-Shrink Grout:
- a. In places of high temperature or fire hazard, anchor bolts shall be grouted in using Cement Based Non-Shrink Grout, Class I.
 - b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the AISC Manual of Steel Construction and ACI 318, Appendix D., but shall not be less than 16 diameters for threaded rod, or 24 diameters for reinforcing or smooth bars.
 - c. When the bolt diameter is one (1) inch or less, the hole diameter should be a minimum of two inches. When the bolt's diameter is greater than one inch, the hole diameter should be at least twice the bolt diameter.
 - d. Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.
 - e. The non-shrink grout should be placed in the holes in a non-sag (trowellable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.
- D. Topping Grout and Concrete/Grout Fill:
- 1. All mechanical, electrical, and finish WORK shall be completed prior to placement of topping or concrete/grout fill. To ensure bonding to the base slab, the base slab shall be given an exposed aggregate finish. Alternatively, where accepted by the FWC, the base slab shall be given a roughened textured surface by a close-spaced rake while the surface is green. After curing, high pressure washing shall expose the aggregates and produce not less than a 3/16-inch amplitude roughness. Jackhammers or chipping hammers shall not be used.
 - 2. The minimum thickness of grout topping and concrete/grout fill shall be one inch. Where the finished surface of concrete/grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep.
 - 3. The base slab shall be thoroughly cleaned and wetted to saturated surface dry (SSD) condition per International Concrete Repair Institute Standards for Surface Preparations, prior to placing topping and fill. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat cement grout shall be broomed into the surface of the slab just before topping or fill placement. The neat cement grout shall not be allowed to dry before topping placement. If it does dry, it must be immediately removed using wet stiff brooms and reapplied. The topping and fill shall be compacted by rolling or thorough tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the

revolving mechanism of the equipment in accordance with the procedures outlined by the equipment MANUFACTURER after the grout is brought to the established grade. Coat surface with evaporation retardant as needed to prevent plastic shrinkage cracks.

4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
 5. The surface shall be tested with a straight edge to detect high and low spots, which shall be immediately eliminated. When the topping and/or fill have hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.
 6. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by the FWC, the tank shall be filled with sufficient water to cover the entire floor for 14 days.
- 3.03 CONSOLIDATION: Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.
- 3.04 CURING: Cement based grouts shall be cured per SECTION 03300 and per the MANUFACTURER's recommendations.
- 3.05 FIELD TESTING:
- A. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the FWC to ensure continued compliance with these specifications. The specimens will be made by the FWC or its representative.
 - B. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C109 (Using 2-in or 50 mm Cube Specimens), at intervals during construction selected by the FWC. A set of three specimens will be made for testing at seven (7) days, 28 days, and each additional time period as appropriate.
 - C. Compression tests and fabrication of specimens for topping grout, and concrete/grout fill will be performed as specified in SECTION 03300, at intervals during construction as selected by the FWC.
 - D. All material, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.
 - E. The cost of all laboratory tests on mortar and grout will be borne by the FWC, but the CONTRACTOR shall assist the FWC in obtaining specimens for testing. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on WORK performed which does not meet the specifications. The CONTRACTOR shall provide all services necessary to conduct the compression tests.
 - F. Compression tests and fabrication of specimens for epoxy grouts will be performed in accordance with ASTM C579, Method B, at intervals during construction as selected by the FWC. A set of three specimens will be made for testing at seven (7) days, and each earlier time period as appropriate.
- 3.06 CONSTRUCTION TOLERANCES: Construction tolerances shall be as indicated in SECTION 03300, unless indicated otherwise.

END OF SECTION

SECTION 03650 SEALANTS AND CAULKINGS

PART 1 - GENERAL

- 1.01 SCOPE: The CONTRACTOR shall furnish all labor, materials and equipment necessary for sealing and caulking as specified herein.
- 1.02 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- A. American Society for Testing and Materials (ASTM) Publications: C920-79 Elastomeric Joint Sealants.
- 1.03 SUBMITTALS:
- A. Certifications of Conformance of Compliance: Submit certificates from the manufacturers attesting that materials meet the specified requirements.
- B. Manufacturer's Descriptive Data: Submit complete descriptive data for each type of material. Clearly mark data to indicate the type the CONTRACTOR intends to provide. Data shall state conformance to specified requirements. Data for sealant and caulking shall include application instructions, shelf life, mixing instructions for multi-component sealants, and recommended cleaning solvents.
- C. Colors: Submit one (1) sample of each color for each sealant and caulking type to verify that products match the colors indicated. Where colors are not indicated, submit not less than four (4) different samples of manufacturers' standard colors for selection by the FWC.
- 1.04 SAMPLE JOINTS: Before sealant and caulking work is started, provide a sample of each type of finished joint where directed on the project. The sample shall show the workmanship, bond, and color of sealant or caulking. The workmanship, bond, and color of sealant or caulking work throughout the project shall match the approved sample joints.
- 1.05 ENVIRONMENTAL CONDITIONS: The ambient temperature shall be within the limits of 40 and 100 degrees F. when the sealant and caulking are applied.
- 1.06 DELIVERY AND STORAGE: Deliver materials to the job site in the manufacturer's external shipping containers, unopened, with brand names, date of manufacture, color, and materials designated clearly thereon. Containers of elastomeric sealant shall be labeled as to type, class, grade and use. Carefully handle and store all materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 degrees Fahrenheit or less than 40 degrees Fahrenheit.
- 1.07 WARRANTY:
- A. The MANUFACTURER shall warrant the EQUIPMENT, MATERIALS and PRODUCTS specified in this section against defective materials and workmanship with the MANUFACTURER'S standard warranty, but for no less than one year from the date of Substantial Completion, and as described in Article 13 of Section 00700 - General Terms and Conditions.
- B. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in Article 13 of Section 00700 - General Terms and Conditions.

PART 2 - PRODUCTS

- 2.01 **MATERIALS**: Products shall conform to the reference documents listed for each use. Color of sealant and caulking shall match adjacent surface color unless specified otherwise. For ASTM C920 sealants, use a sealant that has been tested on the type(s) of substrate to which it will be applied.
- A. Interior Caulking or Sealant: ASTM C920, Type S, Grade NS, Class 12.5 or 25, Use NT. Color of caulking or sealant shall be white.
 - B. Exterior Sealant: For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be gray unless in contact with window frame where it shall be dark brown or bronze.
 - C. Exterior sealants used adjacent to or above roof surfaces shall be compatible with asphaltic bituminous roofing products, should contact be made with the roofing system, that would not have adverse affects to either product.
 - D. Floor Joint Sealant: ASTM C920, Type M, Grade P, Class 25, Use T. Color of sealant shall be gray.
 - E. Primer for Sealant: Use a non-staining, quick-drying, of type and consistency as recommended by the sealant manufacturer for the particular application.
 - F. Bond Breakers: Use the type and consistency recommended by the sealant manufacturer for the particular application.
 - G. Backstops: Use a closed cell polyurethane or polyethylene foam free from oil or other staining elements as recommended by the sealant manufacturer. Backstop material shall be compatible with the sealant. Do not use oakum and other types of absorptive materials as backstops.

PART 3 - EXECUTION

- 3.01 **SURFACE PREPARATION**: Surfaces shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Where adequate grooves have not been provided, clean out grooves to a depth of ½-inch and grind to a minimum width of ¼-inch without damage to the adjoining work. No grinding shall be required on metal surfaces.
- A. Steel Surfaces: Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a solvent that leaves no residue.
 - B. Aluminum or Bronze Surfaces: Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. Use non-staining solvents recommended by the item manufacturer.
- 3.02 **SEALANT PREPARATION**: Do not modify the sealant by addition of liquids, solvents or powders. Mix multi-component elastomeric sealants in accordance with manufacturer's printed instructions.
- 3.03 **APPLICATION**:
- A. Backstops: Where joint cavities are constructed deeper than indicated, tightly pack the back or bottom with backstop material to provide a joint of the depth indicated. Install backstops dry and free of tears or holes.
 - B. Primer: Just prior to application of the sealant or caulking compound, clean out all loose particles from joints. Apply primer in accordance with compound manufacturer's directions. Do not apply primer to exposed finish surfaces.

- C. Bond Breaker: Provide bond breakers as recommended by the sealant manufacturer for each type of joint and sealant used.
- D. Sealant and Caulking Compounds: Use a compound that is compatible with the material to and against which it is applied. Do not use a compound that has exceeded its shelf life or has become too jelled to be discharged in a continuous flow from the gun. Apply the compound in accordance with the manufacturer's printed instructions. Force the compound into joints with sufficient pressure to fill the joints solidly. Compound shall be uniformly smooth and free of wrinkles.
 - 1. Interior Sealant and Caulking: Provide sealant or caulking at all exposed joints in the building and at all joints indicated to receive sealants or caulking.
 - 2. Exterior Sealant: Provide sealant at all joints around the perimeter of openings and at all exposed joints on the building and at all joints indicated to receive sealant.
 - 3. Floor Joint Sealant: Provide sealant in all control joints and in other floor joints indicated or specified.

3.04 PROTECTION AND CLEANING:

- A. Protection: Protect areas adjacent to joints from compound smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.
- B. Cleaning: Immediately scrape off fresh compound that has been smeared on masonry and rub clean with a solvent as recommended by the compound manufacturer. Upon completion of compound application, remove all remaining smears and stains resulting therefrom and leave the work in a clean and neat condition.

END OF SECTION

SECTION 05060 WELDING

PART 1 - GENERAL

1.01 SCOPE: The CONTRACTOR shall provide all labor, equipment, and materials for all shop and field welding as required by the Drawings and/or Specifications.

1. SECTION 05070 - Bolted Fasteners
2. SECTION 05140 – Structural Aluminum

1.02 SHOP DRAWINGS AND ERECTION PROCEDURES:

A. Drawing shall include all shop and erection details, including welds. All welds, both shop and field, shall be indicated by standard welding symbols as noted by American Welding Society (AWS) A2.0. Drawings shall show the size, length and type of each weld.

1.03 STANDARD REFERENCES: The following standard specifications shall apply to the WORK of this SECTION as indicated:

- A. American Welding Society, Structural Welding Code, (AWS)
- B. American Institute of Steel Construction Manual for Steel Construction, 9th Edition, (AISC)
- C. Aluminum Association, Aluminum Design manual, 2015 Edition
- D. American Society for Testing and Materials (ASTM)
- E. American Welding Society:
 1. D1.1 - Code for Welding in Building Construction
- F. Welding shall be in accordance with American Welding Society Standard Code D1.1.

1.04 WELDERS QUALIFICATIONS: All welders, including tack welders, shall be qualified in accordance with Section 5, Part C of AWS D1.1. The CONTRACTOR shall certify by name, to the FWC, the welders so qualified including the code and procedures under which the individual qualified.

- A. Welders and Welding Operators, shop and field, shall be qualified by an independent laboratory using test procedures covered by an independent laboratory using test procedures covered in AWS D1.1, and shall have been employed as a welder using the positions for which he is qualified during the previous 90 days. The CONTRACTOR shall provide the FWC and the laboratory inspector with the names of welders to be employed in the shop and field on the WORK, certification of the position, date of the last qualification test and the name of the qualifying laboratory.
 1. All welders employed in the shop on the fabrication of the steel work shall be qualified for the most difficult welding position during shop fabrication.
 2. All welders employed in the field on the erection of the steel work shall be qualified for the most difficult welding position during field erection.
 3. The CONTRACTOR shall require any welder to retake the test, when, in the opinion of the FWC, the WORK of the welder creates a reasonable doubt as to the proficiency of the welder. Recertification of the welder shall be made to the FWC only after the welder has taken and passed the specified test. The FWC may require radiographic or ultrasonic testing or may require coupons to be cut from any location in any joint for testing.
 4. Should any two radiographic or ultrasonic tests or coupons cut from the work of any welder show strengths, under tests, less than that of the base metal, it will be considered evidence of negligence or incompetence and such welder shall be removed from the WORK.

5. When coupons are removed from any part of a structure, the members cut shall be repaired, at no additional cost to the FWC, in a neat and workmanlike manner with joints of type to develop the full strength of the members and joints cut, with peening to relieve residual stress. All SECTIONS of welds found defective shall be chipped or cut out to base metal and rewelded before proceeding with the WORK.
6. Costs of all qualifications, tests and retests shall be borne by the CONTRACTOR.

1.05 INSPECTION AND TESTING:

- A. Shop inspections and tests shall include fit-up, preparation of surfaces and welding.
- B. Field inspections and tests shall include fit-up, preparation of surface and welding.

1.06 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - MATERIALS

2.01 WELD METAL: The chemical and mechanical properties of all deposited weld metal shall be compatible to the base metal and conform to AWS specifications for electrodes.

2.02 BASE METAL: The parent structural steel shall be a weldable grade with the chemical and mechanical properties to produce a sound and serviceable welded joint.

2.03 FABRICATION:

- A. Surfaces of joints for welded and bolted connections shall be clean, bright metal.
 1. Welded connections will be permitted only where indicated on the drawings. Welded construction shall conform to the AISC and AWS Specifications.

PART 3 - EXECUTION

3.01 WELDING METHODS: Unless otherwise approved by the FWC, welding of steel shall be by an electric arc welding process and shall conform to AWS, Structural Welding Code, and the applicable sections of the AISC.

3.02 WELDING EQUIPMENT: Welding equipment shall be capable of providing the welding required by the drawings or specifications herein in accordance with the requirements of joint qualifications in AWS D1.1.

3.03 WELDING ELECTRODES:

- A. Electrodes and flux used for submerged arc welding shall be of the same manufacture. The flux shall be free of contamination from dirt, mill scale and foreign material. Fused flux used in welding shall not be reused. Bare electrodes and flux used in combination shall conform to the requirements of AWS D1.1.
- B. Electrodes for manual shielded metal-arc welding shall conform to AWS D1.1.

3.04 QUALIFIED WELDS: Only qualified welded joints shall be permitted in accordance with AWS, Structural Welding Code, and applicable sections of AISC.

3.05 PAINING:

- A. After cleaning and connections are approved by the laboratory inspector, all surfaces to be welded shall be given a shop coat of primer. After erection, all field connections shall be cleaned.
- B. All connections, including welds and all abraded surfaces on the shop primer shall be painted to give one complete coat primer. Paint for field touch-up shall be the same paint used for the shop coat.

END OF SECTION

SECTION 05070 BOLTED FASTENERS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The WORK of this SECTION consists of furnishing all labor, materials and equipment necessary for installation of bolted fasteners as shown on the Drawings.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 05140 – Structural Aluminum

1.02 SHOP DRAWINGS:

- A. Shop Drawings shall include bolted connections and the type, size and length of bolts including washers.

1.03 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society of Testing Materials (ASTM)
 - a. A36 – Standard Specification for Carbon Structural Steel
 - b. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - c. A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi (pounds per square inch) Tensile Strength
 - d. A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi (kips per square inch) Minimum Tensile Strength.
 - e. A490 – Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
 - f. A563 – Standard Specification for Carbon and Alloy Steel Nuts
 - g. F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
 - h. F436 – Standard Specification for Hardened Steel Washers
 - i. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - j. F594 - Standard Specification for Stainless Steel Nuts
 - 2. American National Standards Institute (ANSI)
 - a. B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
 - b. B18.2.2 - Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
 - c. B18.2.6 - Metric Fasteners for Use in Structural Applications
 - 3. American Institute of Steel Construction (AISC)

4. Specifications for Structural Joints Using ASTM A325 or A490 bolts, approved April 1978, by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation

1.04 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

1.05 TEMPLATES:

- A. Templates shall be furnished by the Fabricator to the job, together with instructions for the setting of anchors, anchor bolts and bearing plates.

1.06 INSPECTION AND TESTING:

- A. Field inspections and tests shall include fit-up, preparation of surface and bolting.

PART 2 - MATERIALS

2.01 GENERAL

- A. All bolts, nuts and washers not designated stainless steel shall comply with ASTM F1554, Grade 105.
- B. All threaded rods shall comply with ASTM F1554, Grade 105
- C. All stainless steel bolts, nuts and washers shall comply with ASTM F593. ASTM F593 and F2281 bolts shall be used for connections as indicated on the Drawings.
- D. ASTM F593 bolts shall be a group 1 alloy in the CW condition.

2.02 HIGH STRENGTH BOLTS:

- A. High strength bolts not designated stainless steel shall conform to the requirements of ASTM A325. The bolt dimensions shall conform to the current requirements of ANSI B18.2.6 for heavy hex structural bolts.
- B. Stainless Steel high strength bolts shall conform to the requirements of ASTM F593. All bolts shall be a group 1 alloy in the CW condition.

2.03 ALLOY STEEL BOLTS: Alloy steel bolts shall conform to the requirements of ASTM A490.

2.04 NUTS:

- A. Nut dimensions shall conform to ANSI B18.2.2 for heavy hex nuts.
- B. Nuts for bolts not designated stainless steel shall conform to ASTM A563.
- C. Nuts for stainless steel bolts shall conform to ASTM F594. ASTM F594 nuts alloy group shall match the stainless steel bolt alloy group.

2.05 WASHERS:

- A. Flat, circular and square washers for bolts not designated stainless steel shall conform to ASTM F436, Type 1.
- B. Compressible-washer type direct tension indicators for all connections shall conform to ASTM A959, Type 325.

- C. Flat, circular and square washers for stainless steel bolts shall conform to ASTM [F593] [F2281] and meet the dimensional requirements of ASTM F436. ASTM [F593] [F2281] washers alloy group shall match the stainless steel bolt alloy group.

2.06 TAMPER RESISTANT FASTENERS:

- A. Fasteners removable only by use of a special tool.

2.07 ANCHOR BOLTS:

- A. Anchor bolts for equipment and machinery, where permanently anchored into concrete, shall be stainless steel, unless otherwise shown. The diameter, length, and any bend dimensions shall be as required by the equipment or machinery MANUFACTURER. Unless otherwise required, use 3/4 inch minimum diameter and other geometry shown on the Drawings. Furnish a minimum of two (2) nuts and a washer of the same material for each bolt. Provide sleeves as required or as shown for location adjustment.
- B. Submerged use is defined as any connection to concrete from a point one (1) foot six (6) inches above the maximum water surface in a water-holding basin and any connection below that point.
- C. Anchor bolts for other uses to anchor fabricated metalwork or structural building, or structural frame components in areas of wet use or washdown areas shall be stainless steel. Furnish two (2) nuts and one (1) washer per bolt of the same material as the bolt, unless otherwise shown.

2.08 STAINLESS STEEL FASTENERS LUBRICANT (ANTI-SEIZING):

- A. Where stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners are used, the CONTRACTOR shall apply an anti-seizing lubricant to the threads prior to making up the connections. The lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper.

2.09 ANCHORING SYSTEMS FOR CONCRETE:

- A. Expansion (Wedge) Anchors:
 - 1. Expansion anchors shall not be used except in dry areas, unless otherwise indicated on the Drawings.
 - 2. Provide 304 stainless steel anchors; sizes as shown on the Drawings.
 - 3. Expansion anchors shall be: ITW Trubolt Wedge Anchors, manufactured by ITW Redhead, Michigan City, IN; Hilti Kwik Bolt 3, manufactured by Hilti Corporation, Tulsa, OK; Wej-It Anchors, manufactured by Wej-It Fastening Systems, Norwalk, CT; or FWC approved equal.
 - 4. Provide ICC or other similar building code organization recommendations regarding safe allowable design loads.
- B. Adhesive Anchors:
 - 1. Adhesive anchors shall be used for anchoring metal components in damp, below grade or submerged locations and where indicated on the Drawings.
 - 2. Adhesive anchors shall be Hilti HIT-RE 500 epoxy anchoring system with 304 stainless steel threaded rod, nuts and washers, as manufactured by Hilti Corporation, Tulsa, OK, or FWC approved equal.

2.10 BOLTS AND FASTENERS:

- A. Bolts and fasteners not permanently embedded in concrete, but located outdoors in areas subject to the weather; chemical handling areas; equipment rooms subject to drainage, leakage, and washdown; and in galleries and trenches, shall be Type 304 stainless steel as hereinbefore specified.
- B. Bolts for flanges of piping, valves, and other similar connections shall be as specified in other sections or as shown on the Drawings.

2.11 FABRICATION:

- A. Structural material shall be fabricated and assembled in the shop. Assembled pieces shall be taken apart for the removal of burrs and shavings produced by the reaming operation. Parts not connected in the shop shall be secured by bolts to prevent damage in shipment and handling.
- B. Surfaces of joints for bolted connections shall be clean, bright metal. Fit-up of the parts shall be inspected and approved by the laboratory inspector prior to making final connection.
 - 1. Holes for bolts shall be 1/16 inch larger than the diameter of the bolt.
 - 2. ASTM A307 bolts transmitting shear shall be threaded to such a length that no more than one thread will be within the grip of the metal. The bolts shall be of the length that will extend through, but no more than 1/4 inch beyond the nut. Nuts shall be tightened while bolt heads are tapped with a hammer. Tightening shall progress outward from the center of the joint. Nuts shall be locked after final tightening.
 - 3. Bolted connections using ASTM A325 bolts shall conform to the Specifications for Structural Joints using ASTM A325 or A490 bolts. Bolt threads shall be excluded from the shear planes of the contact surfaces between the connected parts and the bolts shall be tightened by the "Turn-of-Nut" method.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Fasteners shall be tightened in properly aligned holes to provide, when all fasteners in the joint are tight, at least the minimum tension required by AISC Specification for Bolted Connections. The turn-of-the-nut method shall be utilized for all high-strength bolts as defined by AISC Specification for Bolted Fasteners.
- B. Anchor Bolts:
 - 1. Anchor bolts and anchors shall be located and built into connecting work. All anchor bolts shall be accurately located and held in place with templates at the time the concrete is poured.
- C. Concrete Anchors:
 - 1. Installation shall not begin until the concrete or masonry receiving the anchors has attained its design strength. An anchor shall not be installed closer than six (6) times its diameter to either an edge of the concrete or masonry, or to another anchor, unless specifically detailed otherwise on the Drawings. Install in strict accordance with MANUFACTURER's written instructions. Use MANUFACTURER's recommended drills and equipment.

3.02 REUSE:

- A. A490 bolts and galvanized A325 bolts shall not be reused. Other A325 bolts may be reused, if approved by the FWC.

3.03 BOLTED PARTS:

- A. The slope of the bolted parts in contact with the bolt head and nut shall not exceed 1:20 with respect to a plane normal to the bolt axis. Holes shall be punched and reamed, or drilled, and shall have a diameter nominally 1/16 inch in excess of the nominal bolt diameter. Over-size, short slotted and long slotted holes shall conform to the requirements of AISC Specifications for Structural Joints.

3.04 GALVANIZING:

- A. The galvanizing of the bolts, nuts and washers shall conform to the requirements of ASTM A153.

END OF SECTION

PART 1 - GENERAL**1.01 SUMMARY:**

- A. Section Includes:
 - 1. Structural aluminum including the fabrication and erection of framing and bracing members, including connection design as required.
- B. Related Specification SECTIONS include but are not necessarily limited to:
 - 1. Division 01 - General Requirements.
 - 2. Division 03 - Concrete.
 - 3. SECTION 05060 - Welding
 - 4. SECTION 05600 - Miscellaneous Metals.
 - 5. SECTION 05520 – Handrails, Railings, Handrail Gates, and Bollards.
 - 6. SECTION 09900 - Protective Coatings.

1.02 QUALITY ASSURANCE:

- A. Referenced Standards:
 - 1. Aluminum Association (AA):
 - a. ADM 1, The Aluminum Design Manual.
 - b. DAF 45, Designation System for Aluminum Finishes.
 - 2. American Institute of Steel Construction (AISC):
 - a. 325, Manual of Steel Construction.
 - 3. ASTM International (ASTM):
 - a. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - b. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - c. B247, Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
 - d. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
 - e. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - f. F467, Standard Specification for Nonferrous Nuts for General Use.
 - g. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use.
 - h. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - i. F594, Standard Specification for Stainless Steel Nuts
 - 4. American Welding Society (AWS):
 - a. D1.2, Structural Welding Code - Aluminum.
- B. Qualifications:
 - 1. Minimum of [10] years of experience in fabrication of structural aluminum.
 - 2. For welding aluminum:
 - a. Qualify welding procedures and welding operators in accordance with AWS D1.2.
 - b. Welding operators to have been qualified during the 12-month period prior to commencement of welding.

1.03 SUBMITTALS:

- A. Shop Drawings:
 - 1. See Specification SECTION 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. Fabrication and/or layout drawings:
 - a. Erection plans and details of each piece including connection details:
 - 1) Show all cuts, copes and holes.

- 2) Indicate all shop welds using AWS symbols.
- 3) Indicate all shop and field bolts.
- b. Complete shop drawings for all of the work showing clearly all pieces, details, connections, materials and shop-applied coatings.
- c. Prepare complete erection drawings showing the location and marks of all pieces.
- 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. MANUFACTURER's installation instructions.
- 4. Certifications.
 - a. Certificates of compliance with standards specified for all major components and fasteners incorporated into work.
 - b. Copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.
- 5. Test reports.
 - a. Certified copies of material mill tests.
 - b. MANUFACTURER's load test and temperature sensitivity data for expansion anchor bolt and adhesive anchor bolts.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following MANUFACTURERS are acceptable:
 - 1. Mechanical anchor bolts: See Specification SECTION 05070.
 - 2. Adhesive anchor bolts: See Specification SECTION 05070.

2.02 MATERIALS

- A. Alloy 6061-T6, 32,000 PSI tensile yield strength minimum.
 - 1. ASTM B209 for sheets and plates.
 - 2. ASTM B221 and ASTM B308 for shapes: Beams, channels, angles and tees.
 - 3. ASTM B247 for forgings.
- B. Alloy 6063-T5 or T6, 15,000 PSI tensile yield strength minimum.
 - 1. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
- C. Nonferrous Bolts and Nuts: ASTM F467 and ASTM F468 of alloy 2024-T4 (60,000 PSI tensile strength minimum).
- D. Stainless Steel Bolts and Nuts : ASTM F593 and ASTM F594, Type 304 or 316 with a minimum yield strength of 30,000 PSI and a minimum tensile strength of 75,000 PSI.
- E. Washers: Same material and alloy as found in bolts and nuts with which the washers are to be used.
- F. Electrodes for Welding Aluminum: AWS D1.2 filler alloy 5356.
- G. Mechanical and Adhesive Anchor Bolts for Fastening to Concrete:
 - 1. Where approved by Engineer.
 - 2. Stainless steel, Type 304 or 316.
 - 3. See Specification SECTION 05070.

2.03 DESIGN

- A. All design shall consider effect of welds on material properties.
 - 1. Eliminate the use of field welding.
 - 2. Observe locations of any specified shop splice welds.
- B. Where final design of connections for any portion of structure is not indicated, perform final design of such connections in accordance with the building code.
- C. Final designs of connections shall conform to AA ADM 1 and to details and requirements stated in the Contract Documents.

1. Design loads for connections to be designed by the CONTRACTOR shall be as shown on the Drawings.
2. Where design loads are not specified, connections shall be detailed to develop the full capacity of the member.

2.04 FABRICATION

- A. Fabrication of bolted and welded connections of aluminum work shall be in accordance with AA ADM 1.
- B. CONTRACTOR to be solely responsible for correctness of all shop and field fabrication and fit. Verify field conditions and dimensions prior to fabrication.
- C. Fabricate aluminum work and assemble in shop to greatest extent possible.
 1. Make splices only where indicated or approved by Engineer.
- D. Provide connections as indicated.
 1. Where not indicated, design and provide connections in accordance with requirements of this Specification SECTION.
 2. One-sided or other types of eccentric connections are not acceptable unless indicated on Contract Drawings or approved on Shop Drawings.
- E. Drill or punch holes at right angles to surface of metal.
 1. Do not make or enlarge holes by burning.
 2. Provide holes clean and free of torn or ragged edges.
 3. Use tools which will make a 1/16 IN bevel to remove outside burrs resulting from drilling or punching operations.
 4. Punch or drill for field connections and for attachment of work by other trades.
- F. Cope at 45 DEG corners of stiffener plates at junction of member flanges with webs.
- G. Welding:
 1. Weld connections to members in shop and bolt connections in field.
 2. Perform welding using electrodes of filler alloy 5356.
 3. Perform welding in accordance with AWS D1.2.
 4. Use only welding procedures and welding operators qualified in accordance with requirements of Paragraph 1.2B. Qualifications.
- H. All full penetration welds shall be nondestructively tested by liquid penetrant or ultrasonic methods per AWS standards.
- I. Form to shapes indicated with straight lines, true angles and smooth curves.
 1. Grind smooth all rough welds and sharp edges.
 2. Round all corners to approximately 1/8 IN radius.
- J. Finish: Mill finish as fabricated.

2.05 SOURCE QUALITY CONTROL

- A. Special Inspection and Testing:
 1. CONTRACTOR responsible for testing to qualify shop welders and as needed for CONTRACTOR's own quality control to ensure compliance with Contract Documents.
 2. CONTRACTOR to inspect and test fabrication in accordance with the fabricators quality control procedures and in accordance with ADM-1 2015 or later.
 3. CONTRACTOR inspect shop welding in accordance with AWS D1.2, Section 5 including the following non-destructive testing:
 - a. Visually inspect all welds.
 - b. In addition to visual inspection, test 50 PCT of full penetration welds and 20 PCT of fillet welds with liquid dye penetrant.
 - c. Test 20 PCT of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.

PART 3 - EXECUTION

3.01 ERECTION

- A. CONTRACTOR is solely responsible for safety.
 - 1. Construction means and methods and sequencing of work is prerogative of the CONTRACTOR.
 - 2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until decks and diagonal bracing or rigid moment connections are installed.
 - 3. Partially complete structural members shall not be loaded without an investigation by the CONTRACTOR.
 - 4. Until all elements of the permanent structure and lateral bracing system are complete, provide temporary bracing designed, furnished and installed by the CONTRACTOR.
- B. Bolting:
 - 1. Protect bolt threads from damage.
 - 2. Rest bolt heads and nuts squarely against surfaces.
 - 3. Where bolt heads or nuts rest on beveled surfaces having slope greater than 1 IN 20 with plane normal to bolt axis, use beveled washers to provide full bearing to head and nut.
 - 4. Correct poor matching of holes by drilling to next larger size and use larger diameter bolt.
 - 5. Unless otherwise specified, connect aluminum members to:
 - a. Aluminum members using 3/4 IN DIA nonferrous bolts of alloy 2024-T4 or stainless steel bolts (ASTM F593 and ASTM F594).
 - b. Carbon and low alloy steel using 3/4 IN DIA stainless steel bolts (ASTM F593 and ASTM F594).
 - 1) Provide dissimilar materials protection.
 - c. Concrete or masonry using stainless steel expansion anchor bolts or adhesive anchor bolts unless shown otherwise.
 - 1) Provide dissimilar materials protection.
- C. Welding: Field welding of aluminum is not allowed unless indicated on Drawings.
- D. Correct fabrication errors and damaged members in shop.
 - 1. Do not use cutting torch in shop or in field to cut any members, to correct fabrication errors, or to cut openings.
- E. Provide templates for anchors, bolts, and other items to be installed in other work.
- F. Field Assembly:
 - 1. Tolerances shall comply with AISC 325 and the ADM-1.
 - a. Before members are assembled, thoroughly clean all bearing surfaces and surfaces that will be in permanent contact.
 - b. After assembly, carefully align all members of each frame or assembly and accurately adjust until final, correct and true location is achieved.
 - 1) As work progresses, securely fasten in place.
 - 2. Provide full length members without splices.
 - 3. Securely tighten and leave in place all erection bolts used in welded construction, unless removal is required.
- G. Set beam and column baseplates accurately, as indicated on nonshrink grout, in accordance with Division 03.
 - 1. If not indicated, provide minimum of 1 IN grout thickness under base plates.
 - 2. Set and anchor each base plate to proper line and elevation.
 - a. Use aluminum wedges, shims, or setting nuts for leveling and plumbing columns and beams.
 - 1) Tighten anchor bolts.
 - b. Fill space between bearing surface and bottom of base plate with nonshrink grout.
 - 1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
 - c. Do not remove wedges or shims and where they protrude, cut off flush with edge of base plate.
- H. Temporary Protection:

1. Suitably protect aluminum surfaces against lime mortar stains, discoloration, surface abrasion and other construction abuses.
 2. Remove protection.
- I. Contact with Dissimilar Materials: Where aluminum surfaces will be embedded in concrete, built into masonry, or in contact with steel, concrete, grout, masonry, or other dissimilar materials, coat the aluminum surfaces as described in Specification SECTION 09900.

3.02 FIELD QUALITY CONTROL

- A. Special Inspection and Testing:
1. Special Inspection is required to:
 - a. Inspect structural aluminum delivered on site, prior to erection.
 - 1) Visually inspect all welds, bolts and general fabrication
 - b. Verify proper identification markings for bolts, nuts and washers per applicable standards. Verify proper hole and bolt size.
 - 1) Frequency: All bolts, prior to being covered up or substantial completion.
 - c. Inspect structural aluminum which has been erected.
 - 1) Inspect the following:
 - a) Details such as bracing and stiffening.
 - b) Member locations.
 - c) Erection tolerances.
 - d) Application of joint details at each connection.
 - 2) Frequency: Prior to members being covered up or substantially complete.

END OF SECTION

SECTION 05520 HANDRAILS, RAILINGS, HANDRAIL GATES, AND BOLLARDS

PART 1 - GENERAL

1.01 SUMMARY:

- A. Summary of Work: The WORK of this SECTION shall consist of furnishing all labor, material, and equipment necessary for the installation of handrails, railings, handrail gates and bollards as shown on the Drawings and specified herein. All handrails and handrail gates are removable and suitable for a submerged environment.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 03600 – Grout
 - 3. SECTION 05070 – Bolted Fasteners
 - 4. SECTION 05600 – Miscellaneous Metals
 - 5. SECTION 05140 – Structural Aluminum
 - 6. SECTION 09900 – Protective Coatings.

1.02 QUALITY ASSURANCE:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Aluminum Association (AA):
 - a. ADM 1, Aluminum Design Manual.
 - 2. American Society of Mechanical Engineers (ASME):
 - a. Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
 - 3. ASTM International (ASTM):
 - a. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - b. B108, Standard Specification for Aluminum-Alloy Permanent Mold Castings.
 - c. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - d. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - e. B247, Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
 - f. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
 - g. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - 4. American Welding Society (AWS):
 - a. C5.5, Recommended Practices for Gas Tungsten Arc Welding.
 - b. D1.2, Structural Welding Code - Aluminum.
 - 5. National Association of Architectural Metal Manufacturers (NAAMM):
 - a. AMP 521, Pipe Railing Systems Manual.
 - 6. U.S. Department of Justice, Architectural and Transportation Barriers Compliance Board (Access Board):
 - a. Americans with Disabilities Act (ADA):
 - 1) Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - 7. Occupational Safety and Health Administration (OSHA):
 - a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
 - 8. Florida Fire Prevention Code
- B. Qualifications:
 - 1. Qualify welding procedures and welding operators in accordance with AWS and ASME Section IX.

1.03 DEFINITIONS:

- A. Handrail: A horizontal or sloping rail intended for grasping by the hand for guidance or support.
- B. Railing: A generic term referring to a handrail.
- C. Handrail Gate: A gate within a handrail to allow access through the handrail.

1.04 SUBMITTALS:

- A. Submittals shall be in accordance with SECTION 01300
- B. Submit Shop Drawings, signed and sealed by a Professional Engineer registered and active in the State of Florida, for all handrails, railings and handrail gates showing materials, quantities, configurations, dimensions, accessories, anchorage, installation, etc.
- C. Shop Drawings:
 - 1. Fabrication and/or layout drawings:
 - a. Drawings showing profile, location, sections and fabrication details including all welding information of each railing and of each gate.
 - b. Type and details of anchorage.
 - c. Location and type of expansion joints.
 - d. Materials of construction, shop coatings and all third-party accessories.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. MANUFACTURER's installation details.
 - 3. Certification that railings and gates have been designed and fabricated to meet the loading requirements specified.
 - 4. Calculations including calculations for all proposed deviations from the Technical Specification.
 - a. Calculations shall be performed, sealed, signed and dated by a registered professional structural engineer licensed in the State of Florida.
 - b. Calculations shall be specific to this Project and shall include all assumptions, references and design interpretations used to achieve the results obtained by the Engineer.
 - c. Reduction in load criteria is not acceptable as reason for deviation from sizes indicated in the Specification SECTION.
 - 5. Certification of welders and welding procedures indicating compliance with AWS requirements.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Deliver and handle railings and gates to preclude damage.
- B. Store railings and gates on skids, keep free of dirt and other foreign matter which will damage railings or gate including the finish. Protect against any corrosion.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Alloy 6061-T6.
 - 1. ASTM B209 for sheets and plates.
 - 2. ASTM B221 and ASTM B308 for shapes - beams, channels, angles, tees, and zees.
 - 3. ASTM B247 for forgings.
- B. Alloy 6063-T5 or T6.
 - 1. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
- C. Cast Fittings: Aluminum, ASTM B108.
- D. Shims: Aluminum of same alloy as component being shimmed.
- E. Fasteners: See Specification Section 05070.
- F. Expansion and Adhesive Anchors: See Specification Section 05070.

- G. Electrodes for Welding:
 - 1. Aluminum: AWS D1.2.
 - 2. Filler alloy 5356 or 4043.
- H. Non-shrink, Nonferrous Grout per SECTION 03600.
- I. Coatings and surface finishes per SECTION 09900.
- J. Bollards: ASTM 53 Grade B, galvanized steel pipe filled with concrete

2.02 FABRICATION:

- A. General:
 - 1. Verify field conditions and dimensions prior to fabrication.
 - 2. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
 - a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
 - 3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.
 - a. Ease exposed edges to a radius of approximately 1/32 IN.
 - b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - c. Drill or punch holes with smooth edges.
 - 4. Form exposed connections with flush, smooth, hairline joints, using stainless steel or aluminum splice locks to splice sections together or by welding.
 - a. Ease the edges of top rail splices and expansion joints and remove all burrs left from cutting.
 - 5. Provide for anchorage of type indicated on Drawings or as required by field conditions.
 - a. Drill or punch holes with smooth edges.
 - 6. Design railings, gates and anchorage system in accordance with NAAMM AMP 521 to resist loading as required by the building code.
 - a. Maximum allowable stresses per AA ADM 1.
 - 7. Design railings and gates in accordance with accessibility requirements per the building code and ADAAG.
- B. Custom fabricate railings and gates to dimensions and profiles indicated.
 - 1. Handrails:
 - a. All Schedule 40 pipe, unless otherwise noted.
 - b. Top rails: 2 IN nominal diameter.
 - c. Intermediate rails: 1-1/2 IN nominal diameter.
 - d. Vertical posts:
 - 1) 2 IN nominal diameter.
 - 2) Vertical posts that are to be side-bracket mounted to a vertical concrete surface or metal structure shall use Alloy 6061-T6 or 6063-T6.
 - 2. Handrail mounted to wall or to vertical posts: 1-1/4 IN nominal diameter Schedule 40 pipe.
 - 3. Where details are not indicated, space intermediate rails to requirements of the building code or OSHA Standards, whichever requires the more restrictive design.
 - 4. Space vertical posts as required by loading requirements but not more than 4 FT on center.
 - a. Avoid locating vertical posts at changes in direction of railing.
 - b. Hold vertical post back from corner and provide radiused corners.
 - 5. Space handrail brackets as required by loading requirements but not more than 4 FT on center.
 - 6. Base plate for vertical posts mounted to top of concrete surface:
 - a. 3/8 x 6 x 6 IN square plate.
 - b. Predrilled to accept four anchors.
 - c. Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.
 - d. Fit the vertical post over the solid rod and weld the post to the base plate.
 - 7. Base plate for vertical post mounted to flange of metal structure:
 - a. 3/8 x 3 x 8 IN plate.
 - b. Predrilled to accept two fasteners.

- c. Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.
- d. Fit the vertical post over the solid rod and weld the post to the base plate.
- 8. Mounting bracket for vertical post mounted to vertical concrete surface or web of metal structural member:
 - a. Pair of 3/8 IN angles or bent plates.
 - b. Predrilled to accept two fasteners each.
 - c. Weld angles or bent plates to vertical posts.
 - d. Provide toeboards on walkway side of all elevated walkways, platforms and stair landings, and where indicated on the Drawings or required by OSHA Standards.
 - 1) 4 IN high extruded toeboard with stiffener ribs and angled toe.
 - a) Similar to Wagner, Model "IR94102."
 - e. Handrail gates:
 - 1) Constructed of same material and sizes as the handrail system.
 - 2) Width of gate as shown on Drawings.
 - 3) Hinges:
 - a) Cast aluminum.
 - b) Self-closing.
 - (1) Stainless steel torsion spring.
 - c) Similar to Wagner, Model "IR100."
 - 4) Gate latch and stop:
 - a) Cast aluminum.
 - b) Spring-loaded pin latch.
 - (1) Stainless steel spring.
 - c) Similar to Wagner, Model "IR101."

C. Railing Fabrication:

- 1. All railings are to be welded systems.
- 2. Use wire welding for all joints.
- 3. All welding to be continuous in accordance with AWS C5.5 and AWS D1.2.
 - a. All welded railing joints shall have full penetration welds unless noted otherwise.
- 4. All exposed welds to be ground smooth and flush to match and blend with adjoining surfaces.
 - a. NAAMM AMP 521, Type 2.
- 5. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
- 6. Finishing joints with filler is not acceptable.
- 7. Provide flush weld fittings using locking weld connectors or coped drive-on connectors.
- 8. Fit exposed ends of handrails and gates with solid terminations.
 - a. Return ends of handrail to wall, but do not attach to wall.
 - b. Where handrail terminates at a wall, provide a vertical post or end-loop 4 IN off the wall to center of vertical member.
- 9. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.
- 10. Install weeps to drain water from hollow sections of railing and posts in all locations.
 - a. Drill 1/4 IN weep hole in railings or posts closed at bottom:
 - 1) 1 IN above walkway surface at bottom of posts set in concrete.
 - 2) 1 IN above solid aluminum rod at posts having base plate.
 - 3) At low point of intermediate rails.
 - b. Drill 1/4 IN weep hole in bottom of base plate.
- 11. Expansion joints:
 - a. Joints to be designed to allow expansion and contraction of railing and gate and still meet design loads required.
 - 1) Top rail splices and expansion joints shall be located within 8 IN of post or other support.
 - 2) Where railings span building [or tank] expansion joints; provide a railing expansion joint in the span crossing the building [or tank] expansion joint.
 - b. Provide expansion joints in any continuous run exceeding 20 FT in length.
 - 1) Space expansion joints at not more than 40 FT on center.

- c. Provide minimum 0.10 IN of expansion joint for each 20 FT length of top rail for each 25 DEGF differential between installation temperature and maximum design temperature.
 - 1) Maximum expansion joint width at time of installation shall not exceed 3/8 IN.
 - a) Provide additional expansion joints as required to limit expansion joint width.
 - d. Provide slip-joint with internal sleeve.
 - 1) Extend slip joint min 2 IN beyond joint at maximum design width.
 - 2) Fasten internal sleeve securely to one side.
 - a) Provide allen-head set screw located in bottom of rail.
 - b) Rivets or exposed screw heads are not acceptable.
- D. Finish:
- 1. Mill.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Prior to installation, inspect and verify condition of substrate.
- B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
 - 1. Field welding aluminum is not permitted unless approved in writing by FWC.

3.02 INSTALLATION:

- A. Install handrails and gates to meet loading requirements of the building code.
- B. Install products in accordance with MANUFACTURER's instructions.
- C. Set work accurately in location, alignment and elevation; plumb, level and true.
 - 1. Measure from established lines and items which are to be built into concrete, masonry or similar construction.
- D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.
 - 1. Provide shims as required.
- E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by MANUFACTURER.
 - 1. Lubricate expansion joint splice bar for smooth movement of railing sections.
- F. Provide handrail sections and gates as indicated on Drawings.
- G. Attach handrails to walls with brackets designed for condition:
 - 1. Provide brackets which provide a minimum 1-1/2 IN clearance between handrail and nearest obstruction.
 - a. Handrails shall not project more than 4-1/2 IN into required stairway width.
 - 2. Anchor handrail brackets to concrete or masonry walls with 1/2 IN stainless steel adhesive anchors with stainless steel hex head bolts.
- H. Anchor railings to concrete with minimum 1/2 IN stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract Documents.
 - 1. Where exposed, bolts shall extend minimum 1/2 IN and maximum 3/4 IN above the top nut.
 - a. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut.
 - b. Bevel the top of the bolt after cutting to provide a smooth surface.
- I. Anchor railings to metal structure with minimum 3/4 IN stainless steel bolts, nuts and washers.
- J. Install toeboards to fit tight to the walking surface.
 - 1. Attach to railing vertical post with MANUFACTURER's standard mounting clamp:
 - a. Adjustable.

- b. Designed to engage in extruded slot on back of toeboard.
 - 2. Provide splice bars, corner splices and brackets:
 - a. MANUFACTURER's standard items as required for a complete installation.
 - 3. Notch toeboards at base plates or other obstructions.
 - 4. Bottom of toeboard shall not exceed 1/4 IN above walking surface.
- K. Coat aluminum in contact with dissimilar metal or concrete in accordance with Specification SECTION 09900.
- L. Install handrail gate plumb and level in location shown on Drawings.
 - 1. Center gate in opening.
 - 2. Top of gate to match top of handrail.
 - 3. Fasten hinges to gate and jamb post:
 - a. Minimum three, 1/4 IN stainless steel countersunk machine screws per leaf.
 - b. Drill and tap into railing and gate vertical posts.
 - 4. Provide not less than two hinges per gate.
 - 5. Install gate latch and stop on strike side of opening.
 - a. Fasten to gate with 1/4 IN stainless steel countersunk machine screws.
 - b. Drill and tap into gate vertical post.
 - c. Drill hole in railing vertical post to receive latch pin.
 - 6. Adjust to provide smooth operation:
 - a. Self-closing and self-latching.
- M. Bollards:
 - 1. Refer to the Drawings for pipe diameters.
 - 2. Erect bollards plumb and aligned and located as shown on Drawings, footings as shown on the Drawings. Fill steel pipes with 3,500 pounds per square inch (psi) concrete and finish top smooth and convex. Paint and finish as required by the FWC. Unless otherwise indicated, paint as specified for structural work in SECTION 09900.

END OF SECTION

SECTION 05600 MISCELLANEOUS METALS

PART 1 - GENERAL

- 1.01 MATERIALS: Materials shall be new, free from defects impairing strength, durability of appearance, and of best commercial quality for intended purposes.
- 1.02 SUBMITTALS: Submit for acceptance fully detailed shop and erection drawings for all miscellaneous metal work required for this project. Include with submittal color selections as required.
- 1.03 RELATED WORK SPECIFIED ELSEWHERE:
- A. SECTION 1300 Submittals
- 1.04 WARRANTY:
- A. The CONTRACTOR shall warrant the WORK against defects for one year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

- 2.01 BASIC MATERIALS:
- A. Miscellaneous Structural Shapes: ASTM A36
- B. Miscellaneous Aluminum Shapes: ASTM B221, alloy 6063 T-5, Sheet: ASTM B 209, alloy 3003, tempered as required
- C. Miscellaneous Iron Castings: ASTM A48, Class 30
- D. Anchors and Fastenings: Compatible with material to be fastened
- E. Shop Primer: No. 5210 Universal Primer by Glidden
- F. Isolator for Aluminum and Specified Galvanized Metals: Aluminum pigmented bituminous paint or epoxy
- 2.02 FINISHES:
- A. Hot-dipped galvanizing ASTM A386, Class C, for angle thresholds and all other shapes cast-in or directly attached to concrete or masonry.
- B. Shop Primer: One coat on all ferrous metals not scheduled or required to be galvanized.
- C. Caustic Etch and Lacquer: Miscellaneous aluminum.
- 2.03 SHOP FABRICATED ITEMS:
- A. Metal Stairs: To detail conforming to all codes and regulations governing industrial stairs.
- B. Angle Thresholds, Corner Guards, and Other Shapes Indicated as Cast-In-Construction: Weld round-rod back anchors as detailed or required. At corners, miter, weld and grind smooth. Follow basic material requirements.

PART 3 - EXECUTION

- 3.01 INSTALLATION:

- A. Follow accepted shop and erection drawings. Coordinate with work of Section 03100 for items cast into concrete.
- B. Isolate aluminum surfaces in contact with other surfaces with two (2) coats of specified paint.
- C. Isolate galvanized surfaces to be cast into concrete with two (2) coats of specified paint.

3.02 FIELD WELDING: Conform to AWS Code Standards. Use certified welders.

3.03 MISCELLANEOUS:

- A. Furnish all fastenings including lag screws, rods, bolts, washers, nuts, and inserts as required to complete all work.
- B. Embed pipe stanchions minimum 3 inches below grade in minimum 1-foot-4-inches diameter by 3-foot-6-inches deep 3000 psi concrete.

END OF SECTION

SECTION 09900 PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide coating on exterior and interior surfaces throughout the Project and which are listed in PART 2, with systems specified on "coating system" sheets at the end of this SECTION.
- B. Regulatory Requirements: In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local and regional jurisdiction. Notify the FWC of any coating specified herein that fails to conform to the requirements for the location of the Project or location of application.
 - 1. Lead Content: Use only coatings that are totally lead free.
 - 2. Chromate Content: Do not use coatings containing zinc-chromate or strontium chromate.
 - 3. Asbestos Content: Materials shall not contain asbestos.
 - 4. Mercury Content: Materials shall not contain mercury or mercury compounds.
 - 5. The specified maximum volatile organic compounds (VOC) content shall apply to the un-thinned product.
- C. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American National Standards Institute (ANSI):
 - a. A13.1 - Scheme for the Identification of Piping Systems
 - b. Z535.1 - Safety Colors
 - 2. American Society for Testing and Materials (ASTM):
 - a. C267 - Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
 - b. D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
 - c. D4258 - Standard Practice for Surface Cleaning Concrete for Coating
 - d. D4259 - Standard Practice for Abrading Concrete
 - e. D4260 - Standard Practice for Acid Etching Concrete
 - f. D4261 - Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating
 - g. D5201 - Standard Practice for Calculating Formulation Physical Constants of Paints and Coatings
 - h. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
 - 3. Society for Protective Coatings (SSPC) Surface Preparation Specifications:
 - a. SP1 - Solvent Cleaning: Removes oil, grease, soil, drawing and cutting compounds, and other soluble contaminants.
 - b. SP2 - Hand Tool Cleaning: Removes loose mill scale, loose rust, loose paint and other loose foreign matter.
 - c. SP3 - Power Tool Cleaning: Removes loose material. Not intended to remove all scale or rust.

- d. SP5 - White Metal Blast Cleaning: Removes all scale, rust, foreign matter. Leaves surface gray-white uniform metallic color.
 - e. SP6 - Commercial Blast Cleaning: Two-thirds of each square inch free of all visible residues; remainder only light discoloration.
 - f. SP7 - Brush-Off Blast Cleaning: Removes only loose material, remaining surface tight and abraded to give anchor pattern.
 - g. SP10 - Near-White Blast Cleaning: At least 95% of each square inch shall be free of all visible residues.
 - h. SP11 - Power Tool Cleaning to Bare Metal
4. International Concrete Repair Institute (ICRI)
 - a. Guideline #03732: Surface preparation should comply with ICRI technical guideline number 03732 (selecting and specifying concrete surface preparation for sealers, coatings and polymer overlays).
 5. United States Army Corps of Engineers (USACE)
 - a. CRD-C 48 - Standard Test Method for Water Permeability of Concrete
 - b. CRD C163 Test Method for Water Permeability of Concrete Using Triaxial Cell

1.03 DEFINITIONS:

- A. Coating systems include surface preparation, prime coat (first coat), finish coats (second and third coats), inspection, cleaning, and touch-up of surfaces and equipment. Shop preparation, prime coat, and finish coats to be shop-applied may be specified elsewhere or referenced to this SECTION so that a complete system is specified and coordinated.
 1. Where surface preparation and first (prime) coat are specified in other SECTIONs to be shop-applied, such as for structural steel, hollow metal doors or equipment, only the touch-up and finish coats are a part of field painting. Surface preparation is the required degree of preparation prior to application of first (prime) coat regardless if done in shop or field.
 2. If materials are provided without shop primer such as miscellaneous steel or sheet metal, then surface preparation, first, second, and third coats are a part of field painting.
 3. Concealed surfaces are generally not required to have finish-coats unless otherwise specified, but prime coat should be applied and touched up prior to concealment.
 4. Where equipment and materials are provided with shop-applied finished coating system, only touch-up is a part of field painting.
 5. Refer to applicable SECTIONs to determine whether surface preparation and first coat, or complete coating system, is to be shop-applied.
 6. The term "DFT" means minimum dry film thickness, with no tolerance for thinner films.

1.04 SUBMITTALS:

- A. Submit as specified in SECTION 01300.
- B. Submittals include, but are not limited to, the following:
 1. Schedule of products and paint systems to be used. Schedule shall include the following information:
 - a. Surfaces for system to be applied
 - b. Surface preparation method and degree of cleanliness
 - c. Product MANUFACTURER, name, and number
 - d. Method of application
 - e. Dry film thickness per coat of coating to be applied
 2. Color charts for selection and acceptance
 3. Product information

- a. MANUFACTURER's data sheet for each product proposed
- b. Technical and performance information that demonstrates compliance with the system performance and material requirements
- c. MANUFACTURER's instructions and recommendations on surface preparation and application
- d. Compatibility of shop and field applied coatings (where applicable)
- e. Material Safety Data Sheet (MSDS) filled out completely according to the Florida Right-to-Know Law, Chapter 442, Florida Statutes, clearly identifying each product used.
4. Certification signed by coating MANUFACTURERS stating that each coating is suitable for service intended as stated on each coating system sheet, and that the materials to be installed comply in all respects with the requirements of this SECTION.
5. The CONTRACTOR shall certify in writing to the FWC that applicators have previously applied all the systems in this SECTION and have the ability and equipment to prepare the surfaces and apply the coatings correctly.
6. Samples
 - a. Painted Wood: Eight (8) inch square samples for each color and material on hardboard.
 - b. Sample of each paint, finish, and other coating material on 8-1/2 inch by 11-inch sheet metal. Each sheet shall be completely coated over its entire surface with one coating material, type, or color.
 - c. Two (2) sets of color samples that match each color selected by the FWC from the MANUFACTURER's color charts. The color designation shall be shown on the back of the color sample.
 - d. Two (2) 2-foot by 2-foot concrete panels shall be constructed at the Site in an area designated by the FWC. On one panel, the CONTRACTOR shall apply the coating system required for water-retaining concrete interior surfaces and the system for concrete exterior surfaces on the other panel. The CONTRACTOR shall not begin coating the structure surfaces until the FWC has accepted both panels. If the FWC does not approve either panel, at its own expense the CONTRACTOR shall erect another, coat it, and request FWC approval.

1.05 QUALITY ASSURANCE:

A. Applicator Qualifications:

1. Coating WORK shall be performed by an SSPC certified CONTRACTOR having a minimum of Category QP 1 certification for WORK without hazardous paint removal, and Category QP 2 certification for WORK involving hazardous paint removal. The certified CONTRACTOR shall maintain in effect all required certifications for the duration of the Project. Any request for Project delay due to an expired certification will not be considered.
2. The applicator shall be certified in application of specified products and systems on projects of similar size and scope, as demonstrated by previous successful installations, and shall be approved by the MANUFACTURER in writing.

B. Manufacturer:

1. Provide products of MANUFACTURER with no less than ten (10) years' experience in manufacturing the materials for the required WORK.

1.06 RESPONSIBILITIES: (Not Used)

1.07 INSPECTION COORDINATION:

A. Pre-painting Conference:

1. Before field painting starts, representatives for the FWC, CONTRACTOR, coating applicator, and coating MANUFACTURER's technical representative shall meet with the FWC's personnel.

2. Agenda for the meeting will include details of surface preparations and coating systems to ensure understanding and agreement by all parties for compliance.
- B. In the event a problem occurs with coating system, surface preparation, or application, coating applicator and coating MANUFACTURER's technical representative shall promptly investigate the problem and submit results to the FWC.
- C. Whenever water tightness in a water-retaining structure is dependent upon WORK in other sections, the CONTRACTOR shall assume full responsibility for water tightness of the integrated assembly. Prior to starting WORK, CONTRACTOR shall meet with installers involved and with MANUFACTURERS of all materials involved to review Drawings and Specifications to insure that materials are being used properly and details are correct. A written report of this meeting shall be submitted to the FWC. The report shall contain at least:
1. Meeting date and names and affiliations of those present and written statements from each installer and MANUFACTURER of their acceptance of Drawings, Specifications and conditions, and of proposed use of their materials as proper for purposes shown.

1.08 WARRANTY:

- A. The CONTRACTOR shall warranty the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Proprietary names and product numbers are specified in most systems for material identification from these MANUFACTURERS.
1. PPG (Pittsburg Plate Glass Co.)
 2. Carboline Company, Inc.
 3. BASF Building Systems
 4. ICI Devoe Coating Company
 5. The Euclid Chemical Company
 6. Tnemec Company, Inc.
 7. Xypex Chemical, Ltd.
 8. Kryton International
 9. Sika Corporation
 10. GML Coatings, LLC
 11. Wasser Corporation
 12. Xymax Coatings, Inc.
 13. Benjamin Moore & Company
 14. Sherwin-Williams
 15. PPC Coatings
 16. International Fire Resistant Systems, Inc.
 17. Penetron
 18. Belzona Inc.
 19. Alocit & Enviropeel USA.

2.02 GENERAL:

- A. Materials furnished for each coating system must be compatible with the substrate.
- B. Single Manufacturer: All materials in each coating system shall be by the same coating MANUFACTURER to assure compatibility of coatings.
- C. Compatibility: When shop-painted surfaces are to be field coated, the CONTRACTOR shall ascertain whether finish materials will be compatible with shop coating. Coatings of uncertain composition shall be removed completely before applying new coatings.
- D. Colors:

1. Color of finish coatings shall match accepted color samples.
 2. When second and finish coats of a system are of same type, CONTRACTOR shall tint or use an easy distinguishable alternate color on second coat to enable visual coverage inspection of the third coat. When first and second coats only are specified and are of same or different types, tint or use an easy distinguishable alternate color on first coat to enable visual coverage inspection of the second coat.
- E. Include on label of material containers:
1. MANUFACTURER's name, product name, and number
 2. Type of paint and generic name
 3. Color name and number
 4. Storage and temperature limits
 5. Mixing and application instructions, including requirements for precautions which must be taken
 6. Drying, recoat, or curing time

2.03 COATING SYSTEMS: Specified on the "Coating System" sheets at the end of this SECTION.

2.04 SURFACES TO BE COATED:

- A. All surfaces extending one (1) foot above the maximum design or historical surface water level, whichever is higher and those that are submerged in fresh water or brackish water shall be provided with the following additional protective measures:
1. For all refurbishment/replacement projects or for new, replacement or refurbishment projects use Crystalline Capillary Waterproofing (CCW) as admixture in accordance with SECTIONS 03050 and 03300. Coating System C-3 is not in place of CCW admixture.
 2. It is not intended to construct with admixture and then coat. The Coating System C-3 shall be used for precast concrete and existing concrete that are or will be installed underwater and one (2) feet above the maximum design or historical surface water elevation, whichever is greater.

<u>Generic Description</u>	<u>Specific Surfaces</u>	<u>System</u>
Steel, mild exposure, non-immersion, Interior	<ol style="list-style-type: none"> 1. Hollow metal doors and frames 2. Miscellaneous steel 	S-1
Steel equipment, prime coated, severe exposure, non-immersion, interior and exterior	<ol style="list-style-type: none"> 1. Carbon steel in fabricated equipment for gate hoists and machinery 	S-3
Steel, severe Exposure, Non-Immersion. Exterior or Interior. DTM Acrylic. Safety Yellow.	<ol style="list-style-type: none"> 1. Bollards, guard posts 	S-7
Existing water-retaining concrete structures, below water level; protection against acid producing bacteria and other elements	<ol style="list-style-type: none"> 1. Channel walls 2. Intake & Discharge Bays 3. Precast Concrete 	C-3
Water-retaining concrete structures (waterproofing) , non-immersion	<ol style="list-style-type: none"> 1. Water Control Structures 2. Pump Stations 	C-4
Aluminum in contact with concrete or any other metal except galvanized steel	<ol style="list-style-type: none"> 1. Handrails, conduits, pipes, and plates 	A-1

2.05 SURFACES NOT TO BE COATED:

- A. Factory finished equipment, except for touch-up or noted otherwise
- B. Metal surfaces of stainless steel, bronze, aluminum, and fiberglass

- C. Concrete, unless listed on specific surfaces above
- D. Machined surfaces
- E. Grease fittings
- F. Glass
- G. Equipment nameplates
- H. Platform gratings, stair treads, door thresholds, and other walking surfaces unless listed on specific surfaces above
- I. Concrete Floors unless listed above

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING:

- A. Manufacturer Recommendations: Unless this specification requires otherwise, CONTRACTOR shall strictly follow the MANUFACTURER's printed recommendations and instructions for storing and handling coating system materials.
- B. Delivery of Materials:
 - 1. Deliver in sealed containers with labels and information legible and intact. Containers shall also have correct labels with required information.
 - 2. CONTRACTOR shall allow sufficient time for testing, if required.
- C. Storage of Materials: CONTRACTOR shall store under conditions recommended by the Material Safety Data Sheets:
 - 1. All protective coating materials shall be used within the MANUFACTURER's recommended shelf life.
 - 2. Store only acceptable materials on Project Site.
 - 3. Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures. Provide separate area and suitable containers for storage of coatings and related coating equipment.
 - 4. Dispose of used or leftover containers, thinners, rags, brushes, and rollers in accordance with applicable regulations.

3.02 PREPARATION FOR COATING:

- A. General: All surfaces to receive protective coatings shall be clean prior to application of coatings. The CONTRACTOR shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Surfaces to be coated shall be dry and free of visible dust.
- B. Protection of surfaces not to be coated: Surfaces that are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.
- C. Hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked, or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.
- D. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

- E. Protection of painted surfaces: Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

3.03 SURFACE PREPARATION:

A. General

1. Prepare surfaces for each coating system conforming to SSPC or ASTM surface preparation specifications listed.
 - a. If grease or oils are present, SSPC-SP1 must precede any other method specified.
 - b. Remove surface irregularities such as weld spatter, burrs, or sharp edges, prior to specified surface preparation.
2. Depth of profile shall be as specified for each system, but in no instance shall it exceed one-third of the total dry-film thickness of complete system.
3. Prepare only those areas which will receive the first coat of the system on the same day.

B. Metals

1. The minimum abrasive blasting surface preparation shall be as indicated in the coating system sheets included at the end of this Section. Where there is a conflict between these specifications and the coating MANUFACTURER's printed recommendations for the intended service, the higher degree of cleaning shall apply.
2. All sharp edges shall be rounded or chamfered, and all burrs, surface defects, and weld splatter shall be ground smooth prior to blast cleaning.
3. The type and size of abrasive shall be selected to produce a surface profile that meets the system sheet requirements for the particular coating and service conditions. Abrasives for submerged and severe service coating systems shall be clean, hard, sharp cutting crushed slag. Automated blasting systems shall not be used for surfaces that will be in submerged service. Metal shot or grit shall not be used for surfaces that will be in submerged service, even if subsequent abrasive blasting is planned to be one with hard, sharp cutting crushed slag.
4. Abrasive shall not be reused unless an automated blasting system is used for surfaces that will be in non-submerged service. For automated blasting systems, clean oil-free abrasives shall be maintained. The abrasive mix shall include at least 50 percent grit.
5. The CONTRACTOR shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.
6. Compressed air for air blast cleaning shall be supplied at adequate pressure from well maintained compressors equipped with oil and moisture separators that remove at least 95 percent of the contaminants.
7. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another method prior to painting.
8. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.
9. Damaged or defective coating shall be removed by the blast cleaning to meet the clean surface requirements before recoating.
10. If the required abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC SP2 or SSPC SP3 may be used.
11. Shop applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC SP1 before the abrasive blast cleaning work is started.
12. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

C. Concrete and Concrete Masonry Units

1. Surface preparation shall not begin until at least 30 days after the concrete or masonry has been placed.
2. All oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC SP1 before abrasive blast cleaning.
3. Concrete, concrete block masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface of the No. 80 grit flint sandpaper, if required by the coating application instructions.
4. If acid etching is required by the coating application instructions, the treatment shall be made after abrasive blasting. After etching, CONTRACTOR shall rinse surfaces with water and test the pH. The pH shall be between neutral and eight (8).
5. Surfaces shall be clean and as recommended by the coating MANUFACTURER before coating is started.
6. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model DB, or equal.

3.04 APPLICATION:

- A. CONTRACTOR shall apply coatings in accordance with coating MANUFACTURER's recommendations. Materials shall be thoroughly stirred, strained, and kept at uniform consistency during application. Coatings from different MANUFACTURERS shall not be mixed together.
- B. Use properly designed brushes, rollers, and spray equipment for all applications.
- C. On unprimed surfaces apply first coat of the system the same day as surface preparation.
- D. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The CONTRACTOR shall schedule such inspection with the FWC in advance.
- E. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.
- F. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.
- G. Dry-film thickness of each system shall be at least as thick as the minimum specified. Maximum dry-film thickness shall not exceed the minimum more than 20% or coating MANUFACTURER's requirements, whichever is less. Where a dry-film thickness range is specified, the thickness shall not be outside the range.
- H. Shop and field painting shall not be applied within three (3) inches of unprepared surface of any substrate such as areas to be welded or bolted.
- I. Environmental Conditions:
 1. Atmospheric temperature must be 50 degrees Fahrenheit or higher during application, unless approved in writing by coating MANUFACTURER. Do not apply coatings when inclement weather or freezing temperature may occur during the curing time interval.
 2. Wind velocities for exterior applications shall be at a minimum to prevent overspray or fallout and not greater than coating MANUFACTURER's limits.
 3. Relative humidity must be less than 85% and the temperature of the surface to be painted must be at least five (5) degrees above the dew point.
 4. Provide adequate ventilation in all areas of application to ensure that at no time does the content of air exceed the Threshold Limit Value given on the MANUFACTURER's Material Safety Data Sheets for the specific coatings being applied.
- J. Recoat Time: In the event a coating, such as an epoxy, has exceeded its recoat time limit, prepare the previously applied coating in accordance with MANUFACTURER's recommendations.

K. Protection:

1. Cover or otherwise protect surfaces not to be painted. Remove protective materials when appropriate.
2. Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.
3. Provide cover or shields to prevent surface preparation media and coatings from entering orifices in electrical or mechanical equipment. Where ventilation systems must be kept in operation at time of surface preparation, take precautions to shield intakes and exhausts to prevent the materials from entering system or being dispersed.
4. Provide signs to indicate fresh paint areas.
5. Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, and thinners. Dispose of leftover containers, thinners, rags, brushes, and rollers that cannot be reused in accordance with applicable regulations.
6. Do not remove or paint over equipment data plates, code stamps on piping, or UL fire-rating labels.

3.05 INSPECTION:

- A. CONTRACTOR shall provide and use a wet-film gauge to check each application approximately every fifteen (15) minutes in order to immediately correct film thickness under or over that specified.
- B. On ferrous surfaces, measurements shall be made with one of the thickness gauges listed below. The gauge shall be calibrated on metal practically identical in composition and surface preparation to that being coated and be of substantially the same thickness, except that for measurements on metal thicker than 1/4 inch, the instrument may be calibrated on metal with a minimum thickness of 1/4 inch. When calibrating any of the gauges for making film measurements of over three (3) mils, the calibrating thickness standards (shims) shall be of non-metallic composition. Where only one thickness criterion is specified, the calibrating shim thickness shall closely approximate the specified thickness, but where both thicknesses are specified, the shim's thickness shall closely approximate an average of the two. Calibrating instructions, thickness standards and, in the case of the Mikrotest gauge, a calibrating tool, should be obtained from the MANUFACTURER or supplier of the gauge. Authorized thickness gauges are:
 1. General Electric, Type B, General Electric Company
 2. Mikrotest, Elektrophysik - Koln
 3. Elcometer, Elcometer Instruments, Ltd.
 4. Inspector Gage, Elcometer Instruments, Ltd.
 5. Minitector, Elcometer Instruments, Ltd.
- C. Use holiday or pinhole detector on systems over metal substrates to detect and correct voids when indicated on system sheet.
- D. Furnish a sling psychrometer and perform periodic checks on both relative humidity and temperature limits.
- E. Check temperature of the substrate at regular intervals to be certain surface is five (5) degrees Fahrenheit or more above the dew point.

3.06 CLEANING AND REPAIRS:

- A. Remove spilled, dripped, or splattered paint from surfaces.
- B. Touch up and restore damaged finishes to original condition. This includes surface preparation and application of coatings specified.

END OF SECTION

		PROTECTIVE COATING SYSTEM	
		System S-1	
<p><u>SERVICE:</u> Steel, Mild Exposure, Non-Immersion, Interior</p> <p>Surface Preparation: Field: SSPC-SP1 and SP6. Clean and dry.</p> <p>First Coat: High solids polyamine or polyamide epoxy with minimum 67% solids by volume. Spray Applications; apply at 5.0 - 8.0 mils DFT. Brush applications, apply at 4.0 mils DFT.</p> <p>Second Coat: Same as first coat.</p> <p>Note: Second coat required only for brush applications.</p> <p>Third Coat (Exterior): Not required.</p> <p>System Total: Minimum 8.0 mils dry film thickness.</p> <p>Volatile Organic Content: Maximum 3.5 lbs/gal (425 g/l).</p>			
COATING MANUFACTURER		PRODUCT DESIGNATION	
PPGCarboline ICI Devoe Tnemec Sherwin-Williams		FIRST COAT Amerlock 2/400 Carboguard 890 Devran 224HS Hi-Build Epoxoline II N69 Macropoxy 646 FC(5-8mils DFT)	SECOND COAT Same as first coat Same as first coat Same as first coat Same as first coat Same as first coat

		PROTECTIVE COATING SYSTEM	
		System S-3	
<u>SERVICE:</u>	Equipment, Factory Coated, Severe Exposure, Non-Immersion, Exterior or Interior		
Surface Preparation:	Field or Shop (if applicable) First Coat: SSPC-SP1 and SP6. Clean and dry.		
First Coat: (Field)	Modified vinyl-alkyd or epoxy-mastic, compatible with existing and new finish. Apply at 1.5 to 2.0 mils dry film thickness.		
Second Coat Interior:	High build polyamide epoxy with minimum 50% solids by volume. Apply at 5.0 mils dry film thickness.		
Second Coat Exterior:	High solids aliphatic or acrylic polyurethane gloss enamel with minimum 52% solids by volume. Apply at 2.0 mils dry film thickness.		
System Total:	Interior: 6.5 mils dry film thickness in addition to existing coating. Exterior: 3.5 mils dry film thickness in addition to existing coating. Check for voids with holiday or pinhole detector.		
Volatile Organic Content:	Maximum 3.5 lbs/gal (425 g/l).		
COATING MANUFACTURER	PRODUCT DESIGNATION		
	FIRST COAT	SECOND COAT (INT)	SECOND COAT (EXT)
PPG	Amercoat 385 or 2/400	Same as first coat	Amercoat 450H
Carboline	Carbomastic 15	Carboguard 890	Carboline 134 HG
ICI Devoe	Bar-Rust 231	Devran 224 HS	Devthane 379H
Tnemec	Omnithane 1	Hi-Build Epoxoline II N69	Endura-Shield 1074
Sherwin-Williams	Kem Kromlik Primer	Macropoxy 646C	Acrolon 218 HS Polyurethane

	PROTECTIVE COATING SYSTEM	
	System S-7	
<u>SERVICE:</u>	Steel; Severe Exposure, Non-Immersion. Exterior or Interior. DTM Acrylic. Safety Yellow.	
Surface Preparation:	SSPC-SP1 and SP6. Clean and dry.	
First Coat:	Direct to Metal Acrylic Safety Yellow. Apply a minimum of 2.5 mils dry film thickness, or greater as required by MANUFACTURER.	
Second Coat:	Same as first coat.	
Third Coat:	Not required.	
System Total:	5.0 mils dry film thickness.	
Volatile Organic Content:	Maximum 2.08 lb per gal (< 250 g/L)	
COATING MANUFACTURER	PRODUCT DESIGNATION	
Benjamin Moore & Co. Sherwin-Williams	FIRST COAT DTM Acrylic Gloss Enamel P28-15 B66Y37 DTM Acrylic Gloss	SECOND COAT Same as 1 st coat Same as 1 st coat

	PROTECTIVE COATING SYSTEM
	System C-3

SERVICE: Existing water-Retaining Concrete Structures, below water level-protection against acid producing bacteria and other elements.

Surface Preparation: Per MANUFACTURER recommendations

First Layer: Two coats of cementitious crystalline coating containing catalytic chemicals which migrate into the concrete using moisture present in the concrete as the migrating medium, and which cause the moisture and the unhydrated cement in the concrete to react causing the growth of nonsoluble crystals, thereby rendering the concrete itself waterproof. The concrete becomes permanently sealed against the penetration of liquids from any direction.

Second Layer: Not Required

Third Coat: Not required

System Total Thickness: As MANUFACTURER recommends

Crystallizing capability of waterproofing material shall be evidenced by independent SEM (Scanning Electron Microscope) photographs documenting penetration of crystal-forming waterproofing material to a depth of 2 inches.

Independent testing shall be performed for 1. Permeability in accordance with USACE CRD C48/ USACE CRD C163 to a pressure of 200 psi with no measurable leakage exhibited and 2. Chemical resistance in accordance to ASTM C267.

COATING MANUFACTURER	PRODUCT DESIGNATION	
Xypex Chemical, Ltd BASF Building Systems Kryton International	FIRST COAT	SECOND COAT
	Concentrate Tegraproof Krystol T1	Modified same as first coat Krystol T2

	PROTECTIVE COATING SYSTEM
	System C-4

SERVICE:	Water -Retaining Concrete Structures (waterproofing), Non-immersion
Surface Preparation:	<p>ASTM D4258, clean and dry, free from grease, oil, and any other contamination. Remove protrusions. Per MANUFACTURER recommendations.</p> <p>For Concrete surfaces that have imperfections (i.e., voids, cracks and pores), use breathable high-build, waterproof cement-based coating. Bonding agent shall be mixed with the coating to improve adhesion to substrate.</p> <p>For concrete surfaces that are perfect, breathable, water based, acrylic emulsion coating that will resist ultraviolet light, alkali, acid and moldew.</p>
Primer Coat:	Apply at 4 mils dry film thickness.
First Coat:	Apply at 25 mils dry film thickness.
Second Coat:	Apply at 15 mils dry film thickness.
Third Coat:	Apply at 15 mils dry film thickness.
System Total:	Minimum 44 mils dry film thickness.
Volatile Organic Content:	None

<u>COATING MANUFACTURER</u>	<u>PRODUCT DESIGNATION</u>		
<u>Concrete surfaces with imperfections</u> Thoro Enduro-Seal Ultra System Products	FIRST COAT	SECOND COAT	THIRD COAT
	<u>Thorseal Thotocoat 200</u>	<u>Thorseal Thotocoat 200</u>	
	<u>EP Enduro-Seal 100</u>	<u>EP Enduro-Seal 100</u>	
	<u>USP - 100 Ultra Seal</u>	<u>USP - 100 Ultra Seal</u>	
<u>Concrete surfaces without imperfections</u> Thoro	<u>Thorocoat 200 or equal</u>	<u>Thorocoat 200 or equal</u>	

		PROTECTIVE COATING SYSTEM	
		System A-1	
<u>SERVICE:</u>		Aluminum in contact with concrete or any other metal except galvanized steel	
Surface Preparation:		Field: SSPC-SP1. Clean and dry	
First Coat:		High solids polyamine or polyamide epoxy with minimum 67 % solids by volume. Brush apply to surfaces to be in contact at 4.0 mils DFT	
Second Coat:		Same as first coat	
Third Coat:		Not required	
System Total:		Minimum 8 mils DFT	
Volatile Organic Content:		Maximum 3.5 lbs/gal (425 g/l)	
COATING MANUFACTURER		PRODUCT DESIGNATION	
PPG Carboline ICI Devoe Tnemec Sherwin-Williams Wasser Corporation	FIRST COAT Amerlock 2/400 Carboguard 890 Devran 224HS Hi-Build Epoxoline II N69 Macropoxy 646 FC Epoxy MC-Prepbond 100	SECOND COAT Same as first coat Same as first coat Same as first coat Same as first coat Same as first coat Same as first coat	

PART 1 - GENERAL

1.01 SCOPE

A. Summary of WORK:

1. The CONTRACTOR shall furnish and install three (3) electric belt-driven axial flow propeller pumping system, including pumps, fittings, supports, anchors, flexible connectors, accessories, electric drive units, and testing to provide a functional installation as indicated in the Drawings for the Bond Farm HEI Pump Station.
2. The CONTRACTOR shall furnish and install a duplex electric belt-driven axial flow propeller pumping system, including pumps, fittings, supports, anchors, flexible connectors, accessories, electric drive units, generator, fuel tank and testing to provide a functional installation as indicated on the Drawings for the SAL Grade Road Pump Station.

B. Related Sections include, but not necessary limited to:

1. DIVISION 1 – General Requirements
2. SECTION 02200 – Earthwork
3. SECTION 15106 – Discharge Pipe

1.02 APPLICABLE PUBLICATIONS: (Not Used)

1.03 DEFINITIONS: (Not Used)

1.04 SUBMITTALS

A. For each pumping system provide the following:

1. Summary of calculations for sizing the piping system and pumping equipment.
2. Drawings of the pumps installation with special attention to suction configuration.
3. Provide data sheets and drawings for all pumping equipment.
4. Provide pump curves for each pump size including efficiency, break horsepower and NPSH requirements.
5. Provide data sheets for piping, valves and appurtenances.
6. Provide a drawing of complete system with pumps, piping, drivers and associated hardware. Drawings shall include pipe sizes, installation locations, supports for bends and equipment and appurtenances. For the SAL Grade Road Pump Station include the generator, diesel fuel tank and all appurtenances.
7. Provide detailed installation plans for all equipment at the Bond Farm HEI Pump Station and the SAL Grade Road Pump Station including data sheets for all cranes to be utilized, location of crane including outriggers during installation, the weight of all equipment to be installed, and the Signed and Sealed calculations that the crane set-up will not damage any buried piping.

1.05 QUALIFICATIONS:

- A. The Pump Manufacturer shall be certified as an ISO 9001:2008 Quality System Accredited Company. A certificate of compliance shall be submitted to FWC.

1.06 RESPONSIBILITIES: (Not Used)

1.07 CERTIFICATIONS: (Not Used)

1.08 INSPECTION COORDINATION: (Not Used)

1.09 WARRANTY:

- A. The CONTRACTOR shall warranty the WORK against defects for one year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The pumping systems shall be manufactured by MWI Corporation or FWC approved equal.

2.02 PUMPS

- A. The pumps shall be electric belt-driven, axial flow propeller, completely submersible with proper bowl assembly, motor assembly, suction bell assembly and discharge tube.

B. Pump Capacities:

1. Bond Farm HEI Pump Station shall consist of one 2,500 gpm pump and two 5,000 gpm each pumps. The performance of characteristics of each pump shall be as follows:
 - a. Pump #1
 - 1) Design Condition: 2,500 GPM at 12 FT TDH
 - 2) Minimum Horsepower: 15
 - 3) Discharge Size: 12 IN
 - 4) Liquid Pumped: Surface Water
 - b. Pump #2
 - 1) Design Condition: 5,000 GPM at 11 FT TDH
 - 2) Minimum Horsepower: 30
 - 3) Discharge Size: 18 IN
 - 4) Liquid Pumped: Surface Water
 - c. Pump #3
 - 1) Design Condition: 5,000 GPM at 10.5 FT TDH
 - 2) Minimum Horsepower: 30
 - 3) Discharge Size: 18 IN
 - 4) Liquid Pumped: Surface Water
2. SAL Grade Road Pump Station shall consist of a duplex pump system with two 5,000 gpm pumps, one primary and one back-up. The performance of characteristics of each pump shall be as follows:
 - a. Pump #4 and #5
 - 1) Design Condition: 5,000 GPM at 13 FT TDH
 - 2) Minimum Horsepower: 15
 - 3) Discharge Size: 18 IN
 - 4) Liquid Pumped: Surface Water

- C. Service Conditions: The equipment provided under this SECTION shall be suitable for continuous all-weather service.

- D. Pump Bowl: Pump bowl assembly shall be manufactured from AISI 316 stainless steel and may have a replaceable AISI 316 stainless steel liner. The suction bell shall be manufactured from 316 stainless steel and bolted to the discharge bowl with heavy flanges accurately machine faced and drilled. Both the intake bell and the pump bowl shall have straightening vanes. Intake bell diameter shall be 1 1/2 times the impeller diameter and shall be constructed to minimize vortex tendencies by maintaining equal pressure and velocities across the bell entrance.
- E. Impeller: The impeller hub shall be manufactured from AISI 316 series stainless steel. The hub shall be bored with a taper and keyed for positive locking to the pump shaft and easy removal. The impeller blades shall be manufactured from AISI 316 series stainless steel. The impeller blades shall be formed with rounded leading edges and tapered trailing edges and has smooth contours for hydraulic efficiency. Blades shall be chamfered both sides at the root for full-penetration welding to the hub. The periphery of the blades shall be machined for a close running fit with the impeller casing. After manufacturing, the complete impeller shall be statically balanced.
- F. Thrust Bearing: The entire weight of the rotating element of the pump and the hydraulic thrust imposed by the impeller shall be carried by the thrust bearing located in the gear drive, vertical motor or pump thrust bearing housing for belt drives.
- G. Pump Column Assembly: Pump discharge column and discharge elbow shall be manufactured from AISI 316 stainless steel. The elbow shall be long radius type with the centerline radius not less than 1 times the nominal pipe diameter. Discharge flanges shall safely withstand all operating heads without distortion or leakage.
- H. Pump Shaft: The pump shaft shall be of sufficient diameter to transmit full load torque and to prevent vibration according to the applicable ASME code for transmission shafting. The shaft shall be manufactured from pump shaft quality (PSQ) cold rolled ASTM A276 type 420 stainless steel. At wetted areas in contact with seals or bearings, the shaft shall be inlaid with hardened nickel chrome. The shaft couplings as required will be heavy wall steel of threaded type. Provisions will be made at the top of gear drives or vertical motors for adjusting the elevation of the propeller with reference to the bowl.
- I. Lineshaft Enclosure: A shaft enclosing tube shall be provided between the discharge bowl and the pump thrust bearing housing. The tube shall be AISI 316 stainless steel Schedule 80 pipe and sealed both ends with lip seals to prevent leakage of lubricant and entrance of water or foreign material.
- J. Bearings: Bronze bearings shall be provided in the shaft enclosing tube. Bearings shall be in alignment and supported in steel sleeve plugs welded in the tube. At bearing locations, the tube shall be amply supported by spiders fastened to the pump discharge column. Bearings shall be oiled from the top of the tube by means of a one-gallon steel oil reservoir which will keep the tube constantly filled, thereby continually covering the contact surfaces of the bearings.
- K. Welding: Pump and pipe welding shall be continuous and full penetration inside and out. All flanges shall be welded inside and out. All slag shall be removed and undercutting shall not exceed 15% of the material thickness.
- L. Data Plates: All data plates shall be of stainless steel and suitably attached to the pump. Data plates shall contain the MANUFACTURER's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data.
- M. Inspection: The pump MANUFACTURER shall arrange for the inspection by FWC of the pump and pump parts during manufacturing stages to assure compliance with these specifications.

2.03 DRIVE EQUIPMENT

- A. Electric Motor Mount For Belt Drive Application: The motor mount shall be of the heavy duty adjustable type. It shall be designed to support the weight of the electric motor plus any loads imposed on it by the belt drive, with an additional safety factor for medium shock loads. It shall be suitable for use in any orientation from vertical to horizontal. The motor mount shall be factory mounted directly to the hood of the water pump. It shall be capable of varying the center distance of the electric motor in relation to the water pump by a minimum of four inches for installation and take up of the drive belts. It shall utilize four hardened steel pusher bolts to adjust the center distance, allow precision parallel alignment of the pump and motor centerline and fine tune the tension of the drive belts.
- B. Belt and Pulley (Sheave) Drive: Belt drives shall be designed using 3VX, 5VX, 5V, or 8V belt cross sections. The small sheave outside diameter shall not be less than the NEMA standard for general-purpose electric motors. Sheaves shall be locked securely to shafts by "QD" type bushings and pump thrust loads shall in no way be transmitted through the bushing or sheave to the thrust bearing. Belts and pulleys shall be protected by a fiberglass or sheet metal guard. The guard shall be constructed as to completely encase the pulleys and belts on all sides.

2.04 DISCHARGE PIPING

- A. Discharge piping shall comply with the requirement in SECTION 15106.

2.05 VALVES

- A. All valves shall be complete with all necessary operators, actuators, worm and gear operators, operator nuts, wrenches, and other accessories or appurtenances which are required for the proper completion of the WORK. Operators, actuators, and other accessories shall be sized and furnished by the valve supplier and factory mounted.
- B. Unless otherwise shown, valves shall be the same size as the adjoining pipe.

PART 3 - EXECUTION

3.01 FACTORY TEST

- A. Prior to shipment, all pumps for each designed pumping system shall be factory tested at the MANUFACTURER's place of business by a Registered Professional Engineer employed by the pump MANUFACTURER. The full size test shall be in accordance with the Hydraulic Institute open sump testing. FWC shall witness these performance tests. The pump MANUFACTURER shall provide a copy of the performance curve certified by the Professional Engineer who performed the full size witness test and is full time employed by the pump MANUFACTURER. The curve shall show the pump capacity, discharge head, speed and horsepower requirement.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. The CONTRACTOR shall furnish all labor, tools, materials, and equipment necessary for installation of the pumping systems.
- B. Piping shall be attached to pumps, valves, equipment, etc., in accordance with the respective MANUFACTURER's recommendations.

3.03 LAYING PIPE

- A. Pipe shall be installed in accordance with the MANUFACTURER's recommendation.
- B. Pipe shall be designed to be piling and surface supported. At valves and meters the piping system shall be supported.

3.04 THRUST RESTRAINT

- A. All pipe joints, fittings, and valves shall be restrained against movement. Anchors shall be of a type recommended by the pipe MANUFACTURER.

3.05 SYSTEM OPERATIONS

- A. Provide services of equipment MANUFACTURER's field service representative(s) to:
 - 1. Inspect equipment covered by these Technical Specifications.
 - 2. Supervise pre-start adjustments and installation checks.
 - a. Installation checks include electrical connections, oil reservoirs, flanged connections, belts, and supports.
 - 3. Conduct initial startup of equipment and perform operational checks.
 - a. Startup checks shall include head conditions at time of test, voltage and amperage readings, and visual observation of the discharge.
 - 4. Provide a written statement that MANUFACTURER's equipment has been installed properly, started up and is ready for operation by FWC's personnel.
- B. Instruct FWC personnel at jobsite on operation and maintenance of the pumping equipment. The training time shall be sufficient to adequately cover the material but shall be a minimum of 4 hours.
- C. CONTRACTOR shall provide one year worth of spare parts/maintenance supplies for each pumping system.
- D. CONTRACTOR shall demonstrate systems are operational. The pumping systems shall be fully tested by the MANUFACTURER's representative..

END OF SECTION

SECTION 11286 FLAP GATE

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish and install flap gates in the quantities, sizes and locations as set forth in the Drawings.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 09900 - Protective Coatings

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Society for Testing and Materials (ASTM):
 - a. A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - b. A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - c. A276 - Standard Specification for Stainless Steel Bars and Shapes
 - d. A536 - Standard Specification for Ductile Iron Castings
 - e. B584 - Standard Specification for Copper Alloy Sand Castings for General Applications
 - f. B21/B21M - Standard Specification for Naval Brass Rod, Bar, and Shapes
 - g. B98/B98M - Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes
 - h. D2000 - Standard Classification System for Rubber Products in Automotive Applications
 - i. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - j. F594 - Standard Specification for Stainless Steel Nuts
 - 2. American Welding Society (AWS):
 - a. ANSI/AWS D1.1 - Structural Welding - Steel
 - 3. American Water Works Association (AWWA):
 - a. C207 - Steel Pipe Flanges for Water Works Service
 - 4. International Organization of Standards (ISO)
 - 5. American Society of Mechanical Engineers (ASME):
 - a. ASME Boiler Pressure Vessel Code Section IX - Welding and Brazing Qualifications
 - b. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
 - 6. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - a. MSS SP-55 - Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Methods for Evaluation of Surface Irregularities

1.03 DEFINITIONS: (Not Applicable)

1.04 SUBMITTALS:

- A. The CONTRACTOR shall furnish submittals for flap gates in accordance with SECTION 01300 and the following provisions. The CONTRACTOR shall be responsible for coordination of materials, equipment, and installation regardless if the submittals are made together or separately.
- B. The CONTRACTOR shall submit the following technical data of the proposed equipment to the FWC for approval prior to fabrication:
 - 1. Catalog data or illustrations showing principal parts and materials.
 - 2. Spare parts list.
 - 3. Assembly and disassembly or repair instructions.
 - 4. Detailed layout dimensions.
 - 5. Protective coating system.
 - 6. Installation, operation, and maintenance manuals.

1.05 QUALIFICATIONS:

- A. The flap valve shall be from a product line that has been use in similar applications and backed with after sales service from direct factory engineering representatives.
- B. The MANUFACTURER shall have a minimum of five (5) years of experience in the production and satisfactory operation of flap gates.
- C. The MANUFACTURER's shop welds, welding procedures, and welders shall be qualified and certified in accordance with the latest edition of ASME, Section IX.

1.06 RESPONSIBILITIES: (Not Applicable)

1.07 TESTING:

- A. Fully assembled flap gates shall be shop inspected before shipping.
- B. After installation, the MANUFACTURER shall field-test the gates in the presence of authorized representatives of the FWC. The CONTRACTOR shall coordinate with the MANUFACTURER and provide a schedule for the field testing. All field tests including but not limited to those specified herein shall be made at the expense of the CONTRACTOR:
 - 1. The gates shall be inspected to ensure flap seats are properly installed against the frame.
 - 2. Conduct operational tests as necessary to determine that the performance of equipment is as specified.
 - 3. Test will generally consist of placing equipment in operation and observing performance.
 - 4. Each gate shall be tested from the closed position to fully open position and back to the closed position at least twice and verify gate is properly seated.
 - 5. Leakage Tests: Leakage shall not exceed 0.1 gpm/ft of wetted seal perimeter in seating head condition.
 - 6. Make all necessary equipment adjustments and corrective WORK indicated by tests.
- C. The CONTRACTOR shall furnish the cost of reinstallation and retesting if field tests do not meet the above-mentioned specifications.

1.08 INSPECTION COORDINATION: (Not Applicable)

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS:

The CONTRACTOR shall furnish cast iron flap gates meeting the following minimum requirements:

A. General:

1. Flap gates shall be of the concrete wall or pipe flange type. For gates mounted on the concrete wall pipe flange, a cushion block/bumper shall be provided to allow the gate to close by design. Flap gates shall have a machined seating surface inclined from vertical at a minimum angle per MANUFACTURER's recommendations to assure positive closure.
2. The valve will be specifically designed for water discharge service for the Bond Farm HEI Pump Station and the SAL Grade Road Pump Station.
3. The flap valve shall be designed to ensure a minimum (25) year service life with all components to be corrosive resistant (except cast iron body). All components shall be designed for minimum maintenance or shall provide a means of maintenance form the surface such as grease lines.
4. The flap valve shall be provided with a means to limit and cushion the opening of the valve as well as cushion its closure. The valve design shall prevent the slamming of the valve under all operating conditions.
5. Nuts, bolts, studs, cotter pins, hinge pins and all other assembly hardware shall be Type 316L stainless steel per ASTM A276, ASTM F593, and ASTM F594. Bushings shall be ultra-high molecular weight polyethylene (UHMWPE). Commercial grade bronze washers and ASTM B21 Alloy 482 bronze seats shall be used. Quantity and size of the fasteners shall be in accordance with the recommendation of the MANUFACTURER unless modified by the FWC.
6. The "gasket" (when required) shall be a minimum of nominal one half inch thick neoprene.
7. The "sealant" (when required) shall be a Sikaflex 201 Industrial Sealant or approved equal.
8. The CONTRACTOR shall furnish flap gate(s) designed and constructed to withstand a minimum seating head of two feet and shall be adjustable (in both the vertical and horizontal directions) to be free flowing on the unseating head side.
9. The CONTRACTOR shall take special care to ensure that dissimilar metals of flap gate, the mounting hardware and the concrete reinforcing rods are isolated from one another using non-conductive sleeves, washers, gaskets, spacers, or other devices as prescribed by the MANUFACTURER.
10. The CONTRACTOR shall require the flap gate MANUFACTURER to package the flap gate(s) in a secure manner to reduce movement and eliminate damage during shipping and handling.

B. Body:

1. The body shall be cast-iron and conform to ASTM A126C- Gray Iron Castings for Valves, Flanges and Pipe Fittings.
2. Flanges shall have ANSI/ASME B16.1, Class 125 drilling to match the discharge pipe flange in accordance AWWA C207 Steel Pipe Flanges for Water Works Service.
3. A resilient seat, neoprene conforming to ASTM D-2000, shall be bonded in a groove machined in the body to provide a wide contact surface for the seat machined in the cover.

4. Provide a steel spring and stop attached to the body and extended over the cover to safely limit the travel of the cover during discharge operation. A rubber pad on the spring shall protect cover during contact.
 5. Bolts or studs for attaching the frame to the pipe flange shall be ASTM F593 Type 316 stainless steel.
- C. Hinge Arms:
1. The hinge arms shall be high-tensile bronze and conform to ASTM B584, Alloy C865 or ASTM A276 Type 316L stainless steel.
 2. Each arm shall have two (2) pivot points, an adjustable lower pivot with limited rotation and an upper hinge post to adjust flap sensitivity. The gates double pivoted hinge linkage shall be designed to permit complete seating, full opening and with stops or other arrangement to prevent the cover from rotating sufficiently to become wedged in the open position. Pivot lugs mounted to the frame shall be adjustable to allow adjustment of hinge links without having to remove cover from gate. Hinge bushings shall be provided to limit lateral mobility during gate operation.
 3. Pins, bolts, fasteners, and studs shall be ASTM F593, Type 316 stainless steel.
- D. Cover (Flap):
1. The cover shall be either a spherical dish design or a flat design with reinforcing ribs and shall be capable of withstanding maximum operating loads.
 2. The cover shall be cast-iron and conform to ASTM A126C or Ductile Iron ASTM A536.
 3. A lifting eye shall be provided as an integral part of the cover (flap).

2.02 PROTECTIVE COATINGS:

- A. Shop Painting:
1. MANUFACTURER shall prepare surfaces, prime and finish paint all iron and steel surfaces suitable for service intended as per SECTION 09900.
 2. All stainless steel and bronze surfaces shall not be painted.
- A. Field Painting:
1. CONTRACTOR shall touch-up coatings damaged during shipment or installation.
 2. MANUFACTURER shall furnish CONTRACTOR with an adequate quantity of touch-up paint.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. The CONTRACTOR shall install the flap gate(s) in accordance with the installation instructions and recommendations of the MANUFACTURER unless modified by the FWC.
- B. The CONTRACTOR shall mount the frames and gates plumb in both vertical planes and level in horizontal plane.
- C. The CONTRACTOR shall ensure that the installed gate provides sufficient separation between dissimilar materials which may promote corrosion, through the use of gaskets, coatings, or similar, where required.

END OF SECTION

SECTION 11290 SLIDE GATES

PART 1 - GENERAL

1.01 SUMMARY:

- A. This SECTION includes self-contained fabricated stainless steel slide gates and accessories.
- B. Furnish the number and type of gates and operators as specified herein and as indicated on the Drawings
- C. Related Work Specified Elsewhere:
 - 1. DIVISION 1 – General Requirements
 - 2. SECTION 01300 - Submittals
 - 3. SECTION 09900 - Protective Coatings

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Water Works Association (AWWA):
 - a. C540 - Standard for Power-Actuating Devices for Valves and Slide Gates
 - b. C561 - Standard for Fabricated Stainless Steel Slide Gates
 - 2. American Society for Testing and Materials (ASTM):
 - a. A276 - Standard Specification for Stainless Steel Bars and Shapes
 - b. A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - c. A582 - Standard Specification for Free-Machining Stainless Steel Bars
 - d. B584 - Standard Specification for Copper Alloy Sand Castings for General Applications
 - e. D707 - Standard Classification System and Basis for Specification for Cellulose Acetate Butyrate Molding and Extrusion Compounds
 - f. D395 Standard Test Methods for Rubber Property—Compression Set
 - g. D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
 - h. D2240 Standard Test Method for Rubber Property—Durometer Hardness
 - i. D2000 - Standard Classification System for Rubber Products in Automotive Applications
 - j. D3935 - Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material
 - k. D4020 - Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
 - l. F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - m. F594 Standard Specification for Stainless Steel Nuts

1.03 SUBMITTALS:

- A. Submit as specified in SECTION 01300.
- B. Include, but not limited to, the following:
 - 1. Catalog data and illustrations showing principal parts and materials
 - 2. Spare parts list
 - 3. Assembly, disassembly and repair instructions and procedures
 - 4. Detailed layout dimensions
 - 5. Protective coating system for non stainless steel components
 - 6. Leakage testing procedures
 - 7. Installation, operation, and maintenance manuals
 - 8. Engineering calculations, prepared by a Professional Engineer licensed in the State of Florida, demonstrating compliance with the mechanical and structural criteria specified.

1.04 QUALITY ASSURANCE:

- A. MANUFACTURERS shall be experienced in the design and manufacture of equipment and accessories for a minimum period of five (5) years.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Shipment Preparation: Prepare equipment and materials for shipment in a manner to facilitate unloading and handling, and to protect against damage or unnecessary exposure in transit and storage. Include:
 - 1. Crates or other suitable packaging materials
 - 2. Covers and other means to prevent corrosion, moisture damage, mechanical injury and accumulation of dirt in motors, electrical equipment and machinery
 - 3. Suitable rust-preventive compound on exposed machined surfaces and unpainted iron and steel
 - 4. Grease packing or oil lubrication in all bearings and similar items
- B. Marking:
 - 1. Tag or mark each item of equipment or material as identified in the delivery schedule or on Submittals and include complete packing lists and bills of material with each shipment. Each piece of every item need not be marked separately provided that all pieces of each item are packed or bundled together and the packages or bundles are properly tagged and marked.
 - 2. Mark partial deliveries of component parts of equipment to identify the equipment, to permit easy accumulation of parts, and to facilitate assembly.

1.06 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in FWC's General Terms and Conditions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Slide Gates:

1. Fontaine Aquanox
2. Golden Harvest
3. Hydro Gate
4. Rodney Hunt
5. Whipps, Inc.
6. FWC approved equal

2.02 SLIDE GATES:

A. Design Requirements:

1. Gate size, mounting type, seating and unseating heads, bottom seal elevations, pedestal or yoke elevations, and operator types shall be in accordance with Table 1:

Table 1 – Slide Gates

		Design Heads				
Opening Size (WxH)	Mounting Type	Seating (ft)	Unseating (ft)	Bottom seal elevation (ft. MSL)	Pedestal Floor or Yoke Elevation (ft. MSL)	Operator Type
4' x 3'	Flat back w/ embedded bottom seal	3.5'	2.5'	23.0	Yoke @ 31.75	Hand Crank

2. Suitable for operation after periods of inactivity of a year or more.

B. Frames:

1. Frames shall be fabricated from structural members or formed plate to form a rigid one piece frame. The frame configuration, for example flange or flat back, channel mount, embedded shall be as indicated on the Drawings. Frames shall be self contained with yoke mounted gate operators or non-self contained with pedestal mounted gate operators as indicated on the Drawings.
 - a. For yoke mounted gate operators, the structural members shall be designed to provide the required structural support for the gate operator and the loads produced from the gate operation under worse case design head conditions (for example: design seating head one side of gate with no water on unseating side). The structural members or formed plates of the yoke shall be sized to limit deflections to 1/360 of its span and resist the following loads imposed on the yoke, both in raising and lowering the gate, by the gate operator:
 - i. Two (2) times the rated output thrust of a manual crank type gate actuator with 40-lb (pounds) effort.
 - ii. One-and-a-quarter (1.25) times the output thrust of an electric-motor-driven actuator in the stalled condition.
 - b. The yoke shall have bolted connections to the frame.
 - c. For pedestal mounted actuators, the CONTRACTOR shall coordinate the mounting of the pedestal with the structural supports indicated on the Drawings. The pedestals shall be cast iron and coated in accordance with SECTION 09900 or fabricated from stainless steel.

2. Frames shall be furnished with gate stops to limit the opening of the gate. The gate stops shall be bolted to the frames to allow removal. Stops shall be located to allow the bottom of the gate to clear the top seal opening plus 6 inches.
 3. Furnish a horizontal framing member at top of gate opening. Frame member shall be attached, welded or bolted connection, to the gate frame for mounting of a top seal.
 4. Gasket material shall be furnished to seal between the frame and concrete mounting surfaces where applicable. For example, flat back or flanged type frames.
- C. Slide:
1. Flat structural plate (minimum ¼-inch thick), reinforced with structural members or formed plates as required to limit its deflection to 1/360 of the gate's span under the design head conditions.
 2. Slide shall be designed to drain when opened above the water level and not trap debris, soil, etc.
- D. Seals:
1. Side Seals: Seals shall extend from the bottom seal to the top seal and be retained with backing plates and fasteners, as required. Slide gate MANUFACTURER may incorporate the side seals with the slide guides. If combined into a single assembly the seal/guide shall meet the requirements of 2.02.D.4 and 2.02.E
 2. Bottom seal: Seal shall be incorporated into a structural member or formed plate. Bottom seal arrangement shall be coordinated with frame configuration and type of frame mounting, reference 2.02.B of this SECTION.
 3. Top Seal: The top seal shall be attached to the horizontal framing member as described in 2.02.B.3. The top seal shall be retained with backing plates and fasteners as required.
 4. Seals shall meet specified maximum leakage rates at the design head conditions in both the seating and unseating conditions. Leakage rates shall be field verified by the FWC after installation of the gate/frame assembly under design head conditions.
 - a. Maximum allowable seating head leakage rate: 0.1 gallons per minute (GPM) per linear foot of seal
 - b. Maximum allowable unseating head leakage rate: 0.2 GPM per linear foot of seal
- E. Slide Guides:
1. Guides shall run the full length of the frame and prevent metal to metal contact between the slide and the frame.
 2. The guides shall be designed to accommodate the total thrust produced by water pressure at the design head conditions.
 3. The guides shall be mechanically interlocked or attached to the frame.
- F. Stem, Stem Couplings, and Stem Guides:
1. Stems:
 - a. The L/r ratio (i.e. Slenderness Ratio) of an unsupported stem shall be less than 200. Furnish stem guides where required to limit the unsupported stem length. Depending on operator type the stem shall be designed to:
 - i. Transmit in compression a minimum of two (2) times the rated output thrust of a manual crank type gate actuator with 40-lb effort.
 - ii. Transmit in compression a minimum of 1.25 times the output thrust of an electric motor driven actuator in the stalled condition.

- b. Stem threads shall be machine-cut, American standard, General purpose Acme type, as defined in the ASME/ANSI B1.5 standard, with a surface finish of 32 micro-inch or better. Acme threads shall be tolerance class 2G. Rolled threads or stub Acme threads are not acceptable.
 - c. A stop nut shall be furnished on the stem to limit the downward travel of the gate. The stop nut shall be fabricated from a single piece matching the stem material, tapped to match the stem, and drilled and tapped for a minimum of two 3/8" set screws.
2. The stem shall be connected to the top of the gate with a bolted connection designed to withstand the maximum design forces imposed by the operator under design head conditions. Connection shall be designed with a minimum safety factor of two (2).
 3. Stem guides where required to limit stem deflection shall be bronze or polymer bushed. Stem guides shall be factory aligned in self contained gate frame applications and adjustable in the horizontal direction for non-self-contained gate frame applications.
 4. Furnish a bellows type stem protection boot for the entire length of the exposed stem from the top of the gate to the underside of the yoke or pedestal as applicable. The stem boot shall be reinforced to minimize contact between the boot and stem. The boot shall be furnished with non-metallic zipper running the full length of the boot to allow removal without disassembly of the gate/stem assembly.
 5. Furnish a rigid protective cover for the stem section above the operator.
 - a. The cover shall be made of clear polycarbonate will not discolor or become opaque for at least five (5) years after installation.
 - b. The cover shall be of sufficient diameter and length to permit full travel of the threaded stem without obstruction.
 - c. The top of the stem cover shall be closed and vented. The bottom end of the stem cover shall be vented, drained, and mounted in a housing or adapter plate for easy field-mounting installation.
 - d. The stem cover shall have graduations every 100th of a foot with numerical marks every foot. It shall be calibrated to read the top of stem at "zero" when gate is closed.

G. Anchor Bolts or Studs:

1. Gate MANUFACTURER shall furnish all anchor bolts and fasteners for the installation of the gate, frame, and operator assembly including but not limited to the following:
 - a. Gate frames
 - b. Stem guides
 - c. Operator pedestals

H. Materials:

1. Gate frame, yoke, slide, stem guides and miscellaneous fabrications: ASTM A276 and A240, Type 304 Stainless Steel
2. Seal backing bars: ASTM A276, Type 304 Stainless Steel
3. Stem: ASTM A276, Type 304
4. Stem Block (stem to gate connection): Bronze, ASTM B584
5. Fasteners and anchor bolts: ASTM F593 and F594 Type 316 Stainless Steel
6. Stem Boot: Nylon reinforced Goretex
7. Gasket material: EDPM (Ethylene propylene diene monomer)

8. Slide Guides: Ultra high molecular weight polyethylene (UHMWPE) meeting the requirements of ASTM D4020
9. Bottom Seal Material: Resilient neoprene meeting the requirements of ASTM D2000 grade 2 BC-510
10. Seals: Resilient neoprene J-type meeting the requirements of ASTM D2000 grade 2 BC 615 or fabricated from ultra high molecular weight polyethylene (UHMWPE) meeting the requirements of ASTM D4020
11. Stem Cover: Clear polycarbonate meeting the requirements of ASTM D707 and D3935.

2.03 GATE OPERATORS: Furnish a gate operator as specified in Table 1 in accordance with “A” or “B” below.

A. Electric Motor Driven Operators: N/A.

B. Manual Operators:

1. Basic Operator:

- a. Furnish mounted to the pedestal or yoke as applicable. The mechanism shall be geared so as to permit slide operation with an effort of not more than 40 lb on the crank handle after the slide is unseated, based on the design head conditions. Gear ratio shall be the MANUFACTURER’s minimum available ratio to maximize gate speed while not exceeding the 40 lb maximum force on the crank handle. The gate travel shall be a minimum of 6 inches per minute with an input speed of 250 rpm. The input shaft of the operator shall be 42 inches above the operating platform. The crank shall be removable and fitted with a corrosion-resistant rotating handle. The maximum crank radius shall be 15 in. A bronze lift nut tapped to fit the stem shall be furnished. Ball or roller bearings shall be provided above and below the flange on the lift nut to take the thrust developed in opening and closing the gate. Gears shall be machined accurately with cut teeth to provide smooth, proper operation for the lifting mechanism. Suitable shafts shall be installed with sleeve, ball, or roller bearings of appropriate size. Pinion shafts shall be stainless steel. All gears and bearings shall be enclosed in a weatherproof cast iron housing. Fittings shall be furnished so that all gears and bearings can be lubricated periodically. All geared lifts shall be suitable for operation by use of a portable-motor apparatus. The lift shall be self locking at any position of the stem travel.
- b. Opening direction: The direction of wheel rotation to open the gate shall be indicated on the lift mechanism.
- c. Lubrication: Provide totally enclosed gearing with lubrication fittings and all necessary mechanical seals.
- d. Gear Housing: Cast iron.
- e. Exposed and enclosed machined or gearing surfaces: Coat with water-resistant grease or rust-preventive compound standard of the MANUFACTURER.
- f. Coating System: Surfaces shall be factory painted with protective coating System S-3 as specified in SECTION 09900.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Comply with provisions of AWWA C561, C540 and as specified.
- B. Lubricate all bearings and grease all gearing before placing gates in operation.
- C. Provide MANUFACTURER’s field services as specified in DIVISION 1.

- D. Perform equipment tests during and after start-up to determine if equipment is performing as specified.

END OF SECTION

SECTION 13300 PRE-ENGINEERED SHELTERS

PART 1 - GENERAL

1.01 SUMMARY:

- A. Furnish labor, materials, tools, equipment, and services for Pre-Engineered Shelters, as indicated, in accordance with provisions of Contract Documents.

1.02 SUBMITTALS:

- A. Shop Drawings.
 - 1. Provide anchorage details.
- B. Product Data:
 - 1. MANUFACTURER'S product literature representing specified products and systems including, but not limited to:
 - a. Wind load
 - b. Materials
 - c. Foundation requirements
 - d. Warranty

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Modular Shelters:
 - 1. Natural Structures.
 - 2. RCP Shelters, Inc.
 - 3. Or Equal.

2.02 MATERIALS

- A. Open Shelter:
 - 1. Open shelter shall be designed to comply with the Florida Building Code (latest Edition) for a Risk Category II building with Occupancy Classification U.
 - 2. Preservative Treated Lumber and Plywood:
 - a. Natural wood products treated to add decay and termite resistance.
 - b. Preservatives:
 - 1) Compatible with direct exposure to precipitation, sunlight and effects of weather.
 - 2) Authenticate by factory marking each piece with MANUFACTURER's mark and applicable standards.
 - 3) Acceptable treatments:
 - a) Alkaline Copper Quaternary (ACQ).
 - b) Copper Boron Azole (CBA).
 - c) Borate based (BORON).
 - c. Lumber Species:
 - 1) Southern Pine.
 - 2) Mixed Southern Pine.

- 3) Other species meeting requirements.
- d. Moisture content:
 - 1) Lumber: 19 percent.
 - 2) Plywood 18 percent.
 - 3) Kiln dried after treatment, (KDAT).
- 3. Fasteners:
 - a. General:
 - 1) Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.
 - 2) Where rough carpentry is exposed to weather, in contact with earth, pressure-preservative treated, or in area of high relative humidity:
 - a) Use fasteners with hot dip zinc coating complying with ASTM A153.
 - b) Use fasteners of Type 304 stainless steel.
 - b. Nails, Brads, and Staples: ASTM F1667.
 - c. Power-Driven Fasteners: NES NER-272.
 - d. Wood Screws: ASME B18.6.1.
 - e. Lag Bolts: ASME B18.2.1.
 - f. Bolts: ASTM A307, Grade A steel bolts with ASTM A563 hex nuts and washers.
 - g. Expansion Anchors:
 - 1) Tested in accordance with ASTM E488.
 - 2) Anchor bolt and sleeve assembly:
 - 3) Masonry assemblies: Sustain load equal to 6 times load imposed when installed in unit.
 - 4) Concrete assemblies: Sustain load equal to 4 times load imposed when installed in unit.
 - h. Exterior and wet applications:
 - 1) Stainless Steel components, ASTM F593 and ASTM F594 Alloy Group 1 or 2.
- 4. Roof System:
 - a. MANUFACTURER's standard Durasteel flat insulated roofing system with EDPM membrane roofing or asphalt shingle.
- 5. Lighting:
 - a. UL-Listed 110V, LED dual lamp, four foot, shop light, enclosed and gasketed, damp location fixtures with fiberglass housing. Provide two per structure.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Verify suitability of site to accept installation.
- B. Installation signifies responsibility for performance.

3.02 INSTALLATION:

- A. Install in accordance with MANUFACTURER's recommendations.
- B. Complete mechanical and electrical connections as indicated.
- C. Prior to occupancy, adjust mechanical, electrical and hardware for proper operation.

END OF SECTION

SECTION 15106 DISCHARGE PIPE

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, materials, and equipment to provide and install large diameter steel water pipe, fittings, couplings and appurtenances for discharge of water from pump stations.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 02200 - Earthwork
 - 3. SECTION 02221 – Pipe Trenching, Backfilling and Compacting
 - 4. SECTION 09900 - Protective Coatings
 - 5. SECTION 11063 – Pumping Systems
 - 6. SECTION 11286 - Flap Gate

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. American Water Works Association (AWWA):
 - a. C200 - Steel Water Pipe 6 Inches and Larger
 - b. C203, Coal Tar Protective Coatings and Linings for Steel Water Pipeline
 - c. C205 – Cement Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100 mm) and Larger.
 - d. C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 Inch through 144 Inch
 - e. C208 - Dimensions for Fabricated Steel Water Pipe Fittings
 - f. M11 - Steel Pipe - A Guide for Design and Installation
 - g. C600 - Installation of Ductile - Iron Water Mains and Their Appurtenances
 - 2. American Society of Mechanical Engineers (ASME):
 - a. B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
 - b. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
 - c. B16.5 - Steel Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
 - 3. American Society for Testing and Materials (ASTM):
 - a. A36 - Standard Specification for Carbon Structural steel
 - b. A139 - Standard Specification for Electric Fusion Welded Steel Pipe (NPS 4 and Over)
 - c. A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
 - d. A568 - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold Rolled, General Requirements for
 - e. A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
 - f. A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

- g. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- 4. Society for Protective Coatings (SSPC):
 - a. SP1 - Solvent Cleaning.
 - b. SP3 - Power Tool Cleaning.
 - c. SP5 - White Metal Blast Cleaning.
 - d. SP7 - Brush Off Blast Cleaning.

1.03 SUBMITTALS:

- A. Submit as specified in SECTION 01300.
- B. Compliance Submittals as per paragraph 1.05. Submit the following for acceptance prior to fabrication:
 - 1. Fabrication and/or Layout Drawings:
 - a. Scaled piping drawings with information including:
 - i. Dimensions of piping lengths.
 - ii. Invert or centerline elevations of piping.
 - iii. Details of fittings, tapping locations, and related appurtenances.
 - iv. Coating and Lining details, including repair and filling procedures between holdbacks.
 - v. Line slopes and vents.
 - 2.
- C. Certificates and Affidavits: Furnish the following prior to shipment:
 - 1. Affidavit of compliance with applicable standards
 - 2. Test certificates
 - a. Factory test reports
 - b. Field hydrostatic testing report

1.04 MANUFACTURER'S QUALIFICATIONS: The MANUFACTURER shall have a minimum of five (5) years' experience in the design and manufacture of pipe, fittings, or appurtenances of the type and size specified herein.

1.05 PRODUCT QUALIFICATION: The following technical data of the discharge pipe shall be submitted to the FWC for approval prior to fabrication:

- A. Submit the following for acceptance prior to fabrication:
 - 1. Pipe and joint details
 - 2. Special, fitting and coupling details
 - 3. Laying and installation schedule
 - 4. Specifications, data sheets and materials
 - 5. Coupling details, materials, installation instructions
 - 6. Welders certificates

1.06 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 GENERAL PIPE REQUIREMENTS:

- A. Furnish pipe of materials, joint types and sizes as indicated or specified.
- B. Pipe Marking: All pipe and fittings shall be marked conforming to the applicable standard specification under which the pipe is manufactured and as otherwise specified.

2.02 STEEL PIPE:

- A. Materials: The pipe shall be fabricated from one of the following materials:
1. Sheet or coil conforming to the requirements of ASTM A1011, Grades 36 or 40
 2. Plate in coil form conforming to the requirements of A36, A283, Grades C or D, or A572, Grade 42
- B. Wall thickness: Steel piping minimum wall thickness shall be as follows:
- | <u>Nominal Pipe Diameter (in.)</u> | <u>Thickness (in.)</u> |
|------------------------------------|------------------------|
| 12 in | 1/4 in. |
| 18 in. | 1/4 in. |
- C. Joints:
1. Flanged:
 - a. Joints shall conform to AWWA C200 and AWWA C207.
 - b. Flanges shall have a pressure rating not less than that required for pipe. Flanges shall be pressure rated AWWA Class B and be drilled ANSI B16.1 Class 25.
 2. Lap Welded Slip Joint:
 - a. Provide lap welded slip joints for all steel pipe except for connection to the pump or unless otherwise specified. The use of flanged joints for this project shall be used only where shown on the Drawings.
 - b. Joints shall conform to AWWA C200.
- D. Fittings and Specials:
1. Fabricate from tested pipe to conform to AWWA C208 except where otherwise indicated or specified.
 2. Reinforce tees, laterals, and outlets conforming to applicable provisions of AWWA M11.
 3. Include all adapters, outlets, taps, plugs, and other specials as required to complete installation as specified or indicated.
 4. Provide openings for air vent connections with threaded bosses or flanged outlets sized and located where indicated.
 5. Fittings shall be tested by dye penetrant method.
- E. Protective Coatings and Linings:
1. Shop Applied:
 - a. Steel pipe interior lining shall be cement mortar per AWWA C205. Cement mortar lining repairs to holdback areas after welding shall be performed per AWWA C205. Contractor shall provide the specific procedures for repair as part of the submittal provided as part of Paragraph 1.05.
 - b. Buried steel pipe exterior coating shall be coal-tar enamel in accordance with AWWA C203 with a minimum dry film of 5 MILS of acceptable asphalt base material.
 - c. Stainless steel surfaces shall not be painted.
 2. Field Painting:
 - a. Exposed sections of piping shall be field painted per MANUFACTURER's requirements.
 - b. CONTRACTOR shall touch-up coatings damaged during shipment or installation.
 - c. MANUFACTURER shall furnish CONTRACTOR with an adequate quantity of touch-up paint.
 - d. Coordinate painting with pump and flap valve MANUFACTURERS to insure consistency.

2.03 DUCTILE IRON PIPE

Ductile Iron Pipe and Fittings shall be as noted in the Drawings.

2.04 GASKETS AND BOLTING MATERIALS:

- A. Provide all gaskets, bolts, lubricant, and other accessories required to install pipe, fittings and specials complete and ready for service.
- B. Gaskets for flanged joints shall conform to ANSI B16.21, 1/8-inch-thick full-face synthetic rubber. Provide full-face gaskets for all pump and equipment connections.
- C. Bolts for flanged joints shall conform to ASTM F593 Type 316 stainless steel. Nut and bolt heads shall be hexagonal.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPE MATERIALS:

- A. Trenching and Backfilling: As specified in SECTIONs 02220 and 02221.
- B. Pipe Installation:
 - 1. Pipe less than 24 inch can be joined prior to placement in the trench provided proper care is taken during placement to ensure the soundness of the joined sections.
 - 2. All steel pipe joints shall be lap welded slip joints and all ductile iron pipe joints shall be restrained joint unless otherwise indicated.
 - 3. Flanged joints where specified shall be made with gaskets and bolting materials and shall be made according to the requirements of AWWA M11 for steel piping and AWWA C115 for ductile iron pipe. All bolts shall be tightened using procedures and recommended torque rates described in AWWA C600.

3.02 Field Quality Control

- A. Pipe testing
 - 1. Test buried piping after the trench has been completely backfilled.
 - 2. Hydrostatic pressure testing shall be performed for all piping to the following pressures:
 - a. Steel: 25 psi
 - b. Ductile Iron: 25 psi
 - 3. Procedure:
 - a. Water shall be used as the hydrostatic test fluid unless otherwise specified. Test water shall be clean and shall be of such quality as to minimize corrosion of the materials in the piping system. Vents at all high points of the piping system shall be opened to purge air pockets while the piping system is filling. Venting during the filling of the system also may be provided by the loosening of flanges having a minimum of four bolts or by the use of equipment vents. All parts of the piping system shall be subjected to the test pressure specified in the Piping Schedule. The hydrostatic test pressure shall be continuously maintained for a minimum time of 2 hours and for such additional time as may be necessary to conduct examinations for leakage. Examination for leakage shall be made at all visible joints and connections. The piping system shall show no visual evidence of weeping or leaking. Any visible leakage shall be corrected at the Contractor's sole expense. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to maintain the test pressure may be measured accurately. This measurement represents the leakage, which is defined as the quantity of water necessary to maintain the specified test pressure for the duration of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{ND(P)^{1/2}}{7400}$$

In the above formula:

L = Allowable leakage, in gallons per hour.

N = Number of joints in the length of pipe tested.

D = Nominal diameter of pipe, in inches.

P = Test pressure during the leakage test, in pounds per square inch.

- b. The CONTRACTOR shall correct any leakage greater than allowance determines under this formula at the CONTRACTOR's sole expense.
 - c. Unless otherwise provided herein, water for testing pipelines will be the responsibility of the Contractor; and, the Contractor shall make all necessary provisions for conveying the water from the designated source to the points of use.
 - d. Prior to hydrostatic testing, all pipelines shall be flushed or blown out as appropriate. The Contractor shall test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. The Contractor shall be responsible for ascertaining that all test bulkheads are suitable restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Care shall be taken to see that all air vents are open during filling.
 - e. The pipeline shall be filled at a rate that will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. The Contractor is responsible for removing all air in the piping to be tested by whatever means is necessary including addition of temporary air vent piping and valving.
 - f. For piping with cement mortar lining, after the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the FWC shall be taken.
4. Test Records:
- a. Records shall be made of each piping system installation during the test. These records shall include:
 - i. Date of Test.
 - ii. Description and Identification of Piping Tested.
 - iii. Test Fluid.
 - iv. Test Pressure.

END OF SECTION

SECTION 16050 BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish all labor, equipment and material for installation of the electrical hardware as described herein and as shown on the Drawings.
1. The provisions of this SECTION apply to all SECTIONS in DIVISION 16, except as indicated otherwise.
 2. Concrete, excavation, backfill, and steel reinforcement required for encasement, installation, or construction of the WORK of the various sections of DIVISION 16 is included as a part of the WORK under the respective sections, including duct banks, manholes, handholes, equipment housekeeping pads, and light pole bases.
 3. For work at existing Sites the CONTRACTOR shall be responsible for identifying available existing circuit breakers in lighting panels for the intended use as required by the Drawings. Costs for this WORK shall be included in the CONTRACTOR's original bid amount.
- B. Related Work Specified Elsewhere:
1. SECTION 01300 - Submittals
 2. DIVISION 16 - Electrical

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:
1. American Society for Testing and Materials (ASTM)
 - a. A36 - Standard Specification for Carbon Structural Steel
 - b. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
 - c. A194 - Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
 - d. A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - e. F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength
 2. Local Building Codes and Standards
 3. MIL-PRF-907E - Antiseize Thread Compound, High Temperature
 4. National Fire Protection Association (NFPA)
 - a. 70 - National Electrical Code
 5. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications
 6. National Electrical Manufacturers Association (NEMA)
 - a. 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum)

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. The CONTRACTOR shall furnish submittals in accordance with SECTION 01300.
- B. The CONTRACTOR shall provide the following for shop drawing submittals:
 - 1. Complete material lists stating manufacturer and brand name of each item or class of material
 - 2. Front, side, rear elevations, and top views with dimensional data
 - 3. Location of conduit entrances and access plates
 - 4. Component data
 - 5. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size, and cable numbers
 - 6. Method of anchoring, seismic requirements, weight
 - 7. Types of materials and finish
 - 8. Nameplates
 - 9. Temperature limitations, as applicable
 - 10. Voltage requirement, phase, and current, as applicable
 - 11. Front and rear access requirements
 - 12. Test reports
 - 13. Grounding requirements
 - 14. Catalog cuts or photocopies of applicable pages of bulletins or brochures for mass produced, non-custom manufactured material. Mark-out any model or part numbers of material on catalog data sheets that do not specifically apply to the project. Catalog data sheets shall be stamped to indicate the project name, applicable Section and paragraph, model number, and options.
- C. Shop Drawings shall be custom prepared. Drawings or data indicating "optional" or "as required" equipment are not acceptable. Options not proposed shall be crossed out or deleted from Shop Drawings.
- D. Materials and Equipment Schedules: The CONTRACTOR shall deliver to the FWC within 30 days of the commencement date in the Notice to Proceed, a complete list of all materials, equipment, apparatus, and fixtures proposed for use. The list shall include type, sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.
- E. Owner's Manuals: Complete information in accordance with SECTION 01300.
- F. Record Drawings: The CONTRACTOR shall show invert and top elevations and routing of all conduits in duct banks and concealed below-grade electrical installations. Buried electrical conduits shall be located by showing the horizontal distance to two fixed structures at the start of the conduit installation, the end of the conduit installation, and for every conduit change of direction. In addition, circuit schematic drawings and wiring drawings shall show all field changes. Layout drawings shall show all equipment location changes. Record drawings shall be prepared, be available to the FWC, and be submitted according to SECTION 01300.
- G. Where test reports are indicated, proof of design test reports for mass-produced equipment shall be submitted with the Shop Drawings, and factory performance test reports for custom-manufactured equipment shall be submitted and be approved prior to shipment. Field test reports shall be submitted for review prior to Substantial Completion.

1.05 QUALIFICATIONS: All electrical work shall be performed by personnel employed by an Electrical Contractor licensed in the State of Florida. Actual work shall be performed by Master and or Journeyman electricians or personnel under direct on-site supervision of a Master and or a Journeyman electrician. If the work is performed under the direct on-site supervision of a Journeyman electrician, he or she shall be certified in the county in which the work is performed or meet the reciprocity standards of Florida State Statute 489 part II. The credentials of the Electrical Contractor, Master and/or Journeyman electricians shall be supplied to the FWC upon request.

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall contact the serving utility and verify compliance with requirements before construction. The CONTRACTOR shall coordinate schedules and make payments for work by all utilities.
- B. Electrical service shall be as indicated and be as required by the serving utility.
- C. The CONTRACTOR shall verify and provide all service conduits, fittings, transformer pad, grounding devices, and all service wires not provided by the serving utility. The CONTRACTOR shall verify with the utility the exact location of each service point and type of service, and shall pay all charges levied by the serving utilities as part of the WORK.
- D. Permits shall be obtained and inspection fees shall be paid according to General Conditions.
- E. The CONTRACTOR shall pay all utility construction/connection charges and turn-on service charges required by the utility company.
- F. The CONTRACTOR shall be responsible for factory and field tests required by specifications in DIVISION 16 and by the FWC and other authorities having jurisdiction. The CONTRACTOR shall furnish necessary testing equipment and pay costs of tests, including all replacement parts and labor, due to damage resulting from damaged equipment or from testing and correction of faulty installation.

1.07 TESTING: N/A

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. The CONTRACTOR shall provide equipment and materials that shall be new, shall be listed by UL, or by an independent testing laboratory acceptable to the local code enforcement agency having jurisdiction, and shall bear the UL label or other certification where these requirements apply. Equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the WORK shall be products of the same MANUFACTURER. Equipment and materials shall be of heavy duty industrial grade.
- B. Where the requirements of the specifications conflict with UL, NEMA, NFPA, or other applicable standards, the more stringent requirements shall govern.
- C. On devices indicated to display dates, the year shall be displayed as 4 digits.

2.02 SIGNAGE:

- A. Electrical Equipment - Each piece of electrical equipment shall be legibly marked to indicate its purpose unless the FWC determines that its purpose is indicated by the location and arrangement.
- B. Warning Signs
 - 1. Over 50 Volts nominal, or more - Entrances to rooms and other guarded locations that contain live parts shall be marked with conspicuous signs prohibiting unqualified persons to enter.
 - 2. All buildings, rooms or enclosures containing exposed live parts or exposed conductors operating at 600 volts nominal, or more, shall be lockable. Permanent and conspicuous warning signs shall be provided reading as follows: DANGER - HIGH VOLTAGE - KEEP OUT.
 - 3. Outside branch circuits and feeders - for 600 volts nominal, or less - Warning signs shall be posted in plain view where unauthorized persons might come in contact with live parts.
- C. Isolating Switches - Isolating switches not interlocked with an approved circuit interrupting device shall be provided with a sign warning against opening them under load.
- D. Back-up Generation - A sign shall be placed at the service entrance equipment indicating the type and location of on-site back-up generation.

2.03 AREA DESIGNATIONS:

- A. General:
 - 1. Raceway system enclosures shall comply as mentioned herein and in SECTION 16110.
 - 2. Electric work specifically indicated in sections within any of the Specifications shall comply with those requirements.

AREA	NEMA ENCLOSURE CLASSIFICATION						Notes
	1	3R	4X	7	9	12	
Air Condition Space	√						
Non A/C Space Interior						√	Or as directed by Project drawings
Outdoor Application			√				Or as directed by Project drawings

- B. Materials Requirements
 - 1. NEMA 4X enclosures shall be 316 stainless steel.
 - 2. NEMA 7 enclosures shall be cast aluminum where used with aluminum conduit; cast iron when used with galvanized steel conduit.
 - 3. NEMA 1, 3R, and 12 enclosures shall be steel coated with ANSI 61 grey paint. NEMA 4X, 7, and 9 enclosures shall not be painted.

2.04 MOUNTING HARDWARE:

- A. Miscellaneous Hardware
 - 1. Threaded rods for trapeze supports shall be continuous threaded, 3/8-inch diameter minimum. Utilize hot dipped galvanized steel for dry indoor non process areas and 316 stainless steel for “wet,” “damp,” or “corrosive” areas.
 - 2. Strut for mounting of conduits and equipment shall be 316 stainless steel or hot dipped galvanized as specified on Project drawings. Where contact with concrete or dissimilar metals may cause galvanic corrosion, suitable non-metallic insulators shall be utilized to prevent such corrosion.

3. Wall-mounted panels that weigh more than 500 pounds shall be provided and mounted with steel support pedestals. Transformers hung from 4 inch stud walls and weighing more than 300 pounds shall have auxiliary floor supports.

B. Bolts and Anchors

1. Standard Service (Non-Corrosive Application): Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be steel as indicated herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, steel for bolt material, anchor bolts and cap screws shall be in accordance with the following.
 - a. Structural connections: ASTM A307, Grade A or B, hot-dip galvanized
 - b. Anchor Bolts: ASTM A307, Grade A or B, or ASTM A36, hot-dip galvanized
 - c. High strength bolts where indicated: ASTM F3125
2. Corrosive Service: All bolts, nuts, and washers in the locations listed below shall be stainless steel as indicated below.
 - a. All buried locations
 - b. All submerged locations
 - c. All locations subject to seasonal or occasional flooding
 - d. Inside hydraulic structures below the top of the structure
 - e. Inside buried vaults, manholes, and structures which do not drain through a gravity sewer or to a sump with a pump
 - f. All chemical handling areas
 - g. Inside trenches, containment walls, and curbed areas
 - h. Locations indicated by the Contract Documents or designated by the FWC to be provided with stainless steel bolts.
3. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be Type 316 stainless steel, class 2, conforming to ASTM A193 for bolts and to ASTM A194 for nuts. All threads on stainless steel bolts shall be protected with an anti-seize lubricant suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.
 - a. Anti-seizure lubricant shall be classified as acceptable for potable water use by the NSF.
 - b. Anti-seizure lubricant shall be odorless, non-toxic, weather-proof, teflon based, with operating temperatures up to 475 deg F.
4. Indoors Finished Areas Service:
 - a. Expanding-Type Anchors: Expanding-type anchors if indicated or permitted, shall be 18-8 stainless steel split expansion ring with threaded stud bolt body and integral cone expander, nut and washer. Plated carbon steel, hot-dipped galvanized carbon steel, type 304 stainless steel or type 316 stainless steel anchor bodies, as identified in the drawings or other notations.

2.05 ELECTRICAL IDENTIFICATION:

- A. Nameplates: Nameplates shall be fabricated from white-letter, black-face laminated plastic engraving stock. Each shall be fastened securely, using fasteners of brass, cadmium plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style with no characters smaller than 1/4-inch high.

- B. Conductor and Equipment Identification: Conductor and equipment identification devices shall be either imprinted plastic-coated cloth marking devices or shall be heat-shrink plastic tubing, imprinted split-sleeve markers cemented in place.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Incidentals: The CONTRACTOR shall provide all materials and incidentals required for a complete and operable system, even if not required explicitly by the Specifications or the Drawings. Typical incidentals are terminal lugs not furnished with vendor supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and control wiring required by vendor furnished equipment to connect with other equipment indicated in the Contract Documents.
- B. Field Control of Location and Arrangement: The CONTRACTOR shall determine the exact locations in the field based on the physical size and arrangement of equipment, finished elevations, and other obstructions. The Drawings diagrammatically indicate the desired location and arrangement of outlets, conduit runs, equipment, and other items. Locations on the Drawings, however, shall be followed as closely as possible.
 - 1. Where conduit development drawings or "home runs" are shown, the CONTRACTOR shall route the conduits in accordance with the indicated installation requirements. Routings shall be exposed or encased as indicated, except that conduit in finished areas shall be concealed unless specifically indicated otherwise. Conduits encased in a slab shall be sized for conduit OD to not exceed one-third of the slab thickness and be laid out and spaced to not impede concrete flow.
 - 2. Conduit and equipment shall be installed in such a manner as to avoid all obstructions and to preserve head room and keep openings and passageways clear. Lighting fixtures, switches, convenience outlets, and similar items shall be located within finished rooms as indicated. Where the Drawings do not indicate exact locations, such locations shall be determined by the FWC. Lighting fixture locations shall be adjusted slightly as necessary prior to installation to avoid obstructions and to minimize shadows.
 - 3. Wherever conduits and wiring for lighting and receptacles are not indicated, it shall be the CONTRACTOR's responsibility to provide all lighting and receptacle-related conduits and wiring as required, based on the actual installed fixture layout and the circuit designations as indicated. Wiring shall be #12 AWG minimum, and conduits shall be 3/4-inch minimum (exposed) and 1 inch minimum (encased). Where circuits are combined in the same raceway, the CONTRACTOR shall derate conductor ampacities in accordance with NEC requirements.
- C. Workmanship: Materials and equipment shall be installed in strict accordance with printed recommendations of the MANUFACTURER. Installation shall be accomplished by workers skilled in the work. Installation shall be coordinated in the field with other trades to avoid interference.
- D. Protection of Equipment and Materials: The CONTRACTOR shall fully protect materials and equipment against damage from any cause. Materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. Moving parts shall be kept clean and dry. The CONTRACTOR shall replace or refinish damaged materials or equipment, including faceplates of panels and switchboard sections as part of the WORK.
- E. Incoming utility power equipment shall be provided in conformance with the utility's requirements.
- F. Installation of electrical equipment and materials shall comply with OSHA Safety and Health Standards (29 CFR 1910 and 29 FR 1926, as applicable), state building standards, and applicable local codes and regulations.

3.02 CORE DRILLING: The CONTRACTOR shall perform core drilling required for installation of raceways through concrete walls and floors. Locations of floor penetrations, as may be required, shall be based on field conditions. Verify all core drilling locations based on equipment actually furnished as well as exact field placement. To the extent possible, identify the existence and locations of encased raceways and other piping in existing walls and floors with the FWC prior to any core drilling activities.

3.03 CONCRETE HOUSEKEEPING PADS:

- A. Concrete housekeeping pads shall be provided for indoor floor standing electrical equipment. Housekeeping pads for equipment, including future units, shall be 4 inches nominal above surrounding finished floor or grade and 4 inches larger in both dimensions than the equipment, unless otherwise indicated.
- B. Concrete housekeeping curbs shall be provided for all conduit stub-ups in indoor locations that are not concealed by equipment enclosures. Such curbing shall be 4 inches nominal above finished floor or grade.

3.04 EQUIPMENT IDENTIFICATION:

- A. General: Equipment and devices shall be identified as follows:
 - 1. Nameplates shall be provided for all panelboards, control and instrumentation panels, starters, switches, and pushbutton stations. In addition to nameplates, control devices shall be equipped with standard collar-type legend plates.
 - 2. Control devices within enclosures shall be identified as indicated. Identification shall be similar to the subparagraph above.
 - 3. Toggle switches which control loads out of sight of switch and all multi-switch locations of more than two (2) switches shall have inscribed finish plates clearly indicating the load.
 - 4. Where shown on the drawings, name tags shall be inscribed with the equipment name and tag number.
 - 5. The CONTRACTOR shall furnish typewritten circuit directories for panelboards; circuit directory shall accurately reflect the devices/equipment connected to each circuit breaker.

3.05 CLEANING: The CONTRACTOR shall thoroughly clean the electrical WORK before final acceptance. Exposed parts shall be thoroughly clean of cement, plaster, and other materials. Oil and grease spots shall be removed with a non-flammable cleaning solvent. Such surfaces shall be carefully wiped, and all cracks and corners scraped out. Touch-up paint shall be applied to scratches on panels and cabinets. Electrical cabinets or enclosures shall be vacuum-cleaned.

END OF SECTION

SECTION 16110 RACEWAYS, BOXES, FITTINGS, AND SUPPORTS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: Furnish and install complete raceway systems as shown on the Drawings and as specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. DIVISION 2 - Site Work
 - 3. SECTION 03300 - Cast-in-Place Concrete
 - 4. SECTION 16050 - Basic Materials and Methods
 - 5. SECTION 16120 - Wires and Cables

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:
 - 1. American National Standards Institute (ANSI)
 - a. A55.1 - Standard Specification for Carbon Steel Tires for Railway and Rapid Transit Applications
 - b. C80.1 - Standard for Electrical Rigid Steel Conduit
 - 2. American Society for Testing and Materials (ASTM)
 - a. A47 - Standard Specification for Ferric Malleable Iron Castings
 - b. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
 - c. A635 - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for
 - d. A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High - Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 - e. D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
 - 3. National Fire Protection Association (NFPA)
 - a. 70 - National Electrical Code (NEC)
 - 4. Local Building Codes and Standards
 - 5. National Electrical Manufacturers Association (NEMA)
 - a. 250 - Enclosure for Electrical Equipment (1,000 Volts Maximum)
 - b. TC-2 - Electrical Polyvinyl Chloride (PVC) Conduit
 - c. VE-1 - Metal Cable Tray System

6. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications
7. Underwriters Laboratories (UL)
 - a. 5B - Standard for Strut-Type Channel Raceways and Fittings
 - b. 6 - Standard for Safety Electrical Rigid Metal Conduit - Steel
 - c. 360 - Standard for Safety Liquid-Tight Flexible Metal Conduit
 - d. 508 - Standard for Industrial Control Equipment
 - e. 514A - Standard for Safety Metallic Outlet Boxes
 - f. 514B - Standard for Safety Conduit, Tubing and Cable Fittings
 - g. 651 - Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
 - h. 886 - Standard for Safety for Outlet Boxes and Fittings for use in Hazardous (Classified) Locations
 - i. 1059 - Standard for Safety Terminal Blocks

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. Furnish submittals in accordance with SECTIONS 01300 and 16050.
- B. Shop Drawings
 1. Complete catalog cuts of all raceways, fittings, boxes, supports, and mounting hardware, marked to show proposed materials and finishes.
 2. Complete catalog cuts of all pullboxes, manholes, and handholes, marked where applicable to show proposed materials and finishes.
 3. Dimensioned layout drawings of all cable tray routings, including elevations.
 4. Dimensioned layout drawings of all conduit racks and trapeze type hangers including elevations.

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES:

- A. Unless otherwise hereinafter specified, or shown on the Drawings, all boxes shall be metal.
- B. Combination expansion-deflection fittings shall be used where exposed or embedded conduits cross structure expansion joints.
- C. All conduit, fittings and accessories shall be UL listed and labeled.
- D. Furnish sizes of conduit, fittings and accessories as indicated, specified or as required by Electrical Codes and Standards.

1.07 TESTING: N/A

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

- 1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Rigid Galvanized Steel (RGS) Conduit:
1. Rigid steel conduit shall be mild steel, hot-dip galvanized inside and out.
 2. Rigid steel conduit shall be manufactured in accordance with ANSI C80.1 and UL-6.
 3. Each conduit length shall be threaded on both ends with threads protected.
- B. Rigid Non-Metallic Conduit:
1. Rigid non-metallic conduit shall be Schedule 80 PVC, sunlight resistant.
 2. Rigid non-metallic conduit shall be manufactured in accordance with NEMA TC-2 and UL-651.
- C. Electrical Metallic Tubing (EMT): Electrical metallic tubing shall be hot-dipped galvanized steel. EMT conduit shall only be allowed in IT communication equipment shelters, office or control room areas which are considered air conditioned interior space. Electrical metallic tubing connectors and couplings shall be steel compression type fittings. Set screw fittings are not acceptable.
- D. Liquidtight Flexible Conduit:
1. Liquidtight flexible conduit shall be constructed of a flexible galvanized metal core with a sunlight resistant thermoplastic outer jacket. Utilize liquid tight flexible conduit with spiral enclosed copper bonding conductors for conduit sizes 1 1/4 inches and smaller.
 2. Liquidtight flexible conduit shall be manufactured in accordance with UL-360.
 3. Fittings used with flexible conduit shall be of the screw-in type as manufactured by O-Z/Gedney, Appleton or Crouse-Hinds.
- E. Flexible Couplings: Flexible couplings shall be of heavy-duty construction, water tight, and have electrical conductivity equal to rigid conduit. 3/4-inches - 2 inches shall have an inner brass core with insulating liner, outer bronze braid. 2 1/2 inches - 4 inches shall have inner stainless steel (SST) core with insulating liner, outer stainless steel braid. Couplings shall be in compliance with UL Standard 886 and conform to ASTM A47, Grade 32510.
- F. Boxes and Fittings:
1. Terminal boxes, junction boxes, pull boxes, etc. shall be sheet steel unless otherwise shown on the Drawings. Boxes shall be galvanized and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14-gauge metal and covers shall not be less than 12-gauge metal. Covers shall be gasketed and fastened with stainless steel screws.
 2. Cast iron boxes and fittings shall be galvanized with cast galvanized covers and corrosion proof screws. Cast and malleable iron fittings for use with metallic conduit shall be the threaded type with five (5) full threads.
 3. In outdoor areas, conduit shall be terminated in raintight hubs. In other than outdoor areas, sealed locknuts and bushings shall be used.
 4. Conduit, fittings, and boxes in hazardous locations shall be suitable for the Class and Division indicated.

5. Floor boxes shall be of the round or rectangular cast metal type. Boxes shall be watertight and cover frames shall be adjustable. Box covers shall finish flush with finished floor surface. Boxes shall be located as directed by the FWC and/or as indicated on the Drawings. Necessary gaskets, sealing compound, plugs, or devices shall be provided for the complete installation.
 6. Steel elbows and couplings shall be hot-dipped galvanized. Joints shall be taped.
 7. Electrical metallic tubing fittings shall be of the rain-tight, concrete-tight, compression type.
- G. Outlet Boxes:
1. Construction: Outlet boxes shall be Zinc-coated or cadmium-plated sheet steel boxes of a class to satisfy the condition at each outlet except where unilet or conduit bodies are required. They shall be knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight-sided gang boxes, four (4) inches octagon concrete rings and four (4) inches octagon hung ceiling boxes with bars, may be folded type. All other boxes shall be one-piece, deep-drawn.
 2. Size: All boxes shall be of sufficient size to accommodate the required number and sizes of conduits, wires and splices in accordance with NEC requirements, but not smaller than size shown or specified. Special purpose boxes shall be sized for the device or application indicated.
 3. Fixture Studs: 3/8-inch malleable-iron fixture studs shall be used in outlet boxes for ceiling lighting fixtures and interior-bracket lighting fixtures, other than lamp receptacles and drop cords.
 4. Exposed: Screw-joint type boxes, with gasketed weatherproof covers shall be used in locations exposed to the weather.
 5. Tile Boxes: Boxes rectangular in shape with square corners and straight sides shall be used for receptacles and switches mounted in furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls. Install without plaster rings.
 6. Wall-mounted Switch, Receptacle, and Signal Boxes: Shall be, unless otherwise noted or specified, not less than four (4) inches square by two (2) inches deep for two (2) devices, and multigang boxes for more than two (2) devices. Boxes for switches and receptacles on unfinished walls may be screw-joint type with covers to fit the devices.
 7. Wall-mounted Telephone Outlet Boxes: Shall be four (4) inches square by two (2) inches deep, unless otherwise noted on the Drawings.
 8. Light Fixture Boxes: Shall be four (4) inches diameter by two (2) inches deep, minimum, for ceiling and interior bracket fixtures with concealed conduits. Plaster covers for bracket fixtures shall have 3 inch diameter openings. Screw-joint boxes with canopy seat shall be used for ceiling and interior bracket fixtures with exposed conduits.
 9. Grounding Terminal: Provide a grounding terminal in each box containing a green equipment ground conductor, or serving motors, lighting fixtures, or receptacles. Grounding terminal shall be green-colored, washer-in-head, machine screw or grounding bushing.
- H. Pullboxes: Pullboxes shall be minimum NEC size requirements unless larger box is noted, as specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches, and as specified for cabinets for pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion resistant screw or bolt attachment.
- I. PVC Fittings:
1. Fittings for use with rigid non-metallic conduit shall be PVC, solvent welded type.
 2. Provide watertight field-applied coat of all weather PVC solvent cement compound with viscosity and wet film thickness recommended as required for installation of non-metallic

conduit and fittings. The cement compound shall be furnished by the conduit MANUFACTURER. PVC solvent cement shall meet the requirements of ASTM D2564.

J. Stainless Steel Boxes:

1. Where stainless steel boxes are used, RGS conduit shall be used and also where indicated.
2. Stainless steel boxes shall be NEMA 4X, Type 316 as indicated in specification SECTION 16050.
3. Stainless steel shall be minimum 14-gauge thickness, with a brushed finish.
4. Doors shall have full length stainless steel piano hinges. Non-hinged boxes are not acceptable.

K. Terminal Cabinets:

1. Interiors shall be so designed that control relays and terminal blocks can be replaced or added without disturbing adjacent units. Each cabinet shall be furnished with a minimum of 30% spare terminals.
2. All interiors shall be completely factory assembled with control relays, terminal blocks, insulating barriers, etc. All 120 volt AC and DC terminal blocks shall be isolated from each other by insulating barriers or separate enclosures.
3. All wiring within the cabinets shall be grouped together in harnesses and secured to the structure.
4. For terminal block specification refer to SECTION 16120.
5. Boxes shall be made from 14-gauge galvanized steel and shall be of sufficient size to provide a minimum of four (4) inches of wiring space on all sides and between adjacent terminal blocks. A minimum two (2) inches spare shall be provided between control relays. A minimum of four (4) mounting studs shall be provided on each cabinet. Cabinets shall be furnished without knockouts. Holes for raceways shall be drilled on the Site.
6. A single hinged door shall cover the front of each terminal cabinet. Doors shall have a neoprene gasket, vault type handle, three-point catch and lock. Two (2) keys will be supplied for each lock. All locks shall be keyed alike.
7. All exterior and interior steel surfaces of the cabinets shall be properly cleaned and finished with gray over a rust-inhibiting phosphatized coating conforming to ANSI A55.1. The finish paint shall be of a type to which field applied paint will adhere.
8. Cabinets shall be painted 14-gauge or sixteen 16-gauge steel with 14-gauge steel doors, seams continuously welded and ground smooth, no holes or knockouts, with latch kit hardware. Cabinets shall conform to UL 508, File No. E61997, Type 12 and Type 13, NEMA/EEMAC Type 12 and Type 13.

L. Conduit Mounting Hardware:

1. Conduit supports shall be one (1) hole galvanized malleable iron pipe straps with galvanized clamp backs and nesting backs where required.
2. Ceiling hangers shall be adjustable galvanized carbon steel pipe hangers. Straps or hangers of plumbers perforated tape shall not be acceptable. Hanger rods shall be 3/8-inch minimum galvanized all-thread rod and shall meet or exceed ASTM A193B7. Trapeze, rod type hangers shall not be loaded in excess of 500 pounds per rod. Where loading exceeds this value, rigid frames shall be provided.
3. Racks shall be constructed from framing channel. Channels and all associated hardware shall be steel, hot dipped galvanized after fabrication of the channel. Field cuts shall be painted with zinc rich paint. Channels attached directly to building surfaces shall be 14-gauge minimum material 1-5/8-inch wide by 13/16-inch depth. All other channels shall be 12-gauge minimum 1-5/8-inch wide by 1-5/8-inch minimum depth. Racks shall be designed to limit deflection to

1/200 of span length. All exposed ends of framing channel shall be covered with MANUFACTURER's standard plastic inserts.

2.02 MANHOLES AND HANDHOLES:

- A. Manholes and pullboxes shall be precast, light duty, heavy duty or extra heavy duty of square, rectangular, or round configurations with loading capacities as shown on the Drawings.
 - 1. Traffic covers shall be traffic type, H-20 loading, except as indicated otherwise. Manhole and pullbox covers shall be identified as "Electric" by raised letters cast into the covers. Manhole frames and covers shall be heavy duty, frost-tight, water-tight neoprene gasketed frame, solid lids and inner lids.
 - 2. Manholes shall have frost-proof and water-tight grey iron frames and covers with solid lids and inner lids with 28 inches clear openings. Covers and lids shall be bolted to cast-in-place steel frames with corrosion resistant hardware. Covers shall be cast-iron and shall have pick-holes.
- B. Manholes and pullboxes shall be equipped with pulling-in irons opposite and below each ductway entrance.
- C. PVC ductbank conduits shall be provided with end bells. Brackets and 60 inches concrete inserts shall be provided in manholes as required for racking wiring through manholes.

2.03 DUCT BANKS:

- A. Underground ducts shall be Schedule 40 PVC, unless otherwise noted.
- B. Ducts shall be arranged as shown on the Drawings and encased in concrete. Variations from the standard duct bank configurations will be considered by the FWC on a case by case basis if needed to clear obstacles or provide adequate cover. Concrete shall have 4,500 psi compressive strength conforming to SECTION 03300.
- C. Ductbanks shall contain a No. 4/0 bare stranded copper ground wire. The ground wire shall be continuous through the ductbank and terminate at power distribution equipment and grounding grid.
- D. Identification Tape: Continuous lengths of underground warning tapes shall be installed 12 inches above and parallel to all ductbanks. Tape shall be six (6) inches wide polyethylene with foil backing film imprinted "CAUTION - ELECTRIC UTILITIES BELOW."

PART 3 - EXECUTION

3.01 PREPARATION:

- A. The CONTRACTOR shall provide suitable protection for conduit risers against damage during construction.
- B. The CONTRACTOR shall cap ends of all conduits before concrete is poured.
- C. The CONTRACTOR shall install pull cord and cap all conduits after cleaning where conduits are to be left empty by this Contract.
- D. The CONTRACTOR shall carefully ream ends of all conduit lengths after cutting to eliminate sharp burrs.
- E. The CONTRACTOR shall clean out all conduits before pulling wire.
- F. The CONTRACTOR shall clean out all conduits immediately after concrete work is finished.

3.02 INSTALLATION:

- A. No conduit smaller than 3/4-inch electrical trade size shall be used, nor shall any have more than three (3) 90° bends in any one (1) run. Pull boxes shall be provided as required per references listed in section 2.01.H.
- B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.
- C. The ends of all conduits shall be tightly plugged to exclude dust and moisture while under construction.
- D. Conduit supports shall be spaced at intervals of eight (8) feet or less, as required to obtain rigid construction.
- E. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-inch diameter.
- F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.
- G. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.
- H. No unbroken run shall exceed 300 feet in length. This length shall be reduced by 75 feet for each 90° elbow.
- I. Conduits terminating in pressed steel boxes shall have double lock nuts and insulated bushings.
- J. Conduits terminating in gasketed enclosures shall be terminated with conduit hubs.
- K. Conduit wall seals shall be used for all conduits penetrating walls below grade or other locations shown on the Drawings.
- L. Liquid-tight, flexible metal conduit shall be used for all motor terminations and other equipment where vibration is present.
- M. Conduit stubouts for future construction shall be provided with threaded PVC end caps at each end.
- N. All wiring shall be run in raceway unless indicated otherwise.
- O. Raceways shall be installed between equipment as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical, and shall be accomplished with tools designed for this purpose. Factory elbows shall be utilized wherever possible.
- P. Where raceway routings are indicated on plan views, follow those routings to the extent possible.
- Q. Where raceways are indicated but routing is not shown, such as home runs or on conduit developments and schedules, raceway routings shall be the CONTRACTOR's choice and in strict accordance with the NEC and customary installation practice. Raceway shall be encased, exposed, concealed, or under floor as indicated, except that conduit in finished areas shall be concealed unless specifically indicated otherwise.

- R. Underground raceways shall be installed between manholes, handholes, and pullboxes as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical, and shall be fabricated with tools designed for this purpose. Factory elbows shall be utilized wherever possible. Continuous lengths of underground warning tapes shall be installed 12 inches above and parallel to all underground conduits. Tape shall be six (6) inches wide polyethylene with foil backing film imprinted "CAUTION – ELECTRIC UTILITIES BELOW."
- S. Routing shall be adjusted to avoid obstruction. Coordinate between trades prior to installation of raceways. Lack of such coordination shall not be justification for extra compensation, and removal and re-installation to resolve conflicts shall be by the CONTRACTOR as part of the WORK.
- T. Exposed raceways shall be installed parallel or perpendicular to structural beams.
- U. Install expansion fittings with bonding jumpers wherever raceways cross building expansion joints.
- V. Wherever contact with concrete or dissimilar metals can produce galvanic corrosion of equipment, suitable insulating means shall be provided to prevent such corrosion.
- W. Holes:
 - 1. The CONTRACTOR shall provide the required insert materials and holes for all openings in new WORK completely bonded, curbed, flashed and finished off in an approved manner, whether in concrete, steel grating, metal panels or roofs. Resulting seal shall prevent smoke and gas penetration and adhere to Lloyds Register Standards Certificate Numbers SVG/F93/468, SVG/F93/469 and SVG/F93/470 and applicable UL Standards. Insert materials shall be of one of the following type:
 - a. Non-shrinking grout applied to continuously fill annular space between pipe and wall opening. The resulting seal shall serve as an isolator of fire, weather and gaseous conditions.
 - b. Fire rated, Ozone and Ultra-Violet radiation resistant, two-part silicone room temperature vulcanizing (RTV) foam.
 - 2. The CONTRACTOR shall core-drill all holes required in existing building work using a dustless method.
 - 3. The CONTRACTOR shall place grout or foam as specified, in the following locations:
 - a. All holes in concrete wall, floor and roof slabs after installation of conduit.
 - b. Wall entrances where conduit enters the building or vaults from exterior underground.
 - 4. The CONTRACTOR shall install fire and smoke stop fittings at all conduit penetration of fire rated walls, ceilings, and floors.

3.03 CONDUIT:

- A. Exposed conduit shall be Rigid Galvanized Steel, unless indicated otherwise:
 - 1. IT communication equipment shelters, office or control areas galvanized EMT conduit shall be utilized.
 - 2. In areas with chlorine or hydrofluosilicic acid, Schedule 40 PVC shall be utilized.
 - 3. In lime or ferric chloride areas, rigid aluminum conduit shall be utilized
 - 4. In Class I, Div. I or Div. II hazardous locations, rigid aluminum conduit shall be utilized.
- B. Where conduit emerges from concrete encasement, use a PVC Schedule 40 elbow with a PVC terminal adapter and stainless steel threaded coupling. Install the top of the stainless steel coupling flush with top of concrete. Insert a PVC plug into the open end of the coupling to prevent debris from entering the

conduit during construction. Use a PVC conduit nipple atop the elbow for height adjustment. Conduit shall emerge from the concrete perpendicular to the surface whenever possible.

- C. Concrete cover for conduit and fittings shall not be less than 1-1/2 inches for concrete exposed to earth or weather, or less than 3/4-inch for concrete not exposed to weather or in contact with the ground.
- D. Conduits passing through a slab, wall, or beam shall not impair significantly the strength of the construction.
- E. Conduits embedded within a slab, wall, or beam (other than those merely passing through) shall satisfy the following:
 - 1. Conduits with their fittings embedded within a column shall not displace more than four (4) percent of the gross area of cross section.
 - 2. Conduits shall not be larger in outside dimension than one third the overall thickness of slab, wall, or beam in which embedded.
 - 3. Conduits shall not be spaced closer than three (3) outside diameters on centers.
- F. Conduit shall be placed so that cutting, bending, or displacing reinforcement from its proper location will not be required.
- G. Threads shall be coated with a conductive lubricant before assembly.
- H. Joints shall be tight, thoroughly grounded, secure, and free of obstructions in the pipe. Conduit shall be adequately reamed to prevent damage to wires and cables during installation. Strap wrenches and vises shall be used to install conduit to prevent wrench marks on conduit. Conduit with wrench marks shall be replaced.
- I. Wherever possible, conduit runs shall slope to drain at one or both ends of run. Wherever conduit enters substructures below grade, the conduit shall be sloped to drain water away from the structure.
- J. Installation of rigid steel conduit through a core-drilled hole in an exterior wall below grade shall utilize a modular sealing device.
- K. Each conduit shall be identified at each end with a permanent non-corrosive metal marker. Designation shall be pressure stamped into the tag. The conduit identification shall be designated circuit number as shown.

3.04 SUPPORTS:

- A. The CONTRACTOR shall construct metal framing strut systems with sufficient rigidity to hold all mounted equipment and material in permanent and neat alignment. All channels, fittings and hardware of the strut assemblies shall be as per Drawings and specifications and shall not exceed load requirements in UL classification 5B and applicable NEC, NEMA and ASTM standards. Utilize galvanized material for interior non-corrosive and air conditioned spaces and stainless steel, for outdoor or corrosive environments.
- B. Design supports to provide 1/4-inch space between equipment housings and walls or columns upon which they are mounted.
- C. After Power Tool Cleaning, paint all welds, field cuts and damaged areas with one manufacturer type of primer and paint. Utilize organic zinc-rich primer at three (3) mils dry film thickness.
- D. All screws, nuts, bolts, pipe clamps and other anchoring materials for struts and framing shall be stainless steel.
- E. All outdoor supports shall be constructed to meet wind load requirements of the Site as set forth in structural specifications or/and Drawings.

3.05 OUTLET BOXES:

- A. Installation: Unless otherwise specified or shown on the Drawings, outlet boxes shall be flush mounted, and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line; or, if installed in walls and ceilings of incombustible construction, not more than 1/4 inch back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. A multiple of box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hangers, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steelwork.
- B. Mounting Heights: The mounting height of a wall-mounted outlet box shall be construed to mean the height from the finished floor to the horizontal center line of the cover plate. On exposed tile, block, or brick constructions, mount outlet boxes at the nearest bed joint to the mounting height indicated. Verify heights with the FWC.
- C. Wall-mounted Switch, Receptacle and Signal Outlets: On columns, pilasters, etc., mount so the centers of the columns are clear for future installation of partitions. Install outlet boxes near doors or windows close to the trim. Install according to Drawings, unless other locations are approved by the FWC.
- D. Back-to-Back: Outlets shown on the Drawings "back-to-back" are to be installed with a minimum of six (6) inches lateral separation between outlets. "Through-the-wall" type boxes are not permitted.

3.06 FIXTURE CONNECTIONS: Recessed or surface light fixtures in lay-in or accessible ceilings shall be connected with minimum 1/2-inch flexible metallic conduit, four (4) to six (6) feet long, with grounding provisions.

3.07 DUCTBANKS:

- A. Ductbanks shall be installed in accordance with the criteria below:
 - 1. Duct shall be assembled using high impact non-metallic spacers and saddles to provide conduits with vertical and horizontal separation. Plastic spacers shall be set every five (5) feet. The duct array shall be anchored every five (5) feet to prevent movement during placement of concrete.
 - 2. Duct shall be laid on a grade line of at least three (3) inches per 100 feet, sloping towards pullboxes or manholes. Duct shall be installed and pullbox and manhole depths adjusted so that the top of the concrete envelope is a minimum of 18 inches below grade and a minimum of 24 inches below roadways.
 - 3. Changes in direction of the duct envelope by more than 10° horizontally or vertically shall be accomplished using bends with a minimum radius 24 times the duct diameter.
 - 4. Duct couplings shall be staggered a minimum of six (6) inches.
 - 5. The bottom of trench shall be of select backfill or sand.
- B. Each bore of the completed ductbank shall be cleaned by drawing through it a standard flexible mandrel one foot long and 1/4-inch smaller than the nominal size of the duct. After passing of the mandrel, a wire brush and swab shall be drawn through. Spare raceways that are not indicated to contain conductors shall have a 1/8-inch polypropylene pull cord installed throughout the entire length of the raceway.
- C. Duct entrances shall be grouted smooth; ducts shall be terminated with flush end bells. Sections of pre-fabricated manholes and pullboxes shall be assembled with waterproof mastic and shall be set on a 12 inch bed of gravel as recommended by the MANUFACTURER or as required by field conditions.

- D. Ductbank penetration through walls of manholes, pullboxes, and building walls below grade shall be watertight.
- E. Concrete encased ductbank shall terminate at building foundations. When duct enters the building with a concrete slab on grade foundation, duct shall not be encased, but shall transition to rigid steel conduits at the edge of the slab.

END OF SECTION

SECTION 16120 WIRES AND CABLE

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION includes furnishing and installing (including terminations) of all electrical wire, cable, and accessories.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 16050 - Basic Materials and Methods

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:
 - 1. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications
 - 2. National Fire Protection Association (NFPA)
 - a. 70 - National Electrical Code
 - 3. Underwriters Laboratories (UL)
 - a. 83 - Thermoplastic Insulated Wires and Cables

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. Submittals shall be made in accordance with SECTION 01300.
- B. The CONTRACTOR shall submit Shop Drawings in accordance with CONTRACTOR Submittals and SECTION 16050.

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: N/A

1.07 TESTING:

- A. Cable Assembly and Testing: Cable assembly and testing shall comply with applicable requirements of NETA ATS Section 7.3.2. Factory test results shall be submitted in accordance with SECTION 01300 prior to shipment of cable. The following field tests shall be the minimum requirements:
 - 1. Power cable rated at 600 VAC shall be tested for insulation resistance between phases and from each phase to a ground using a megohmmeter.
 - 2. Field testing shall be done after cables are installed in the raceways.
 - 3. Field tests shall be performed by a certified test organization acceptable to the cable MANUFACTURER. Test results shall be submitted to the FWC for review and acceptance.
 - 4. Cables failing the tests shall be replaced with a new cable.

B. Continuity Test: Control and instrumentation cables shall be tested for continuity, polarity, undesirable ground, and origination. Such tests shall be performed after installation and prior to placing cables in service.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new work activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - MATERIALS

2.01 GENERAL: Conductors, include grounding conductors, shall be stranded copper. Aluminum conductor wire and cable will not be permitted. Insulation shall bear UL label, the MANUFACTURER's trademark, and identify the type, voltage, and conductor size. All conductors except flexible cords and cables, fixture wires, and conductors that form an integral part of equipment such as motors and controllers shall conform to the requirements of Article 310 of the National Electric Code, latest edition, for current carrying capacity. Flexible cords and cables shall conform to Article 400, and fixture wires shall conform to Article 402. Wiring shall have wire markers at each end.

2.02 LOW VOLTAGE WIRE AND CABLE:

A. Power and Lighting Wire

1. Wire rated for 600 volts in duct or conduit for all power and lighting circuits shall be Class B Type THHN or THWN, polyvinyl chloride rated at 90°C in dry locations, 75°C in wet locations, meeting the requirements of UL 83.
2. Conductors for feeders as defined in Article 100 of the NEC shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
3. Conductors for branch circuits as defined in Article 100 of the NEC shall be sized to prevent voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.

B. Control Wire

1. Control wire in duct or conduit shall be the same type as power and lighting wire indicated above.
2. Interconnecting control wiring installed in conduit to or between field devices (field wiring) shall be sized in accordance with NEC Article 310.15, Table 310.16 and shall not be smaller than No.14 AWG (minimum), unless otherwise indicated on Project drawings
3. Internal wiring installed within a control panel and cabinets shall be sized in accordance with NFPA 79, Table 12.5.1; and shall not be smaller than No. 18 AWG, unless otherwise indicated on Project drawings.
4. Internal control wires within control panels and cabinets shall be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations.

C. Instrumentation Cable

1. Instrumentation cable shall be rated at 600 volts.

2. Individual conductors shall be No. 16 AWG stranded, tinned copper. Insulation shall be color coded polyethylene: black-red for two-conductor cable and black-red-white for three-conductor cable.
3. Instrumentation cables shall be composed of the individual conductors, an aluminum polyester foil shield, a No. 16 AWG stranded tinned copper drain wire, and a PVC outer jacket with a nominal thickness of 0.048-inches.

2.03 CONNECTORS:

A. General Requirements:

1. Cable connectors shall be designed and sized for specific cable being connected.
2. Solderless, pressure-type connectors shall be constructed of non-corrodible tin-plated copper.
3. All connectors shall have a current-carrying capacity equal to or greater than the cable being connected.
4. Application tooling for compression type connectors shall contain die or piston stops to prevent over-crimping and cycling or pressure relief to prevent under-crimping. Dies of all application tooling shall provide wire size coding for quality control verification. All tooling shall be manufactured by the connector MANUFACTURER.
5. General purpose insulating tape shall be high temperature (105°C) tape, with a dielectric strength of 1,150 V/mil of polyvinyl material.

B. Mechanical Pressure Connectors:

1. Connectors shall be threaded split bolt type of high strength copper alloy.
2. Pressure type, twist-on connectors will not be acceptable.
3. Barrel shall have funnel entry, and vinyl insulation.

C. Power Lugs (10 AWG and Smaller) 600V and Below:

1. Pre-insulated ring tongue type
2. Manufactured from high-strength copper alloy

D. Power Lugs (Sizes 8-4 AWG) 600V and Below:

1. Non-insulated ring-tongue type
2. Ring tongue sized to match terminal stud size
3. Brazed barrel seam
4. Sight hole to verify proper cable insertion
5. Application tooling designed to crimp the wire barrel (conductor grip) with a one-step crimp

E. Control, Instrument and Specialty Cable Connectors:

1. Tin-plated copper
2. Vinyl or nylon pre-insulated ring-tongue type (Spade lugs will not be permitted.)
3. Sized to match terminal stud size
4. Have insulation grip sleeve to firmly hold to cable insulation
5. Insulation grip sleeve shall be funneled to facilitate wire insertion and prevent turned-back strands.

6. Application tooling designed to crimp the wire barrel (conductor grip) and the insulation grip sleeve with a one-step crimp.

2.04 TERMINAL BLOCKS:

- A. For Mounting in Terminal Boxes:
 1. Designed and sized for the cables being terminated
 2. Phenolic block rated 600 volts
 3. Binding screw-type terminals for power cables and straight-strap stud terminals for control and instrument cables
 4. Rated current carrying capacity equal to or greater than the cable being terminated
 5. Marking strip
- B. For Mounting in Cabinets, Panels, Control Boards, etc.:
 1. Designed and sized for the cables being terminated
 2. Terminal blocks shall be tubular screw type with pressure plates and shall be rated 600 V AC/DC, 10 A rated minimum.

2.05 CABLE IDENTIFICATION SLEEVES: Refer to SECTION 16050 for appropriate conductor identification material.

PART 3 - EXECUTION

3.01 GENERAL: The CONTRACTOR shall provide and terminate all power, control, and instrumentation conductors except where indicated.

3.02 INSTALLATION:

- A. Conductors shall not be pulled into raceway until raceway has been cleared of moisture and debris.
- B. Pulling tensions on raceway cables shall be within the limits recommended by the cable MANUFACTURER. Wire pulling lubricant, where needed, shall be UL approved.
- C. Instrumentation wire shall not be run in the same raceway with power and control wiring except where specifically indicated.
- D. Wire in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be fanned out to terminals.
- E. Single conductor cable in cable trays shall be No. 1/0 or larger and shall be of a type listed and marked for use in cable trays. Tray cable smaller than 1/0 shall be multi-conductor, with outer jacket.

3.03 SPLICES AND TERMINATIONS:

- A. General
 1. Wire taps and splices shall be properly taped and insulated according to their respective classes.
 2. In general, there shall be no cable splices in underground manholes or pullboxes. If splices are necessary, the cables shall be brought aboveground and terminated in a NEMA 4X, stainless steel terminal or splice cabinet that is stand mounted on a concrete pad. Splices in underground manholes and pullboxes may be made only with the approval of the FWC and shall utilize outdoor mechanical or compression type splice connectors meeting UL486D and UL50 requirements.

3. Stranded conductors shall be terminated directly on equipment box lugs making sure that all conductor strands are confined within lug. Use compression lugs where equipment box lugs have not been provided.
 4. Surplus control and instrumentation wire shall be properly taped and terminated as spares.
- B. Control Wire and Cable
1. Control conductors shall be spliced or terminated only at the locations indicated and only on terminal strips or terminal lugs of vendor furnished equipment.
 2. In junction boxes, motor control centers, and control panels, control wire and spare wire shall be terminated to terminal strips.
- C. Instrumentation Wire and Cable
1. Shielded instrumentation cables shall be grounded at one (1) end only, preferably the receiving end on a 4-20 mA system.
 2. Two and three conductor shielded cables installed in conduit runs which exceed available standard cable lengths may be spliced in pullboxes. Such cable runs shall have only one splice per conductor. Splices, where approved by the FWC, shall be made on terminal blocks.
- D. Power Wire and Cable
1. All 120/208-volt, 120/240-volt, and 480/277-volt branch circuit conductors may be spliced in suitable boxes or conduit bodies at locations determined by the CONTRACTOR.
 2. Splices to motor leads in motor terminal boxes shall be wrapped with mastic material to form a mold and then shall be taped with a minimum of two layers of varnished cambric tape overtaped with a minimum of two layers of high temperature tape.

3.04 CABLE IDENTIFICATION:

- A. General: Wires and cables shall be identified for proper control of circuits and equipment and to reduce maintenance effort.
- B. Identification Numbers: The CONTRACTOR shall assign to each control and instrumentation wire and cable a unique identification number. Numbers shall be assigned to all conductors having common terminals and shall be shown on "as built" drawings. Identification numbers shall appear within 3 inches of conductor terminals. "Control Conductor" shall be defined as any conductor used for alarm, control, annunciation, or signal purposes.
1. Multiconductor cable shall be assigned a number which shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath free-standing equipment. It is expected that the cable number shall form a part of the individual wire number. Individual control conductors and instrumentation cable shall be identified at pull points as described above. The instrumentation cable numbers shall incorporate the loop numbers assigned in the Contract Documents.
 2. All 120/208-volt system feeder cables and branch circuit conductors shall be color coded as follows: Phase A - black, Phase B - blue, Phase C - red, and Neutral - white. The 120/240-volt system conductors shall be color coded as follows: Line 1 - Black, Line 2 - Red, and Neutral - White. The 480/277-volt system conductors shall be color coded as follows: Phase A - Yellow, Phase B - Brown, Phase C - Orange, and Neutral - Gray. Color coding tape shall be used where colored insulation is not available. Branch circuit switched conductors shall be yellow. Insulated ground wire shall be green. Color coding and phasing shall be consistent throughout the Site, but bus bars at panelboards, switchboards, and motor control centers shall be connected Phase A-B-C, top to bottom, or left to right, facing connecting lugs.
 3. All 4-wire, delta-connected secondary where the midpoint of one phase winding is grounded, the phase conductor having the higher voltage to ground shall be identified by an outer finish

that is orange in color. Color coding tape shall be used where colored insulation is not available. Such identification shall be place at each point where a connection is made if the ground conductor is also present. The B phase shall be that phase having the higher voltage to ground on 3-phase, 4 wire delta-connected system.

4. Fire alarm cable jackets shall be red. General purpose DC control cable jackets shall be blue.
5. Spare conductors shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.
6. Terminal strips shall be identified by computer printable, cloth, self-sticking marker strips attached under the terminal strip.

END OF SECTION

SECTION 16140 WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The WORK of this SECTION shall consist of furnishing all labor, materials, and equipment necessary for installation of wiring devices and plates as shown on the Drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 16050 - Basic Materials and Methods
 - 3. SECTION 16110 - Raceways, Boxes, Fittings, and Supports
 - 4. SECTION 16450 - Grounding

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:
 - 1. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications
 - 2. Local Building Codes and Standards
 - 3. National Fire Protection Association (NFPA)
 - a. 70 - National Electrical Code
 - 4. National Electrical Manufacturers Association (NEMA)
 - a. 250 - Enclosure for Electrical Equipment (1,000 Volts Maximum)
 - 5. Underwriters Laboratories (UL)
 - a. 498 - Standard for Safety Attachment Plugs and Receptacles
 - b. 1449 - Standard for Transient Voltage Surge Suppressors

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. Furnish submittals in accordance with CONTRACTOR Submittals and specified in SECTION 01300.
- B. Shop Drawings
 - 1. Complete catalog cuts of switches, receptacles, enclosures, covers, and appurtenances, marked to clearly identify proposed materials
 - 2. Documentation showing that proposed materials comply with the requirements of NEC and UL.

1.05 QUALIFICATIONS: Submit documentation of the MANUFACTURER's qualifications.

1.06 RESPONSIBILITIES:

- A. The requirements of SECTION 16050 apply to this SECTION.
- B. Single Manufacturer: Like products shall be the end product of one MANUFACTURER in order to achieve standardization of appearance, operation, maintenance, spare parts, and MANUFACTURER's services.

1.07 TESTING:

- A. Provide checkout, field, and functional testing of wiring devices in accordance with SECTION 16050.
- B. Test each receptacle for polarity and ground integrity with a standard receptacle tester.
- C. Test Ground-fault circuit interrupting (GFCI) receptacle for correct tripping operation with suitable tester.

1.08 INSPECTIONS COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 SNAP SWITCHES:

- A. Unless otherwise specified, each snap switch (flush tumbler-toggle) shall be of the C.C. commercial grade type for mounting in a single-gang spacing, fully rated 20 amperes, minimum, at 120-277 VAC, conforming to minimum requirements of the latest revision of the Underwriters' Laboratories, Inc., "Snap Switches" and further requirements herein specified.
- B. Specification grade, heavy-duty, single pole, 3-way or 4-way, of the maintained type as indicated on the Drawings shall be used.
- C. Switches shall operate in any position and shall be fully enclosed cup type with entire body molded phenolic, urea or melamine.
- D. Fiber, paper or similar insulating material shall not be used for body or cover. Ivory color handles unless otherwise indicated on the Drawings.
- E. Silver or silver alloy contacts. Brass contact arm.
- F. Snap switches shall be capable of withstanding tests as outlined in NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems section 7.5.1.1.
- G. Switches for hazardous locations shall be factory sealed, rated at 20 amperes, 120-277 VAC, capable of controlling 100 percent tungsten filament, fluorescent and HID lamp loads.

2.02 RECEPTACLES:

- A. Industrial or Hospital Grade:
 - 1. Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publications and UL Listings.

2. Receptacles shall be rated for 125 VAC, 20 amperes shall be polarized three (3) wire type for use with three (3) wire cord with grounded lead and one (1) designated stud shall be permanently grounded to the conduit system (NEMA 5-20R).
 3. Receptacles shall also be fire-resistant, non-absorptive, with nylon top (face) and bodies and bases with metal plaster ears (integral with the supporting member).
 4. They shall be single or duplex as shown or noted on Drawings, and ivory color unless otherwise noted, with triple wipe or equivalent brass alloy power contacts for each prong.
 5. MANUFACTURERS are:
 - a. Hubbell,
 - b. Cooper,
 - c. Pass & Seymour,
 - d. Leviton, or
 - e. FWC approved equal.
- B. Grounding Type: All receptacles shall be grounding type with a green-colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper in accordance with NEC, Article 250. Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.
- C. GFCI:
1. Ground-fault circuit interrupting receptacles (GFCI's) shall be installed at the locations indicated and as required by the NEC.
 2. GFCI's shall be duplex, Industrial or Hospital grade, tripping at five (5) mA.
 3. Ratings shall be 125 V, 20 amperes, NEMA WD-1, Configuration 5-20R, capable of interrupting 5,000 amperes without damage.
 4. Feed-through type GFCI's serving standard receptacles will not be permitted.
- D. Floor receptacles and jacks shall be installed in rectangular floor boxes. Floor boxes shall be 1, 2, or 3 gang as required for each installation. Boxes shall conform to requirements set forth in Specification SECTION 16110.
- E. Pedestal type boxes for laboratory bench receptacles shall be cast iron, polished finish, single face with 1/2-inch N.P.T. tapped flanged inlet; single gang, meeting UL Standard 514.
- F. Special Purpose: Receptacles for special applications shall be as indicated on the Drawings.
1. Special purpose receptacles shall have ratings and number of poles as indicated or required for anticipated purpose.
 2. Matching plug with cord-grip features shall be provided with each special-purpose receptacle.
 3. Emergency generator receptacles:
 - a. Three Phase: Emergency generator receptacles for 120/240 VAC three phase shall be Appleton Powertite 200 Amp Pin and Sleeve Clamp Cover Plugs and Receptacles for reverse service. Receptacle shall be supplied with mounting box, model number ADJA20044-200-RS. Provide and turn over to FWC the matching plug ADJA20044-200-RS.
- G. Receptacles for Hazardous Locations:
1. Receptacles for hazardous locations shall be single gang receptacles with spring door. Receptacles shall have a factory sealed chamber.

2. The receptacles shall have a delayed action feature requiring the plug to be inserted in the receptacle and rotated before the electrical connection is made.
3. The receptacle shall not work with non-hazardous rated plugs.
4. One plug shall be furnished with each receptacle.
5. The receptacles shall be rated for 20 amps at 125 VAC.

H. **TVSS Receptacles:**

Transient voltage surge suppressing receptacles shall comply with the requirements set forth in paragraph 2.02A in this specification and in addition shall have the following as a minimum:

1. A filtering capacitor for seven (7) to one (1) average noise reduction
2. Two (2) way protection for line equipment
3. Response time less than one (1) nanosecond for unmounted Metal Oxide Varistor (MOV)
4. Overcurrent protection
5. Thermal protection
6. Transient suppressing MOV's
7. Varistor with voltage capabilities of 150V RMS

2.03 **PLUG CAPS & CORDS:** Provide and install a matching plug cap and properly-sized cord for equipment items noted on the drawings as by Electrical CONTRACTOR. No plug caps are required for duplex receptacle.

2.04 **DEVICE PLATES:**

- A. **General:** Provide device plates for each switch, receptacle, signal and telephone outlet, and special purpose outlet. Do not use sectional gang plates for multi-gang boxes. Plates shall be of commercial grade nylon.
- B. Provide nameplates or equivalent markings on switch enclosures to indicate ON and OFF positions of each switch. ON and OFF for 3-way or 4-way switches is not acceptable. Receptacles slated for special purposes shall have nameplates clearly indicating their intended use. Conform to requirements of SECTION 16050.
- C. **Special Purpose:** Plates for special purpose outlets shall be of a design suitable for the particular application and as called for in the Drawings.

PART 3 - EXECUTION

3.01 **GENERAL:** Perform WORK in accordance with the National Electrical Code.

3.02 **CONNECTION:**

- A. Rigidly attach wiring devices in accordance with National Electrical Code, and as indicated, avoiding interference with other equipment.
- B. Securely fasten nameplates using screws, bolts, or rivets centered under or on the device, unless otherwise indicated.

3.03 **GROUNDING:**

- A. Ground all devices, including switches and receptacles, in accordance with NEC, ART 250, and SECTION 16450.

- B. Ground switches and associated metal plates through switch mounting yoke, outlet box, and raceway system.
- C. Ground flush receptacles and their metal plates through positive ground connections to outlet box and grounding system. Maintain ground to each receptacle by spring-loaded grounding contact to mounting screw or by grounding jumper, each making positive connection to outlet box and grounding system at all times.

END OF SECTION

SECTION 16150 MOTORS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide electric motors, accessories, and appurtenances complete and operable, in conformance with the individual driven equipment specifications and the Contract Documents.
- B. The provisions of this SECTION apply to all low voltage AC (alternating current) squirrel cage induction motors except as indicated otherwise.
- C. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 16050 - Basic Materials and Methods
 - 3. DIVISION 16 - Electrical

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.
 - 1. Institute of Electrical and Electronics Engineers (IEEE)
 - a. 43 - Recommended Practice for Testing Insulating Resistance of Electric Machinery
 - b. 112 - Standard Test Procedure for Polyphase Induction Motors and Generators
 - 2. Local Building Codes and Standards
 - 3. National Electrical Manufacturers Association (NEMA)
 - a. MG-1 - Motors and Generators
 - b. MG-2 - Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
 - 4. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications
 - 5. National Fire Protection Association (NFPA)
 - a. 70 - National Electrical Code (NEC)
 - 6. Underwriters Laboratory (UL)

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. Furnish submittals in accordance with submittal requirements of SECTIONS 01300 and 16050.
- B. Complete motor data shall be submitted with the driven machinery Shop Drawings. Motor data shall include:
 - 1. Machine name and specification number of driven machine

2. Motor MANUFACTURER
 3. Motor type or model and dimension drawing. Include motor weight.
 4. Nominal horsepower
 5. NEMA Design
 6. Enclosure
 7. Frame Size
 8. Winding insulation class and temperature rise class
 9. Voltage, phase and frequency ratings
 10. Service factor
 11. Full load current at rated horsepower for application voltage
 12. Full load speed
 13. Guaranteed minimum full load efficiency. Also nominal efficiencies at 1/2 and 3/4 load.
 14. Type of thermal protection or overtemperature protection, if included
 15. Wiring diagram for devices such as motor leak detection, temperature, or zero speed switches, as applicable
 16. Bearing data. Include recommendation for lubricants of relubricatable type bearings.
 17. Power factor at 1/2, 3/4 and full load
 18. Recommended size for power factor correction capacitors to improve power factor to 0.95 (lagging) when operated at full load.
- C. If water cooling is required for motor thrust bearings, the Shop Drawing submittals shall indicate this requirement.

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: The CONTRACTOR shall assign to the equipment supplier the responsibility to select suitable electric motors for the equipment. The choice of motor MANUFACTURER shall be subject to review by the FWC. Such review will consider future availability of replacement parts and compatibility with driven equipment.

1.07 TESTING:

- A. Factory Testing: Motors rated 100 HP (horsepower) and larger shall be factory tested in conformance with ANSI/IEEE 112, IEEE 43, and NEMA MG-2. Except where specific testing or witnessed shop tests are required by the specifications for driven equipment, factory test reports may be copies of routine test reports of electrically identical motors. Test report shall indicate test procedure and instrumentation used to measure and record data. Test report shall be certified by the motor MANUFACTURER's test personnel and be submitted to the FWC.
- B. Field Testing: The CONTRACTOR shall perform the following field tests:
1. Inspect each motor installation for any deviation from rated voltage, phase, or frequency and improper installation.
 2. Visually check for proper phase and ground connections. Verify that multi-voltage motors are connected for proper voltage.
 3. Check winding and bearing temperature detectors and space heaters for functional operation.
 4. Test for proper rotation prior to connection to the driven equipment.

5. Test insulation (megger test) of all new and re-used motors in accordance with NEMA MG-1. Test voltage shall be 1000 VAC (Volts Alternating Current) plus twice the rated voltage of the motor.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide at least 48 hours advance notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in FWC's General Terms and Conditions.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS:

- A. Electric motors driving identical machines shall be identical.
- B. Maximum motor loading shall in all cases be equal to nameplate horsepower rating or less, exclusive of service factor and be verifiable from the submittal data of the driven machinery.
- C. Motor Capacity
 1. The CONTRACTOR shall size motors for the larger of the following criteria:
 - a. Size motors to continuously carry the maximum load that develops across the full range of driven equipment operation.
 - b. Size motors for minimum size indicated
 2. In all cases, motor sizes shall be derated from nameplate values as follows:
 - a. Ambient Temperature
 - i. For ambient temperatures up to but not exceeding 40° Celsius (C), no derating is required.
 - ii. For ambient temperatures exceeding 40° C but less than 50° C, derate nameplate HP ratings to 85 percent.
 3. Increased circuit breaker, magnetic starter, and conductor and conduit capacities required for motors larger than the indicated sizes shall be provided as part of the WORK.
- D. Exempt Motors: Motors for valve operators, submersible pumps, or motors which are an integral part of standard manufactured equipment, i.e., non-NEMA mounting, common shaft with driven element, or part of domestic or commercial use apparatus may be excepted from these specifications to the extent that such variation reflects a necessary condition of motor service or a requirement of the driven equipment.

2.02 DESIGN REQUIREMENTS:

- A. General: Electric motors shall comply with ANSI/NEMA MG-1.
- B. NEMA Design: Electric motors shall be NEMA Design B, unless otherwise indicated. In no case shall starting torque or breakdown torque be less than the value in ANSI/NEMA MG 1. Motors shall be suitable for the indicated starting method.
- C. Motor Voltage Ratings: Motors shall have voltage ratings in accordance with the following, unless otherwise indicated:

1. Motors below 1/2-HP shall be rated 115 volts, single-phase, 60-Hz (hertz). Dual voltage motors rated 115/230-volts, 115/208-volts, or 120-240 volts are acceptable, provided all leads are brought out to the conduit box.
 2. Motors 1/2-HP and larger shall be rated 208 volts, 230 volts or 460 volts, 3-phase, 60-Hz. Dual voltage motors rated 230/460 volts or 208/230/460 volts are acceptable, provided all loads are brought out to the conduit box.
- D. Insulation: All 3-phase motors shall be provided with non-hygroscopic, chemical and humidity resistant Class F insulation. The insulation for 1.5 HP and above shall be rated to operate at a maximum ambient temperature of 40° C and at the altitudes where the motors will be installed/operated, without exceeding Class B temperature rise limits stated in ANSI/NEMA MG 1-12.44. Single phase motors shall have Class F insulation with temperature rise not to exceed the insulation class.
- E. Motors 50 HP or smaller located in non-hazardous areas shall be totally enclosed, fan cooled (Totally Enclosed Fan-Cooled (TEFC)) with a Service Factor of 1.15 unless otherwise indicated.
- F. Motors larger than 50 HP and located in non-hazardous areas shall be TEFC or Weather Protected Type WPII, with a service factor of 1.15.
- G. Motors for use in hazardous locations shall have enclosures suitable for the classification indicated. Such motors shall be UL listed and be stamped as such.
- H. High Efficiency Motors
1. Motors with a nameplate rating of one (1) HP and larger shall be "high efficiency" units. Motors shall be stamped with the efficiency on the nameplate with the caption "NEMA High Efficiency" or "NEMA Nominal Efficiency." Such motors shall have efficiencies determined by the test as set forth in ANSI/IEEE 112 -Standard Test Procedure for Polyphase Induction Motors and Generators, Method B.
 2. Efficiency: Nominal efficiency and minimum efficiency shall be defined in accordance with ANSI/NEMA MG 1-12.60 - Efficiency Levels of Energy Efficient Polyphase Squirrel-Cage Induction Motors: these two (2) values shall be stated in the Shop Drawing submittal.
 3. High Efficiency motors shall conform to the following guaranteed minimum efficiency requirements which are full load values:

OPEN DRIP-PROOF (ODP)								
FULL-LOAD EFFICIENCIES OF ENERGY EFFICIENT MOTORS								
OPEN MOTORS								
HP	2 POLE		4 POLE		6 POLE		8 POLE	
	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1.0	--	--	82.5	80.0	80.0	77.0	74.0	70.0
1.5	82.5	80.0	84.0	81.5	84.0	81.5	75.5	72.0
2.0	84.0	81.5	84.0	81.5	85.5	82.5	85.5	82.5
3.0	84.0	81.5	86.5	84.0	86.5	84.0	86.5	84.0
5.0	85.5	82.5	87.5	85.5	87.5	85.5	87.5	85.5
7.5	87.5	85.5	88.5	86.5	88.5	86.5	88.5	86.5
10.0	88.5	86.5	89.5	87.5	90.2	88.5	89.5	87.5
15.0	89.5	87.5	91.0	89.5	90.2	88.5	89.5	87.5
20.0	90.2	88.5	91.0	89.5	91.0	89.5	90.2	88.5
25.0	91.0	89.5	91.7	90.2	91.7	90.2	90.2	88.5
30.0	91.0	89.5	92.4	91.0	92.4	91.0	91.0	89.5
40.0	91.7	90.2	93.0	91.7	93.0	91.7	91.0	89.5
50.0	92.4	91.0	93.0	91.7	93.0	91.7	91.7	90.2
60.0	93.0	91.7	93.6	92.4	93.6	92.4	92.4	91.0
75.0	93.0	91.7	94.1	93.0	93.6	92.4	93.6	92.4
100.0	93.0	91.7	94.1	93.0	94.1	93.0	93.6	92.4
125.0	93.6	92.4	94.5	93.6	94.1	93.0	93.6	92.4
150.0	93.6	92.4	95.0	94.1	94.5	93.6	93.6	92.4
200.0	94.5	93.6	95.0	94.1	94.5	93.6	93.6	92.4
250.0	94.5	93.6	95.4	94.5	95.4	94.5	94.5	93.6
300.0	95.0	94.1	95.4	94.5	95.4	94.5	--	--
350.0	95.0	94.1	95.4	94.5	95.4	94.5	--	--
400.0	95.4	94.5	95.4	94.5	--	--	--	--
450.0	95.8	95.0	95.8	95.0	--	--	--	--
500.0	95.8	95.0	95.8	95.0	--	--	--	--

TOTALLY ENCLOSED - FAN COOLED (TEFC)								
ENCLOSED MOTORS								
	2 POLE		4 POLE		6 POLE		8 POLE	
HP	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.	Nom. Effic.	Min. Effic.
1.0	75.5	72.0	82.5	80.0	80.0	77.0	74.0	70.0
1.5	82.5	80.0	84.0	81.5	85.5	82.5	77.0	74.0
2.0	84.0	81.5	84.0	81.5	86.5	84.0	82.5	80.0
3.0	85.5	82.5	87.5	85.5	87.5	85.5	84.0	81.5
5.0	87.5	85.5	87.5	85.5	87.5	85.5	85.5	82.5
7.5	88.5	86.5	89.5	87.5	89.5	87.5	85.5	82.5
10.0	89.5	87.5	89.5	87.5	89.5	87.5	88.5	86.5
15.0	90.2	88.5	91.0	89.5	90.2	88.5	88.5	86.5
20.0	90.2	88.5	91.0	89.5	90.2	88.5	89.5	87.5
25.0	91.0	89.5	92.4	91.0	91.7	90.2	89.5	87.5
30.0	91.0	89.5	92.4	91.0	91.7	90.2	91.0	89.5
40.0	91.7	90.2	93.0	91.7	93.0	91.7	91.0	89.5
50.0	92.4	91.0	93.0	91.7	93.0	91.7	91.7	90.2
60.0	93.0	91.7	93.6	92.4	93.6	92.4	91.7	90.2
75.0	93.0	91.7	94.1	93.0	93.6	92.4	93.0	91.7
100.0	93.6	92.4	94.5	93.6	94.1	93.0	93.0	91.7
125.0	94.5	93.6	94.5	93.6	94.1	93.0	93.6	92.4
150.0	94.5	93.6	95.0	94.1	95.0	94.1	93.6	92.4
200.0	95.0	94.1	95.0	94.1	95.0	94.1	94.1	93.0
250.0	95.4	94.5	95.0	94.1	95.0	94.1	94.5	93.6
300.0	95.4	94.5	95.4	94.5	95.0	94.1	--	--
350.0	95.4	94.5	95.4	94.5	95.0	94.1	--	--
400.0	95.4	94.5	95.4	94.5	--	--	--	--
450.0	95.4	94.5	95.4	94.5	--	--	--	--
500.0	95.4	94.5	95.8	95.0	--	--	--	--

I. All two-speed motors shall be the two-winding types.

2.03 ACCESSORY REQUIREMENTS:

- A. General: Horizontal motors three (3) HP and larger, and all vertical motors, shall have split-type cast metal conduit boxes. Motors less than three (3) HP shall have the MANUFACTURER's standard conduit boxes. Motors other than open drip-proof shall be gasketed.
- B. Lifting Devices: Motors weighing 265 pounds (lb) (120 kilogram (kg)) or more shall have suitable lifting eyes for installation and removal.
- C. Special Requirements: The CONTRACTOR shall refer to individual equipment specifications for special requirements such as motor winding thermal protection or multi-speed windings.
- D. Grounding Lugs: Provide motor grounding lug suitable to terminate ground wire, sized as indicated.
- E. Nameplate: Motors shall be fitted with permanent stainless steel nameplates indelibly stamped or engraved with NEMA Standard motor data, in conformance with NEMA MG-1-10.40.
- F. Where motors are indicated by elementary schematics or specifications to have zero speed switches, the switches shall be factory mounted integral to the motors. Switches shall close contact when the motor is at zero speed.

2.04 MOTOR THERMAL PROTECTION:

- A. Single Phase Motors: Single phase 120, 208, or 230 volt motors shall have integral thermal overload protection or shall be inherently current limited.
- B. Thermostats: When called for on the Drawing schematics the motors shall be supplied with winding thermostats of snap action, bi-metallic, temperature-actuated switch type. Thermostats shall be provided with one (1) normally closed contact. The thermostat switch point shall be precalibrated by the MANUFACTURER.
- C. Resistance Temperature Detectors (RTDs): Bearing RTDs and/or winding RTDs (two per phase) shall be provided where indicated. RTDs shall be 100 ohm platinum.

2.05 MOTOR BEARINGS:

- A. Motors greater than two (2) HP shall have bearings designed for 17,500 hours (belted) or 100,000 hours (coupled) L-10 life.
- B. Fractional Horsepower: Motors with fractional horsepower through two (2) HP shall be provided with Lubricated-for-Life ball bearings.
- C. Horizontal Motors Over two (2) HP: Motors larger than two (2) HP shall be provided with relubricatable ball bearings. Lubrication shall be per MANUFACTURER's recommendation for smooth operation and long life of the bearings.
- D. Vertical Motors Over two (2) HP: Vertical motors larger than two (2) HP shall be provided with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per MANUFACTURER's recommendation for smooth operation and long life of the bearings.
- E. Water Cooled Motors: If water cooling is required for the thrust bearings, cooling water lines shall be provided complete with shut-off valve, strainer, solenoid valve, flow indicator, thermometer, throttling valve, and, (where subject to freezing), insulation with heat tracing.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Motor installation shall be performed in accordance with the motor MANUFACTURER's written recommendations and the written requirements of the MANUFACTURER of the driven equipment.
- B. Related electrical work involving connections, controls, switches, and disconnects shall be performed in accordance with the applicable sections of Division 16.
- C. For motors utilizing power factor correction capacitors connected to the starter output terminals, the motor overload elements or trip settings shall be adjusted downwards to reflect the reduction in line current resulting from power factor correction.

END OF SECTION

SECTION 16155 MOTOR STARTERS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The WORK of this SECTION shall consist of furnishing all labor, material, and equipment as necessary for the installation of low voltage motor control equipment as shown on the Drawings and specified herein. The equipment covered by this specification covers standalone full voltage starters, microprocessor based soft starters, reduced voltage starters and complete motor control centers (MCC) with all associated controls.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 16050 – Basic Materials and Methods

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:
 - 1. Institute of Electrical and Electronics Association (IEEE)
 - a. 43 - Recommended Practice for Testing Insulation Resistance of Rotating Machinery
 - b. 112 - Standard Test Procedure for Polyphase Induction Motors and Generators
 - 2. Local Building Codes and Standards
 - 3. National Fire Protection Association (NFPA)
 - a. 70 - National Electrical Code
 - 4. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications
 - 5. National Electrical Manufacturers Association (NEMA)
 - a. 250 - Enclosure for Electrical Equipment (1,000 Volts Maximum)
 - b. ICS2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600V
 - 6. Underwriters Laboratory (UL)
 - a. 508 - Industrial Control Equipment

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. General: Submittals shall be in accordance with SECTIONS 01300 and 16050.
- B. Shop Drawings
 - 1. Enclosure NEMA rating and color
 - 2. Voltage rating and interrupting capacity. Include materials of construction
 - 3. Relays, timers, pilot devices, control transformer VA and fuse sizes

4. Elementary schematic ladder diagrams for each starter or compartment. Custom schematics shall be furnished. Diagrams shall include all remote devices. Submittals with drawings not meeting this requirement will not be reviewed further and will be returned to the CONTRACTOR stamped "REJECTED-RESUBMIT".
5. Short circuit rating of the complete assembly
6. Replacement parts lists and operation and maintenance procedures per Project and/or FWC requirements.

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: The electrical equipment and distribution system components shown on the drawings is not intended to limit the equipment rating or size. When motors furnished differ from the expected rating indicated, the CONTRACTOR shall make the necessary adjustments to wiring, conduit, disconnect devices, motor starters, branch circuit protection, and other affected material or equipment to accommodate the motors actually installed.

1.07 TESTING:

- A. Factory Test: All motor starters, motor control centers, microprocessor based soft starters and their components shall be given MANUFACTURER's standard electrical and mechanical production tests and inspections. The tests shall include electrical continuity check, dielectric tests for each circuit, and inspection for proper functioning of all components including controls, protective devices, metering, and alarm devices.
- B. Field Test, Soft Starters:
 1. Inspection, Startup, Field Adjustment: An authorized service representative of the MANUFACTURER shall supervise the following and certify the equipment and controls have been properly installed, aligned, and readied for operation.
 - a. Installation of the equipment
 - b. Inspection, checking, and adjusting the equipment
 - c. Startup and field testing for proper operation
- C. Electrical Tests
 1. Insulation tests
 - a. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute. Test voltage and minimum acceptable resistance shall be in accordance with MANUFACTURER's recommendations.
 - b. Measure insulation resistance of each starter section phase to phase and phase to ground with the starter contacts closed and the protective device open. Test voltage and minimum acceptable resistance shall be in accordance with the MANUFACTURER's recommendations.
 - c. Measure insulation resistance of each control circuit with respect to ground.
 2. Verify proper operation of control logic in all modes of control.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in Article 13 of Section 00700 - General Terms and Conditions.

PART 2 - PRODUCTS

2.01 MOTOR CONTROL, GENERAL:

- A. Provide each motor with a suitable controller and devices that will function as specified for the respective motors and meeting NEMA ICS 2, the NEC, and UL.
- B. Devices of the same type shall be products of the same MANUFACTURER. This requirement applies to all control devices, and insofar as practical, to equipment manufactured on a production basis. It also applies without exception to equipment custom fabricated for this Project.

2.02 SOLID STATE REDUCED VOLTAGE STARTERS:

Solid state reduced voltage starters shall meet the requirements of UL 508 and shall consist of an incoming power circuit breaker, a power section, logic board, isolation contactor, and paralleling full load bypass contactor.

- A. Soft Starters shall conform to the following:
 - 1. The SCR-based power section shall consist of 6 back-to-back SCRs, two SCRs per phase, and shall be rated for a minimum peak inverse voltage rating of 2.5 times line voltage, 1200 PIV for 480 volts. Units using triacs or SCR/diode combinations shall not be acceptable. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dv/dt characteristics of the electrical system.
 - 2. Starters shall include the following logic and control functions:
 - a. Adjustable maximum starting current from 200 percent to 500 percent
 - b. Ramp time adjustment from 1 to 40 seconds
 - c. Adjustable linear voltage deceleration
 - d. Kick start
 - e. Phase loss protection
 - f. Adjustable Undervoltage/ overvoltage protection
 - g. Current unbalance protection
 - h. Instantaneous overcurrent detection
 - i. Phase rotation protection (prevents starting)
 - j. Shorted SCR detection
 - k. Selectable Class 10, 20, 30 electronic overload protections. Heat sink overtemperature protection shall be provided.
 - l. Dry contacts for remote indication of RUN and TRIP status
 - m. Battery “back up” of set starter parameters
 - n. Event recorder
 - o. Elapsed time meter
 - p. LCD status display
 - 3. The paralleling bypass contactor shall energize when the motor reaches full speed. The contactor shall be fully rated for across-the-line starting duty. The effect of the bypass contactor during normal operation is the elimination of heat buildup resulting from the voltage drop across the SCR's. It is the intent of the FWC to use the bypass contactor also as a means of starting the motor should problems be encountered with the soft starter. A door mounted

selector switch shall be furnished such that the starting means can be selected as being either via the soft starter or via the bypass contactor as across-the-line.

4. An isolation contactor shall be supplied. The isolation contactor shall remove three (3) phase power from the input side of the solid state controller when the bypass contactor is selected for across-the-line starting
5. The starter shall be housed in an appropriate NEMA rated enclosure as directed by Project drawings. Heaters and cooling fans shall be provided if required to maintain the equipment within the MANUFACTURER's environmental guidelines.
6. The enclosure shall be of two-door compartment type construction. The left hand compartment shall contain the starter power section and any equipment rated at line voltage. The right hand compartment shall include only that equipment rated at 120 VAC or less including the starter's CPU PC card and LCD display. The enclosure shall include a partition dividing the two compartments. Each compartment shall be designed to provide a barrier between the equipment at line voltage and the equipment at 120 VAC or less
7. The starter shall be provided with a control power transformer sized to accommodate all controls indicated on the Contract Drawings. An input power circuit breaker shall be provided. Lug termination of the incoming power conductors shall not be permitted. The starter and circuit breaker shall be rated for **10 KAIC RMS** minimum, at 480V.
8. The starter shall have door mounted indication of run, phase rotation, phase loss, undervoltage, current unbalance, and current trip.
9. Door mounted LCD / keyboard display assembly designed to:
 - a. Set or examine operating parameters
 - b. Provide starter status information
 - c. Provide real-time information about line current, voltage, and frequency
 - d. Provide a means to start and stop the starter

2.03 MAIN AND FEEDER CIRCUIT BREAKERS (480 VAC):

- A. Circuit breakers having a frame size of 150 amperes or less shall be molded-case type with thermal magnetic non-interchangeable, trip-free, sealed trip units.
- B. Circuit breakers with a frame size of 225 amperes to 1,200 amperes shall be molded case with interchangeable thermal, and adjustable magnetic trip or RMS sensing electronic trip elements.
- C. The interrupting capacity of all main, and feeder branch circuit breakers shall be a minimum of **10 kAIC RMS** symmetrical amperes. Service disconnects rated 1000A or more shall provide ground fault protection of equipment.
- D. Circuit breaker disconnect operators shall be capable of accommodating three (3) padlocks for locking in the "open" position.

2.04 CONTROL DEVICES:

- A. All control devices shall conform to the requirements set forth herein:
- B. Provide solid state type metering where indicated. Include CT's and PT's of ratios as indicated.
 1. Solid state "metering" shall include but not be limited to the following functions:
 - a. Metering: Device shall monitor Voltage (VLL/VLN), Current (Amps per phase), Real Power (W), Reactive Power (VAR) and Apparent Power (VA). Device shall have data gathering ability for analysis. The device(s) shall conform to the requirements of UL 508.

- b. Alarms: Device shall utilize assignable output relays to trigger alarms for specific applications. Alarm messages shall be displayed on the front panel of the device. Alarm outputs via dry contacts shall alarm Over/Under Current, Over/Under Voltage, Current Unbalance/Neutral Current, Phase Sequence, Over/Under Frequency, Power Factor and Switch Inputs.
 - c. Communications: Device shall be able to communicate with current and future process control systems using a standard protocol such as Devicenet, Ethernet, Modbus, Profibus, or as called for on Project drawings. Front and rear panel communications ports shall be available for information access. Display of monitored values shall be available both locally and remotely.
- C. Pushbuttons, selector switches, and pilot lights shall be the heavy-duty, oil-tight type, sized to 30 mm. Miniature style devices are not acceptable. All devices shall conform to the requirements of UL 508.
 - 1. Lens colors for “run”, “stop”, “on”, “off”, “open”, and “closed” shall be coordinated with the FWC’s requirements.
 - 2. Pilot lights shall be LED, push-to-test type.
 - 3. Provide hazardous location type pilot devices in classified locations per the NEC.
 - D. Relays shall be three (3) PDT with 10 amp contacts, plug-in type utilizing rectangular blades and provided with sockets for screw-type termination and hold-down clips.
 - E. Elapsed time meters shall be non-resettable type, read to a maximum of 99999.9 hours.
 - F. Time delay relays shall be combination on delay and off delay (selectable) with adjustable timing ranges. Provide socket with screw terminal connections and retaining strap.

PART 3 - EXECUTION

3.01 GENERAL:

- A. The CONTRACTOR shall install solid state reduced voltage starters in accordance with MANUFACTURER's published instructions. Conduit installation shall be coordinated with MANUFACTURER's as-fabricated drawings so that all conduit stub-ups are within the area allotted for conduit. Conduit shall be stubbed up in the section that contains the devices to which conductors are terminated.
- B. If stored at the Site, solid state reduced voltage starters shall be stored in a clean, dry space. Factory wrapping shall be maintained or an additional heavy plastic cover shall be provided to protect units from dirt, water, construction debris, and traffic. Storage space shall be heated or MCC space heaters shall be energized.
- C. Solid state reduced voltage starters shall be handled carefully to avoid damage to components, enclosure, and finish. Damage shall be repaired before installation.

3.02 INSTALLATION:

- A. The CONTRACTOR shall:
 - 1. Torque all bus bar bolts to MANUFACTURER's recommendations. Tighten all sheet metal and structure assembly bolts.
 - 2. Adjust all Motor Circuit Protector (MCP) devices to the instantaneous trip setting position recommended for the actual horsepower and full load amps of the motor. Verify that overload devices are proper for equipment installed; make necessary changes in overload devices as required for motors having power factor correcting capacitors.

3. After equipment is installed, touch up scratches and verify that nameplate and other identification is accurate.

3.03 SOLID STATE REDUCED VOLTAGE STARTER INSTALLATION:

A. The CONTRACTOR shall:

1. Verify that the overload devices are properly adjusted for the equipment installed.
2. Furnish a MANUFACTURER's representative to assist in installation, to inspect and adjust the equipment before initial service, and during startup. Testing, checkout, and startup of the starter shall be performed under the technical direction of the MANUFACTURER's representative. Under no circumstances, are any portions of the drive system to be energized without authorization from the MANUFACTURER's representative. In addition, the MANUFACTURER's representative shall instruct the FWC in the maintenance and operation on the starter assembly. On site instructions shall be for a minimum of two (2) hours.
3. After the equipment is installed, touch up scratches and verify that nameplate and other identification is accurate.

END OF SECTION

SECTION 16160 PANELBOARDS AND GENERAL PURPOSE DRY TYPE TRANSFORMER

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide panelboards and general purpose dry-type transformers, complete and operable, in accordance with the Contract Documents.
- B. Single Manufacturer: Like products shall be the end product of one MANUFACTURER in order to achieve standardization of appearance, operation, maintenance, spare parts, and MANUFACTURER's services.
- C. Related Work Specified Elsewhere:
 - 1. SECTION 16050 - Basic Materials and Methods

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:
 - 1. American Society for Testing Materials (ASTM)
 - a. D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
 - 2. Institute of Electrical and Electronics Engineers (IEEE)
 - a. ANSI/IEEE C57.12.10 - General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and/or Resin Encapsulated Windings
 - 3. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications
 - 4. National Fire Protection Association (NFPA)
 - a. 70 - National Electrical Code
 - 5. National Electrical Manufacturers Association (NEMA)
 - a. 250 - Enclosure for Electrical Equipment (1,000 Volts Maximum)
 - b. ST-20 - Dry Type Transformers for General Applications
 - c. TR 1 - Transformers, Regulators and Reactors
 - 6. Underwriters Laboratories (UL)
 - a. 50 - Standard for Safety for Enclosures for Electrical Equipment
 - b. 67 - Panelboards

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. General: Submittals shall be in accordance with CONTRACTOR Submittals and SECTION 16050.
- B. Shop Drawings

1. Transformers
 - a. Dimension drawings
 - b. Technical certification sheets
 - c. Drawing of conduit entry/exit locations
 - d. Transformer ratings, including:
 - i. Voltage
 - ii. Continuous current
 - iii. Basic impulse level for equipment over 600 volts
 - iv. KVA
 - e. Descriptive bulletins
 - f. Product sheets
2. Panelboards
 - a. Breaker layout drawings with dimensions and nameplate designations
 - b. Component list
 - c. Drawings of conduit entry/exit locations
 - d. Assembly ratings including:
 - i. Short circuit rating
 - ii. Voltage
 - iii. Continuous current
 - e. Cable terminal sizes
 - f. Descriptive bulletins
 - g. Product sheets
 - h. Installation information

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: N/A

1.07 TESTING: The general purpose Dry Type Transformers shall be factory tested per the latest applicable standards of ANSI and NEMA.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Transformers:

1. The transformers shall be dry-type, designed, manufactured in accordance with the latest applicable standards of the ANSI C57 series, NEMA TR 1 and IEEE C57.12.10.
2. Transformers shall be UL-listed and bear the UL label.

B. Panelboards:

1. Panelboards shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1-Panelboards, as well as the provisions of UL 50 - Safety Enclosures for Electrical Equipment and UL 67 - Panelboards. Panelboards used for service equipment shall be UL labeled for such use. Lighting panelboards shall be rated for 120/208-volt, 3-phase operation or 120/240-volt for single phase operation as indicated. Power panelboards shall be rated for 480 volts, 3-phase, 3-wire operation.
2. The MANUFACTURER of the panelboard shall be the MANUFACTURER of the major components within the assembly, including circuit breakers.

2.02 TRANSFORMERS:

A. Ratings:

1. KVA and voltage ratings shall be as indicated.
2. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96 - Guide for Loading Dry Type Distribution and Power Transformers
3. Transformer sound levels shall not exceed the following ANSI and NEMA ST-20 levels for self-cooled ratings:

Up to 9 KVA	40 db
10 to 50 KVA	45 db
51 to 150 KVA	50 db

B. Construction:

1. Insulation Systems:
 - a. Transformers shall be insulated as follows:
 - i. 2KVA and below: 150° C insulation system based upon 80 ° C rise
 - ii. 2KVA to 15 KVA: 185° C insulation system based upon 115 ° C rise
 - iii. 15 KVA and above: 220° C insulation system based upon 115° C rise
 - b. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40° C maximum ambient.
 - c. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM D 635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
2. Transformer windings shall be copper.
3. Transformers shall have four 2-1/2 percent taps, two above and two below 480 volts.

2.03 PANELBOARDS:

A. Ratings:

1. Panelboards rated 240 VAC or less shall have short circuit ratings not less than 10,000 amperes RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.

2. Panelboards rated 480 VAC shall have short circuit ratings not less than 25,000 amperes RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.
 3. Panelboards shall be labeled with a UL short circuit rating. Series ratings are not acceptable.
- B. Construction:
1. All lighting and power distribution panels shall have copper bus bars.
 2. Breakers shall be one (1), two (2), or three (3) pole as indicated, with ampere trip ratings as required by the equipment. Breakers shall be quick-make and quick-break, inverse time trip characteristics, to trip free on overload or short circuit, and to indicate trip condition by the handle position.
 3. The panels shall have hinged doors with combination catch and latch. The front panels shall be so arranged that when the plates are removed, the gutters, terminals and wiring will be exposed and accessible. The doors shall have inner doors within the plates to have only the breaker operating mechanism exposed when they are opened. Live conductors and terminals shall be concealed behind the plates.
 4. All panelboards shall be rated for the intended voltage.
 5. All circuit breakers shall be interchangeable and bolt on type capable of being operated in any position as well as being removable from the front of the panelboard without disturbing adjacent units. No plug-in circuit breakers will be acceptable.
 6. Lighting and power distribution panels which are not part of a motor control center shall be constructed in accordance with SECTION 16050. Panels shall have the necessary barriers, supports, and liberal wiring gutters. Trim screws shall be stainless steel. All panelboard parts of metal other than copper, aluminum, or stainless steel shall be cadmium plated.
 7. Panelboards shall be UL listed except for special enclosures which are not available with UL listing.
 8. Panelboards shall be suitable for use as service entrance as indicated or as otherwise required by the NEC.

PART 3 - EXECUTION

3.01 GENERAL: All WORK of this SECTION shall be installed as indicated in SECTION 16050.

3.02 EQUIPMENT:

- A. The CONTRACTOR shall install the specified panelboards and small dry type transformers at locations indicated on the drawings.
- B. The CONTRACTOR shall surface mount panelboards on wall, as indicated on Project drawings, at an elevation convenient for operation and as required in the latest NEC.
- C. Install circuit directory in panelboard. The directory shall be typed, clearly indicating the serving load on each circuit breaker line.

END OF SECTION

SECTION 16289 TRANSIENT VOLTAGE SURGE SUPPRESSORS

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall furnish and install Transient Voltage Surge Suppressors as indicated on the project drawings.

1.02 REFERENCES: The latest edition of the following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied under this contract.

- A. NEC (NFPA 70) National Electrical Code
- B. NETA International Electrical Testing Association - Acceptance Testing Specifications
- C. Local Building Codes and Standards
- D. UL 1449 - Transient Voltage Surge Suppressors
- E. UL 1283 - Electromagnetic Interference Filters

1.03 DEFINITIONS:

- A. High Lightning Exposure Areas: There are locations with high incidence of lightning strikes. Typically these are outdoor remote locations, rural tall buildings and communication towers (Typical High Lightning Exposure Area: most of South Florida).
- B. Medium Lightning Exposure Areas: These are locations with typical lightning exposure. Typical structures would be office building within cities.

1.04 SUBMITTALS:

- A. The CONTRACTOR shall furnish submittals in accordance with Contractor Submittals and SECTION 16050 Basic Materials and Methods.
- B. The CONTRACTOR shall provide the following for shop drawing submittals:
 - 1. Product information sheet
 - 2. Surge Current Ratings - Submit bill of materials listing the number of MOVs installed per phase. Also, include MOV part number, manufacturer, and surge current rating per MOV. Include information on control components as listed below:
 - a. Control and diagnostic contacts
 - b. Annunciation lights

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: N/A

1.07 TESTING:

Transient Voltage Surge Suppressors shall be tested in accordance with the requirements set forth in SECTION 16950 Field Testing.

1.08 INSPECTION COORDINATION:

The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The Contractor shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY:

A. The CONTRACTOR shall warranty the WORK against defects for one year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 SURGE SUPPRESSORS:

A. General:

1. For TVSS equipment mounted outside of either the service entrance equipment or distribution panels, refer to specification SECTION 16050 for appropriate NEMA enclosure rating.

B. Service Entrance Surge Suppressor:

1. TVSS shall comply with UL 1449 and be UL 1283 listed.
2. TVSS shall have a UL 1449 listed 200kA SCCR in compliance with NEC 285.6.
3. TVSS shall provide surge current diversion paths for all modes of protection; L-N, N-G in WYE systems, and L-L, L-G in DELTA systems.
4. TVSS for service entrance applications shall be modular in design. Each mode including N-G shall be fused with a 200kAIC UL recognized surge rated fuse and incorporate a thermal cutout device.
5. TVSS shall provide audible diagnostic monitoring by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided.
6. If a dedicated breaker for the TVSS is not provided in the switchboard, the service entrance TVSS shall include an integral UL recognized disconnect switch. A dedicated breaker shall serve as a means of disconnect for distribution TVSS.
7. TVSS shall meet or exceed the following criteria:
 - a. Minimum surge current capability (single pulse rated) per phase shall be:
 - i. 320kA per phase (High Lightning Exposure Areas)
 - ii. 240kA per phase (Medium Lightning Exposure Areas)
 - b. UL 1449 2nd Edition Listed Suppression Voltage Ratings for service entrance shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>MCOV</u>
208Y/120V	400	400	400	150V
480Y/277V	700	700	700	320V
8. TVSS shall have a minimum EMI/RFI filtering of -50dB at 100 kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.
9. TVSS shall be provided with one set of NO/NC dry contacts.

C. Distribution and Branch Panel Surge Suppressor

1. TVSS shall be UL 1449 and UL 1283 listed.

2. TVSS shall have a UL 1449 listed 200kA SCCR in compliance with NEC 285.6.
3. TVSS shall provide surge current diversion paths for all modes of protection; L-N, L-G, and N-G in WYE systems, and L-L, L-G in DELTA systems.
4. TVSS for service entrance applications shall be chase nipped in design. Each mode including N-G shall be fused with a 200kAIC UL recognized surge rated fuse and incorporate a thermal cutout device.
5. TVSS shall provide diagnostic lights.
6. A dedicated breaker shall serve as a means of disconnect for distribution TVSS.
7. TVSS shall meet or exceed the following criteria:
 - a. Minimum surge current capability (single pulse rated) per phase shall be:
 - i. 160kA per phase (High Exposure)
 - ii. 80kA per phase (Medium Exposure)
 - b. UL 1449 2nd Edition Listed Suppression Voltage Ratings for service entrance shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>MCOV</u>
208Y/120V	400	400	900	150V
480Y/277V	700	700	700	320V

PART 3 - EXECUTION

3.01 GENERAL

- A. TVSS shall be installed at service entrance switchboards and distribution equipment where shown on project drawings and as close as practical to the equipment to be protected.
- B. Where installation space permits and where no code restrictions apply, TVSS may be installed within protected equipment. Suppressors installed in this manner shall utilize the equipment ground bus or enclosure as a medium for bonding of their ground terminals. Bonding jumpers not exceeding two inches in length shall be installed between the ground bus or enclosure and suppressor ground terminals. Bolted connections with star washers shall be used to insure electrical and mechanical integrity of connections to the ground bus or enclosure. Remove paint where connections are made to the enclosure.
- C. Conductors from the TVSS shall attach to main service bus in the service entrance equipment on the load side of any electrical metering equipment.
- D. All system wiring shall be classified into protected and non-protected categories. Wiring on the exposed side of suppression devices shall be considered unprotected. Surge suppressor grounding and bonding conductors shall also fall into this category.
- E. All wiring between surge suppressors and protected equipment shall be considered protected and connected in accordance with the latest edition of the NEC.
- F. A minimum of three inches of separation shall be provided between parallel runs of protected and unprotected wiring in control panels, terminal cabinets, terminal boards and other locations. In no case shall protected and unprotected wiring be bundled together or routed through the same conduit. Where bundles of protected and unprotected wiring cross, such crossings shall be made at right angles.
- G. All units shall be installed and wired in accordance with the manufacturers written recommendations.

- H. Mount TVSS in a manner in order that all conductors, including neutral and ground, installed between suppressor and points of attachment shall be as short and straight as possible. Twist-tie the conductors every 4 inches.
- I. Disconnect TVSS equipment prior to megger testing of service entrance distribution equipment and distribution panelboards.

END OF SECTION

PART 1 - GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Basic requirements for complete instrumentation system for process control.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals Section.
 - 2. SECTION 16430 - Control System Equipment Panels and Racks.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. The International Society of Automation (ISA):
 - a. 7.0.01, Quality Standard for Instrument Air.
 - b. S5.1, Instrumentation Symbols and Identification.
 - c. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
 - d. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.
- B. Qualifications:
 - 1. System Integrator:
 - a. Experience:
 - 1) Have satisfactorily provided a control system for a minimum of five projects of similar magnitude and function.
 - 2. Panel Fabricator:
 - a. Experience:
 - 1) Have satisfactorily fabricated control panels for a minimum of five projects of similar magnitude and function.
 - b. Certification:
 - 1) UL508A Certification
- C. Miscellaneous:
 - 1. Comply with electrical classifications and NEMA enclosure types shown on Drawings.

1.03 DEFINITIONS

- A. Calibrate: To standardize a device so that it provides a specified response to known inputs.
- B. Highly Corrosive and Corrosive Areas: Rooms or areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.

- C. System Integrator: A CONTRACTOR/Subcontractor who combines instrumentation, control devices, hardware, software, and networking products from multiple vendors to provide a fully functioning control system.

1.04 SYSTEM DESCRIPTION

A. Control System Requirements:

1. This Specification Section provides the general requirements for the control system.
2. The control system consists of all primary elements, transmitters, switches, controllers, computers, communication devices, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the plant as specified in the Contract Documents.

B. Utilization of System Integrator:

1. Utilize a System Integrator to provide a fully functioning control system.
 - a. The System Integrator shall be responsible for the provision of an integrated control system fully functioning in accordance with the requirements of the Contract Documents.
2. Provide all required coordination of instrumentation with other work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.

1.05 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01300 for requirements for the mechanics and administration of the submittal process.
2. Submittals shall be original printed material or clear unblemished photocopies of original printed material.
 - a. Facsimile information is not acceptable.
3. Limit the scope of each submittal to one Specification Section.
 - a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.
 - b. Do not provide any submittals for Specification Section 13400.
4. Product technical data including:
 - a. Equipment catalog cut sheets.
 - b. Instrument data sheets:
 - 1) ISA S20 or approved equal.
 - 2) Separate data sheet for each instrument type.
 - c. Materials of construction.
 - d. Physical limits of components including temperature and pressure limits.
 - e. Size and weight.
 - f. Electrical power requirements and wiring diagrams.
 - g. NEMA rating of housings.
 - h. Submittals shall be marked with arrows to show exact features to be provided.
5. Comprehensive set of wiring diagrams as specified in Section 13430.
6. Panel fabrication drawings as specified in Section 13430.
7. Nameplate layout drawings.

- a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
 - 8. All panel and wiring drawings shall be provided in both hardcopy and softcopy.
 - a. Furnish electronic files on owner's designated electronic media.
 - 9. Testing reports: Source quality control reports.
- B. Qualifications Submittal:
 - 1. Documentation verifying CONTRACTOR/subcontractor adherence to specified certifications and qualifications
- C. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. MANUFACTURER standard Operation and Maintenance Manual.
 - 2. All Shop Drawings shall be modified with as-built information/corrections.
 - 3. Instrumentation and Control Equipment Operation and Maintenance Manual Content:
 - a. Provide the following detailed information:
 - 1) Use equipment tag numbers from the Contract Documents to identify equipment and system components.
 - 2) As-constructed fabrication or layout drawings and wiring diagrams.
 - b. Additional information as required in the associated equipment or system Specification Section.
 - 4. Warranties: Provide copies of warranties and list of factory authorized service agents.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

PART 2 - PRODUCTS

2.01 NEMA TYPE REQUIREMENTS

- A. Provide enclosures/housing for control system components in accordance with the area designations provided on the Drawings.
 - 1. Areas designated as wet: NEMA Type 4.
 - 2. Areas designated as wet and/or corrosive: NEMA Type 4X.
 - 3. Either architecturally or non-architecturally finished areas designated as dry, noncorrosive, and nonhazardous: NEMA Type 12.
 - 4. Areas designated to be subject to temporary submersion: NEMA 6P.

2.02 ACCESSORIES

- A. Provide identification devices for instrumentation system components.
- B. Provide corrosion resistant spacers to maintain 1/4 IN separation between equipment and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Clarifiers, Digesters, Reservoirs, etc.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes.
- B. Install electrical components per the requirements of the Electrical design.

C. Panel-Mounted Instruments:

1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.

3.02 FIELD QUALITY CONTROL

- A. Maintain accurate daily log of all startup activities, calibration functions, and final setpoint adjustments.

END OF SECTION

SECTION 16410 TELEMETRY SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes:
 - 1. Items required include but are not necessarily limited to the following:
 - a. Cellular-Based RTUs.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals Section.
 - 2. SECTION 16430 - Control System Equipment Panels and Racks

1.02 QUALITY ASSURANCE:

- A. Referenced Standards:
 - 1. Federal Communications Commission (FCC):
 - a. 47 CFR 15 - Radio Frequency Devices, Section 15.247 - Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.
 - 2. International Electrotechnical Commission (IEC):
 - a. 61131-3 - Programmable Controllers, Part 3: Programming Languages.
 - 3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 802.3, Information Processing Systems - Local Area Networks - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 508A, Standard for Safety Industrial Control Panels.
- B. Qualifications.
 - 1. Radio Study/Survey Staff or Subcontractor:
 - a. Experience:
 - i. Has satisfactorily provided a radio study/survey report for a minimum of five projects of similar magnitude and function.

1.03 DEFINITIONS:

- A. ARQ (Automatic Resend Query): Method of error correction where the receiver initiates an order to retransmit data blocks that are determined to be corrupted in transmission.
- B. BER (Bit Error Rate):
 - 1. Ratio of the number of bits received in error to the total number of bits transmitted.
 - 2. Used as a measure of quality for data links.
- C. CRC (Cyclic Redundancy Check):
 - 1. A method utilized for detecting errors in data transmission or storage.
 - 2. A number is calculated on the originating end based on the message contents, and then appended to the message before transmission.

3. The CRC is re-calculated on the receiving end, and compared to the previously calculated value.
 4. A match of the two calculated values indicates a high probability that the message was received correctly.
- D. Omnidirectional Antenna: An antenna that radiates maximum power uniformly 360 DEG in the horizontal plane.
- E. RTU (Remote Terminal Unit):
1. A remotely located device that collects data, codes the data into a format that is transmittable and transmits the data back to a central Supervisory Control and Data Acquisition (SCADA) system.
 2. The RTU also receives communication from the SCADA system and implements processes as directed.
- F. Spread Spectrum:
1. Communications technique whereby a radio frequency signal is spread (modulated) in order to generate an expanded bandwidth signal.
 - a. Frequency Hopping Spread Spectrum: Communications technique where the frequency of the radio signal repeatedly “hops” from one Frequency to another in accordance with a random but predictable sequence.
 - b. Direct Sequence Spread Spectrum: Communications technique whereby the stream of information (data signal) is combined with a higher data-rate bit sequence, or chipping code, that divides the user data according to a spreading ratio.
- G. Yagi Antenna:
1. A uni-directional radio antenna, consisting of a driven element, a reflector, and one or more directors.
 2. The antenna is primarily used for frequencies above 10 MHz and are used only in point-to-point applications.

1.04 SUBMITTALS:

- A. Shop Drawings:
1. See Specification SECTION 16400.
 2. Product technical data:
 - a. Annotated hard copies of RTU software programs.
 - i. Annotate program listing to include the following (as applicable):
 - a) Descriptive titles for all subroutine functions.
 - b) Reference to control loop numbers.
 - c) Reference to instrumentation and equipment tag numbers.
 - ii. Define all function blocks used in program.
 - iii. Provide listing of all addresses referenced in logic diagram with description of data associated with each address.
 - b. Arrangement drawings for RTU system components in accordance with Specification SECTION 16430.
 - c. Panel and enclosure plans, sections and details in accordance with Specification SECTION 16430.

- d. Enclosure internal wiring and terminal blocks in accordance with Specification SECTION 16430.
 - e. MANUFACTURER's installation instructions.
3. Submit all panel fabrication drawings and associated wiring diagrams for RTUs under Specification SECTION 16430 submittals.
- B. Contract Closeout Information:
- 1. Operation and Maintenance Data:
 - a. See SECTION 01730 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
- C. Other Submittals:
- 1. Clear listing of all passwords required to edit, modify, or view programming and configuration.
 - 2. Radio site survey results including the following minimum information:
 - a. Data rate for each radio.
 - b. Received radio signal strength at installed antenna height for each radio.
 - 3. List of all recommended spares for maintenance purposes with each item separately priced.
 - a. List shall include all special tools and test equipment necessary for the maintenance of the complete system.
 - 4. Results of factory testing procedures.
- D. Field Quality Control.
- 1. Items listed under Part 3, 3.2 of this specification section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Subject to compliance with the Contract Documents, the MANUFACTURERS listed in the applicable Articles below are acceptable.

2.02 CELLULAR-BASED RTU'S:

A. MANUFACTURERS:

- 1. Sanders Company Sci-Text-Plus

B. Design and Fabrication:

- 1. Transmission of data:
 - a. Type: Cellular service provider.
 - b. 4G communication.
- 2. RTU asset monitoring service:
 - a. Update times:
 - i. Discrete input changes-of-state to be reported to the monitoring service upon detection.
 - b. Data logging capabilities to include time of day and number of occurrences of discrete input changes such as such as pump starts and stops and operator site visits.
 - c. Monitoring service shall provide a paging and phone call feature to notify selected personnel of alarm situations.

- i. The service shall allow for a rotational schedule of phone/pager numbers to be called and shall be configurable from the web site or RTU.
 - d. Secure, password protected web access to the FWC's site information.
- 3. Antenna and flexible coaxial cable shall be provided with the RTU.

2.03 ACCESSORIES:

- A. Provide all accessories required to furnish a complete telemetry system to accomplish the requirements of the Drawings and Specifications.

2.04 SOURCE QUALITY CONTROL:

- A. Provide a performance test after factory completion and prior to shipment.
 - 1. Conduct a test where the RTU is operated continuously and checked for correct operation.
 - 2. Conduct testing with dummy I/O's to verify each control loop operation.
 - 3. Allow for FWC and representatives to witness testing program.
 - a. Provide minimum of 15 days' notice prior to testing.
 - 4. Do not ship prior to successful completion of this testing program.

2.05 MAINTENANCE MATERIALS:

- A. Furnish FWC with the following extra materials:
 - 1. One spare power supply of each type for every 10 power supplies or fraction thereof installed.
 - 2. One spare surge arrestor.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install telemetry system as shown on Drawings in accordance with MANUFACTURER's written instruction.
- B. Provide documentation verifying the data communication rate (actual throughput), signal strength and signal quality for each radio.

3.02 FIELD QUALITY CONTROL:

- A. Conduct startup of equipment and perform operational checks.
- B. Maintain and submit an accurate daily or weekly log of all commissioning and startup functions.
 - 1. All commissioning/startup functions may be witnessed by the Engineer.
 - 2. All reports shall be signed and dated by the CONTRACTOR.
- C. Provide FWC with a written statement that equipment has been installed properly, started up, and is ready for operation by FWC's personnel.

3.03 DEMONSTRATION:

- A. Demonstrate system in accordance with Specification SECTION 01660.

3.04 TRAINING:

- A. On-site Training:
 - 1. Provide certified MANUFACTURER's representative to provide 4 HRS of operation and maintenance training at the Project site after the system has successfully undergone all field testing and acceptance procedures.
 - a. As a minimum, training shall cover:
 - i. Hardware overview.
 - ii. Software overview.
 - iii. Maintenance.

- iv. Troubleshooting.
 - a) How to recover from an RTU failure (i.e. reloading an RTU's programming from scratch).
- v. Operation, e.g., changing set points, passwords, etc.

END OF SECTION

SECTION 16420 LEVEL INSTRUMENTATION

PART 1 - GENERAL

1.01 SUMMARY:

- A. Section Includes:
 - 1. Level Switches:
 - a. Float-Tilt Type Level Switch.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals SECTION 13410 - Telemetry Systems.
 - 2. SECTION 16400 - Process Controls Systems General Requirements.
 - 3. SECTION 16430 – Control System Equipment Panels and Racks.

1.02 QUALITY ASSURANCE:

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI).

1.03 SUBMITTALS:

- A. Shop Drawings:
 - 1. See Specification SECTION 01300 for requirements for the mechanics and administration of the submittal process.
 - 2. See Specification SECTION 16400.
- B. Operation and Maintenance Manuals:
 - 1. See Specification SECTION 01730 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

1.04 SYSTEM DESCRIPTION:

- A. These instruments are integrated with other control system components specified under Specification SECTION 16400 series to produce the functional control defined in the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Subject to compliance with the Contract Documents, the MANUFACTURERS listed in the Articles describing the elements are acceptable.

2.02 LEVEL SWITCHES:

- A. Float-Tilt Type Level Switch:
 - 1. Acceptable MANUFACTURERS:
 - a. Anchor Scientific Inc.
 - b. Consolidated Electric.
 - c. Contegra.
 - 2. Materials:
 - a. Float material: Polypropylene or Teflon coated type 316 stainless steel.
 - b. Cable jacket: PVC, neoprene.
 - c. Cable clamp: Polypropylene or 316 stainless steel.
 - 3. Design and fabrication:
 - a. Mercury-free switch.

- b. Provide switch complete with flexible electrical cables.
- c. SPDT contact rated at 1 amp at 120 VAC.
- 4 Direct acting float switch:
 - a. Switch actuates on rising level.
 - b. Switch deactuates when liquid falls 1 IN below actuation level.
 - c. Terminate cables in junction box.
 - d. Process temperature: max. 120 DEGF.
 - e. Install floats per drawing details.

2.03 ACCESSORIES:

- A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.
 - 1 Materials, unless otherwise specified, shall be as follows:
 - a. Bolts, nuts, washers, expansion anchors: 316 stainless steel.
 - b. Mounting brackets:
 - i. Standard: 316 stainless steel.
 - c. Mounting plates, angles:
 - ii. Corrosive areas: 316 stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install products in accordance with MANUFACTURER's instructions.
- B. Instrument Mounting:
 - 1 Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
 - 2 Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
 - 3 Mount instruments level, plumb, and support rigidly.
 - 4 Mount to provide:
 - a. Protect from heat, shock, and vibrations.
 - b. Provide accessibility for maintenance.
 - c. Free from interference with piping, conduit and equipment.

END OF SECTION

PART 1 - GENERAL1.01 SUMMARY:

- A. Section Includes:
 - 1. Requirements for control panels and enclosures utilized as follows:
 - a. Unless noted otherwise, all control panels and enclosures housing control components are specified in SECTION 16410 and SECTION 16420.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 - Submittals
 - 2. SECTION 16400 - Process Controls Systems General Requirements.
 - 3. SECTION 16410 - Telemetry Systems.
 - 4. SECTION 16420 - Level Instrumentation

1.02 QUALITY ASSURANCE:

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI).
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. ICS 4, Industrial Control and Systems: Terminal Blocks.
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC):
 - i. Article 409, Industrial Control Panels.
 - 4. Underwriters Laboratories, Inc. (UL):
 - a. 508A, Standard for Safety Industrial Control Panels.
- B. Miscellaneous:
 - 1. Approved supplier of Industrial Control Panels under provisions of UL 508A.
 - a. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.
 - b. Control panel(s) without an affixed UL 508A label shall be rejected and sent back to the MANUFACTURER's factory.

1.03 DEFINITIONS:

- A. Panel: Control panels or enclosures listed in the schedule included in this Specification Section.
- B. Foreign Voltages: Voltages that may be present in circuits when the panel main power is disconnected.
- C. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- D. Ground Fault Circuit Interrupter (GFCI): A type of device (e.g., circuit breaker or receptacle) which detects an abnormal current flow to ground and opens the circuit preventing a hazardous situation.
- E. Remote Terminal Unit (RTU): An industrial data collection device designed for location at a remote site, that communicates data to a host system by using telemetry such as radio, dial-up telephone, or leased lines.

F. Input/Output (I/O): Hardware for the moving of control signals into and/or out of a PLC or RTU.

1.04 SUBMITTALS:

A. Shop Drawings:

1. See SECTION 01300 for requirements for the mechanics and administration of the submittal process.
2. See SECTION 16400.
3. Prepared with computer aided design (CAD) software.
4. Printed on 11 by 17 IN sheets.
5. Drawings shall include a title block containing the following:
 - a. Plant or facility name where panel(s) are to be installed.
 - b. Drawing title.
 - c. Drawing number.
 - d. Revision list with revision number and date
 - e. Drawing date.
 - f. Drawing scale.
 - g. MANUFACTURER name, address, and telephone number.
6. Cover sheet for each drawing set shall indicate the following:
 - a. Plant or facility name.
 - b. Project name.
 - c. Submittal description.
 - d. Revision number.
 - e. Issue date.
7. Table of contents sheet(s) shall indicate the following for each drawing in the set:
 - a. Drawing number.
 - b. Drawing title.
 - c. Sheet number.
8. Legend and abbreviation sheet shall indicate the following:
 - a. Description of symbols and abbreviations used.
 - b. Panel construction notes including enclosure NEMA rating, finish type and color, wire type, wire color strategy, conductor sizes, and wire labeling strategy.
 - c. Confirmation that the panel(s) are to be affixed with a UL 508A label prior to shipment from the factory.
9. Bill of Material for each panel shall include the following component information:
 - a. Instrument tag number.
 - b. Quantity.
 - c. Functional name or description.
 - d. MANUFACTURER.
 - e. Complete model number.
 - f. Size or rating.
10. Panel exterior layout drawings to scale and shall indicate the following:
 - a. Panel materials of construction, dimensions, and total assembled weight.
 - b. Panel access openings.
 - c. Conduit access locations.
 - d. Front panel device layout.
 - e. Nameplate schedule:

- i. Nameplate location.
 - ii. Legend which indicates text, letter height and color, and background color.
 - iii. Short Circuit Current Rating (SCCR) marking per NFPA 70 or statement of exception. Include any required calculations.
- 11. Panel interior layout drawings shall be drawn to scale and shall indicate the following:
 - a. Sub-panel or mounting pan dimensions.
 - b. Interior device layouts.
 - c. PLC/RTU general arrangement layouts.
 - d. Wire-way locations, purpose, and dimensions.
 - e. Terminal strip designations.
 - f. Location of external wiring and/or piping connections.
 - g. Location of lighting fixtures, switches and receptacles.
- 12. Wiring diagrams shall consist of the following:
 - a. Panel power distribution diagrams.
 - b. Control and instrumentation wiring diagrams.
 - c. I/O information:
 - i. Signal function and type.
 - d. Wiring diagrams shall identify each wire as it is to be labeled.
- B. MANUFACTURER catalog cut sheets for enclosure, finish, panel devices, control auxiliaries, and accessories.
- C. Electrical load calculations for each panel:
 - 1. Total connected load.
 - 2. Peak electrical demand for each panel.
- D. Climate control calculations for each panel.
 - 1. Verify that sufficient dissipation and/or generation of heat is provided to maintain interior panel temperatures within the rated operating temperatures of panel components.
- E. Contract Closeout Information:
 - 1. Operation and Maintenance Data:
 - a. See SECTION 01730 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
 - 2. See SECTION 16400.
- F. Other Submittals:
 - 1. Record Drawings:
 - a. Updated panel drawings delivered with the panel(s) from the MANUFACTURER's factory.
 - b. Drawings shall be enclosed in transparent plastic and firmly secured within each panel.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Subject to compliance with the Contract Documents, the following MANUFACTURERS are acceptable:
 - 1. Enclosures:
 - a. Hoffman Engineering Co.
 - b. Rittal.
 - c. Hammond Manufacturing.
 - d. Millbank Mfg. Co.
 - 2. Panel heaters:

- a. Hoffman Enclosures, Inc.
- b. Rittal.
- c. Hammond Manufacturing.
- 3. Heat exchangers and air conditioners:
 - a. Hoffman Enclosures, Inc.
 - b. Rittal.
 - c. Hammond Manufacturing.
- 4. Cooling fans and exhaust packages:
 - a. Hoffman Enclosures, Inc.
 - b. Rittal.
- 5. Internal corrosion inhibitors:
 - a. Hoffman Enclosures, Inc.; Model A-HCI.
 - b. Northern Technologies International Corporation (NTIC); Model Zerust VC.
 - c. Cortec Corporation; Model VpCI Emitting Systems.

2.02 FABRICATION:

B. General:

- 1. Fabricate panels with instrument arrangements and dimensions identified in the Contract Documents.
- 2. Provide panel(s) with the required enclosure rating per NEMA 250 to meet classifications identified in the Contract Documents.
- 3. Devices installed in panel openings shall have a NEMA enclosure rating at least equal to the panel enclosure rating.
- 4. Panel(s) shall be completely assembled at the MANUFACTURER's factory.
 - a. No fabrication other than correction of minor defects or minor transit damage shall be performed on panels at the jobsite.
- 5. Painting:
 - a. Panels fabricated from steel shall have their internal and external surfaces prepared, cleaned, primed, and painted.
 - i. Mechanically abrade all surfaces to remove rust, scale, and surface imperfections.
 - ii. Provide final surface treatment with 120 grit abrasives or finer, followed by spot putty to fill all voids.
 - iii. Utilize solvent or chemical methods to clean panel surfaces.
 - iv. Apply surface conversion of zinc phosphate prior to painting to improve paint adhesion and to increase corrosion resistance.
 - v. Electrostatically apply polyester urethane powder coating to all inside and outside surfaces.
 - vi. Bake powder coating at high temperatures to bond coating to enclosure surface.
 - a) Panel interior shall be white with semi-gloss finish.
 - b) Panel exterior shall be ANSI #61 gray with flat finish.
 - vii. Application of alkyd liquid enamel coating shall be allowed in lieu of polyester urethane powder for wall mounted NEMA 1 or NEMA 12 rated panels.
 - b. Panels fabricated from stainless steel, aluminum, or fiberglass shall not be painted.
- 6. Finish opening edges of panel cutouts to smooth and true surface conditions.
 - a. Panels fabricated from steel shall have the opening edges finished with the panel exterior paint.
- 7. Panels shall meet all requirements of UL 508A.

- a. If more than one disconnect switch is required to disconnect all power within a panel or enclosure, provide a cautionary marking with the word "CAUTION" and the following or equivalent, "Risk of Electric Shock-More than one disconnect switch required to de-energize the equipment before servicing."
 - 8. Provide control panel in accordance with NFPA 70, Article 409.
 - a. In the event of any conflict between NFPA 70, Article 409 and UL 508A, the more stringent requirement shall apply.
 - 9. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
 - a. Determine the SCCR rating by one of the following methods:
 - i. Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
 - ii. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
 - iii. Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
 - b. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the control panel circuit originates.
- C. Free-Standing Panels:
 - 1. Welded construction.
 - 2. Completely enclosed, self-supporting, and gasketed, dust-tight.
 - 3. Rolled lip around all sides of enclosure door opening.
 - 4. Seams and corners welded and ground smooth to touch and smooth in visual appearance.
 - 5. Full height, fully gasketed flush pan doors.
 - 6. Full length piano hinges rated for 1.5 times door plus instrument weight.
 - 7. Doors with keyed alike locking handles and three-point catch.
 - 8. Appropriate conduit, wiring, and instrument openings shall be provided.
 - 9. Lifting eyebolts to allow simple, safe rigging and lifting of panel during installation.
- D. Wall and Rack Mounted Panels:
 - 1. Seams continuously welded and ground smooth.
 - 2. Rolled lip around all sides of enclosure door opening.
 - 3. Gasketed dust tight.
 - 4. Three-point latching mechanism operated by oil tight key-locking handle.
 - 5. Key doors alike.
 - 6. Continuous heavy GA hinge pin on doors.
 - a. Hinges rated for 1.5 times door plus instrument weight.
 - 7. Front full opening door.
 - 8. Brackets for wall mounting.
- E. Internal Panel Wiring:
 - 1. Panel wire duct shall be installed between each row of components, and adjacent to each terminal strip.
 - a. Route wiring within the panel in wire-duct neatly tied and bundled with tie wraps.
 - b. Follow wire-duct MANUFACTURER's recommended fill limits.
 - c. Wire-duct shall have removable snap-on covers and perforated walls for easy wire entrance.

- d. Wire-duct shall be constructed of nonmetallic materials with rating in excess of the maximum voltage carried therein.
2. Wiring shall be installed such that if wires are removed from one device, source of power will not be disrupted to other devices.
3. Splicing and tapping of wires permitted only at terminal blocks.
4. Wire bunches to doors shall be secured at each end so that bending or twisting will be around longitudinal axis of wire.
 - a. Protect bend area with sleeve.
5. Arrange wiring neatly, cut to proper length, with surplus wire removed.
 - a. Arrange wiring with sufficient clearance.
 - b. Provide abrasion protection for wire bundles that pass through openings or across edges of sheet metal.
6. AC circuits shall be routed separate from analog signal cables and digital signal cables.
 - a. Separate by at least 6 IN, except at unavoidable crossover points and at device terminations.
7. Wiring to pilot devices or rotary switches shall be individually bundled and installed with a "flexible loop" of sufficient length to permit the component to be removed from panel for maintenance without removing terminations.
8. Conductors for AC and DC circuits shall be type MTW stranded copper listed for operation with 600 V at 90 DEGC.
 - a. Conductor size shall be as required for load and 16 AWG minimum.
 - b. Internal panel wiring color code:
 - i. AC circuits:
 - a) Power wiring: Black.
 - b) Control interconnections: Yellow.
 - c) Neutral: White.
 - d) Ground: Green.
 - ii. Low voltage DC circuits:
 - a) Power wiring: Blue.
 - b) Control interconnections: Violet.
 - iii. Foreign voltage circuits: Pink.
 - iv. Annunciator circuits: Red.
 - v. Intrinsically safe circuits: Light Blue.
9. Equipment grounding conductors shall be separated from incoming power conductors at the point of entry.
10. Minimize grounding conductor length within the enclosure by locating the ground reference point as close as practical to the incoming power point of entry.
11. Bond electrical racks, chassis and machine elements to a central ground bus.
 - a. Nonconductive materials, such as paint, shall be removed from the area where the equipment contacts the enclosure.
12. Bond the enclosure to the ground bus.
13. It is imperative that good electrical connections are made at the point between the ground bus and enclosure.
14. Panel-mounted devices shall be bonded to the panel enclosure or the panel grounding system by means of locknuts or pressure mounting methods.
15. Sub-panels and doors shall be bonded to ground.

F. Termination Requirements:

1. Wiring to circuits external to the panel connected to interposing terminal blocks.
2. Terminal blocks rigidly mounted on DIN rail mounting channels.
3. Terminal strips located to provide adequate space for entrance and termination of the field conductors.
4. One side of each strip of terminal blocks reserved exclusively for the termination of field conductors.
5. Terminal block markings:
 - a. Marking shall be the same as associated wire marking.
 - b. Legible, machine-printed markings.
 - c. Markings as identified in the shop drawings.
6. Terminal block mechanical characteristics, and electrical characteristics shall be in accordance with NEMA ICS 4.
7. Terminal blocks with continuous marking strips.
 - a. Each terminal block shall be identified with machine printed labels.
8. Terminals shall facilitate wire sizes as follows:
 - a. 120 VAC applications: Conductor size 12 AWG minimum.
 - b. Other: Conductor size 14 AWG minimum.
9. Install minimum of 20 PCT spare terminals.
10. Bladed, knife switch, isolating type terminal blocks where control voltages enter or leave the panel.
11. Fused terminal blocks shall be used in the following circuits:
 - a. Control voltage is used to energize a solenoid valve.
 - b. DC power is connected to 2-wire, loop-powered instruments.
12. Fused terminal blocks shall be provided with blown fuse indicators.
13. When control circuits require more than one field conductor connected to a single wiring point, a sufficient number of terminal points shall be connected internally to allow termination of only one field conductor per terminal block.
14. DIN rail mounting channels shall be installed along full length of the terminal strip areas to facilitate future expansion.
15. Connections to devices with screw type terminals shall be made using spade-tongue, insulated, compression terminators.

G. Component Mounting and Placement:

1. Components shall be installed per MANUFACTURER instructions.
2. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
3. Control relays and other control auxiliaries shall be mounted on DIN rail mounting channels where practical.
4. Front panel devices shall be mounted within a range of 40 to 70 IN above the finished floor, unless otherwise shown in the Contract Documents.

5. Locate power supplies with sufficient spacing for circulation of air.
 6. Where components such as magnetic starters, contactors, relays, and other electromagnetic devices are installed within the same enclosure as the PLC/RTU system components, provide a barrier of at least 6 IN of separation between the “power area containing the electromagnetic devices” and the “control area”.
 7. Components mounted in the panel interior shall be fastened to an interior sub-panel using machine screws.
 - a. Fastening devices shall not project through the outer surface of the panel enclosure.
 8. Excess mounting space of at least 20 PCT for component types listed below to facilitate future expansion:
 - a. Fuse holders.
 - b. Circuit breakers.
 - c. Control relays.
 - d. Time delay relays.
 9. Components installed on sub-panels shall be provided with a minimum spacing between component and wire duct of 1 IN.
 - a. Minimum of 2 IN separation between terminal strips and wire ducts.
 10. In addition to the requirements above, mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
- H. Power Distribution:
1. Main incoming power circuits shall be protected with a thermal magnetic circuit breaker.
 - a. Limit load to maximum of 80 PCT of circuit breaker rating.
 2. Equip each panel with necessary power supplies with ratings required for installed equipment and with minimum 25 PCT spare capacity.
- I. Internal Panel Lighting and Service Receptacles:
1. Panels less than or equal to 4 FT wide:
 - a. One electrical GFCI duplex receptacle.
 - b. One compact fluorescent light fixture with manual switch(es).
 2. Panels or panel faces greater than 4 FT wide:
 - a. One duplex electrical GFCI receptacle per 6 FT of length.
 - b. Continuous fluorescent lighting strip with manual switches.
- J. Environmental Controls:
1. Outdoor panels:
 - a. Outdoor temperature range of 0 DEGF through 120 DEGF.
 - b. Thermostat controlled heaters to maintain temperature approximately 10 DEGF above ambient dew point for condensation prevention inside the panels.
 - c. Outdoor temperature range of 0 DEGF through 120 DEGF.
 - d. Thermostat controlled closed-loop heat exchangers or closed-loop air conditioners if required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the panel.

- e. Internal corrosion inhibitors.
- 2. Environmental control components:
 - a. Panel heaters:
 - i. Thermostat controlled.
 - ii. Fan driven.
 - iii. Components mounted in an anodized aluminum housing.
 - iv. Designed for sub-panel mounting.
 - v. Powered from 120 VAC and protected with a dedicated circuit breaker.
 - b. Cooling fans and exhaust packages:
 - i. Cooling fan with louver or grill and replaceable filter.
 - ii. Designed to be mounted within a panel cutout to provide positive airflow through the panel.
 - iii. Cooling fan and exhaust louvers shall be designed and listed to maintain a NEMA 12 enclosure rating.
 - iv. Fitted with replaceable, high-density foam or synthetic fiber.
 - v. Cooling fan controlled with a separately mounted thermostat with bi-metal sensor and adjustable dial for temperature setting.
 - vi. Powered from 120 VAC and protected with a dedicated circuit breaker.
 - c. Heat exchangers and air conditioners:
 - i. Dual-loop design to isolate panel interior air from exterior air.
 - ii. Thermostat controlled.
 - iii. Operate from 120 VAC and protected with a dedicated circuit breaker.
 - d. Internal corrosion inhibitors:
 - i. Contains chemical which vaporizes and condenses on surfaces in the enclosure.
 - ii. Inhibitor shall be applied in accordance with MANUFACTURER instructions for the enclosure volume.
 - iii. Inhibitor shall be applied in the panel(s) prior to shipment from the MANUFACTURER's factory.

2.03 MAINTENANCE MATERIALS:

- A. Extra Materials:
 - 1. Quantity of 25 PCT replacement lamps for each type installed (minimum of 12 of each type).
 - 2. Minimum 12 replacement filters for each type installed.
 - 3. 1 QT of exterior finish touch-up paint.
 - 4. One complete set of replacement corrosion inhibitors in sealed packages for each panel.

PART 3 - EXECUTION

3.01 FACTORY TESTING:

- A. Scope: Inspect and test entire panel assembly to verify readiness for shipment.
- B. Location: MANUFACTURER's factory.
- C. Factory Tests:
 - 1. Tests shall be fully documented and signed by the MANUFACTURER's factory supervisor.
 - 2. The panel shop shall fully test the control panel for correct wiring.
 - a. Each I/O point shall be checked by measuring or connecting circuits at the field terminal blocks.
 - 3. Burn-in test: Panel(s) shall be fully energized for a minimum period of 48 HRS.

4. A PLC Central Processing Unit (CPU) shall be obtained and connected to the panel(s) if necessary for testing purposes.
5. Testing equipment (such as digital multi-meters, analog loop calibrators, and laptop computers with PLC programming software) shall be used as required for testing.
6. The following functions shall be tested as a minimum:
 - a. Demonstrate functions of the panel(s) required by the Contract Documents.
 - b. Correctness of wiring from all panel field terminals to all I/O points and to all panel components.
 - c. Simulate and test each discrete signal at the field terminal strips.
 - d. Correct operation of all digital communication devices.
 - e. Demonstrate online and offline diagnostic tests and procedures.
 - f. Notify the Engineer in writing a minimum of 15 calendar days prior to the Factory Tests.
 - i. Engineer has the option to witness all required tests.
7. Make following documentation available to the Engineer at test site during the tests:
 - a. Contract Documents.
 - b. Factory Demonstration Testing procedures.
 - c. List of equipment to be testing including make, model, and serial number.
 - d. Shop Drawing submittal data for equipment being tested.
8. Deficiencies shall be corrected prior to shipment from the MANUFACTURER's factory.

3.02 INSTALLATION:

- A. Install free-standing panels on 4 IN high concrete housekeeping pads.
- B. Anchor panels in a manner to prevent the enclosure from racking, which may cause the access doors to become misaligned.
- C. Obtain approved panel layouts prior to installation of conduits.
- D. Install products in accordance with MANUFACTURER's instructions.

END OF SECTION

SECTION 16440 DISCONNECT SAFETY SWITCH

PART 1 - GENERAL

1.01 SCOPE:

A. Summary of Work:

1. The WORK of this SECTION shall consist of furnishing all labor, materials, and equipment necessary for installation of safety switches, service entrance fusible and non fusible switches, and stand alone service entrance main circuit breakers as shown on the Drawings and as specified herein.
2. Safety switches without the neutral assembly shall not be allowed as service entrance equipment but can be utilized as local load disconnects.

B. Related Work Specified Elsewhere:

1. SECTION 01300 - Submittals
2. SECTION 16050 - Basic Materials and Methods
3. SECTION 16110 - Raceways, Boxes, Fittings and Supports
4. SECTION 16120 - Wires and Cables
5. SECTION 16950 - Field Testing

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:

1. Local Building Codes and Standards
2. National Fire Protection Association (NFPA)
 - a. 70 - National Electrical Code (NEC)
3. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications
4. National Electrical Manufacturers Association (NEMA)
 - a. 250 - Enclosure for Electrical Equipment (1,000 Volts Maximum)
5. Underwriters Laboratories (UL)
 - a. 98 - Standard for Safety for Enclosed and Dead-Front Switches
 - b. 489 - Molded-Case Circuit Breakers, Molded - Case Switches, and Circuit-Breaker Enclosures

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. Submit as specified in SECTION 01300.
- B. Furnish Shop Drawings in accordance with CONTRACTOR Submittals and SECTION 16050.

- C. Include catalog cuts of all switches and circuit breakers.
- D. Include fuse and circuit breaker protection coordination curves.

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: If required by Contract Documents, the CONTRACTOR shall perform a system protection coordination study to properly set the protection devices.

1.07 TESTING: Test devices as called for in SECTION 16950.

1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours notice of its intention to begin new WORK activities.

1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 DISCONNECTING MEANS:

A. Service Entrance Rated Disconnect Switches:

1. Service entrance rated disconnect switches shall be heavy duty quick-make, quick-break type, rated for 250 or 600 VAC as required for the application.
2. Number of poles and ampacity shall be as noted or required by code.
3. Switches shall include a neutral and ground assembly to comply with the NEC as service entrance equipment and meet the requirements of UL 98.
4. Where noted, provide with fuse clips suitable for power fuses unless current-limiting fuses are noted.
5. Short circuit rating shall be sufficient to withstand the available fault current or let-through current before the fuse melts without damage or change in rating.
6. The enclosures shall meet the area classification set forth in SECTION 16050.
7. Provide auxiliary control contact as required in the Drawings.

B. Separately Enclosed Motor Snap Switches/Safety Switches:

1. Motor snap switches and/or heavy duty safety switches may be used for motor disconnect means, controller, and motor overcurrent protection when applicable.
2. These devices shall be horsepower rated and may contain motor running overcurrent protection.
3. The enclosures shall meet the classification set forth in SECTION 16050.

C. Services Entrance Rated Main Circuit Breakers

1. Service entrance rated circuit breakers shall be provided in a free standing enclosure suitable for the designated installed area as called for in SECTION 16050.
2. Stand-alone main circuit breaker service shall be used for services including and above 800 AMPS. All main service entrance circuit breakers shall incorporate a neutral and a ground bus to meet the NEC.
3. Circuit breakers shall also meet the requirements set forth in UL 489.

4. Main circuit breakers used for service entrance equipment shall have a minimum interrupting rating as called for on the Drawings.
5. The circuit breakers shall incorporate a self powered microprocessor type trip unit for control of the long time, short time and instantaneous trip settings.
6. In addition, the circuit breaker for services more than 150 volts phase to ground but not exceeding 600 volts phase to phase and rated 1000 amperes and more shall incorporate a ground fault trip unit with adjustable trip and delay settings.
7. Auxiliary contacts for remote indication shall be provided if called for on the Drawings.

2.02 FUSES:

- A. General: All fuses shall be dual element, time delay type, based on heavy service unless otherwise noted or required for installation.
- B. Current-Limiting Fuses:
 1. Shall be provided where indicated on the Drawings.
 2. For individual motor circuit protection, provide fuse sized approximately 300 percent of full load current with 200,000 amperes interrupting capacity.
 3. For non-motor feeder protection in conjunction with fused switches, install NEMA Class L fuses sized 125 percent of full load current or as required for coordination.

2.03 SPARE FUSES:

- A. Furnish one (1) complete spare set of each size of fuses installed.
- B. The CONTRACTOR shall deliver to the FWC Site in original boxes and store them in the fuse cabinet furnished under this Contract.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Disconnect Devices shall be installed in accordance with SECTION 16050 and in accordance with the MANUFACTURER recommendations.
- B. Disconnect Devices shall be protected at the Site from loss, damage, and the effects of weather. Services Entrance Devices shall be stored in an indoor, dry location. Heating shall be provided in areas subject to corrosion and humidity.
- C. Disconnect Device interiors and exteriors shall be cleaned, and coatings shall be touched up to match original finish upon completion of the WORK.
- D. Conduit, conductors, and terminations shall be installed in accordance with SECTIONs 16050 and 16120.

END OF SECTION

SECTION 16450 GROUNDING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: The CONTRACTOR shall provide the electrical grounding system, complete and operable, in accordance with the Contract Documents. Including but not limited to the building grounding grid, the grounding rod system and ground riser extension to electrical equipment. All metal shall be grounded unless otherwise specified by FWC.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 01300 – Submittals
 - 2. SECTION 16050 – Basic Materials and Methods
 - 3. SECTION 16950 – Field Testing

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:
 - 1. American Water Works Association (AWWA)
 - a. C210 - Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
 - 2. American Welding Society (AWS)
 - 3. Building Industry Consulting Service International (BICSI)
 - a. Telecommunication Distribution Methods Manual (TDMM)
 - 4. Institute of Electrical and Electronics Engineers (IEEE)
 - a. 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
 - b. 837 - Standard for Qualifying Permanent Connections Used in Substation Grounding
 - 5. National Fire Protection Association (NFPA)
 - a. 250 - Grounding, National Electrical Code (NEC)
 - 6. International Acceptance Testing Specifications (NETA)
 - a. Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
 - 7. Underwriters Laboratories (UL)
 - a. 467 - Standard for Safety Grounding and Bonding Equipment

1.03 DEFINITIONS:

- A. Low Voltage Grounded System (600V or less): A low voltage grounded system is a system where the local power supply is a transformer with the transformer secondary grounded.
 - 1. The first disconnecting means on the load side of this transformer shall provide the point where the neutral conductor is grounded.
 - 2. The neutral shall be connected to the Equipment Grounding Circuit Conductor only at one (1) point which is within the enclosure of the disconnecting means.
 - 3. The Grounding Electrode Conductor or the Equipment Grounding Circuit Conductor shall not be used as the neutral.

1.04 SUBMITTALS:

- A. Furnish submittals in accordance with CONTRACTOR Submittals and SECTIONS 01300 and 16050.
- B. Product Data: MANUFACTURER's product information for connections, clamps, grounding rods and grounding system components, showing compliance with the requirements of this SECTION.
- C. "As-built" Drawings: Provide the FWC with "as-built" drawings of actual grounding system installation. The "as-built" drawings of the grounding system shall be signed and sealed by a State of Florida licensed land surveyor.

1.05 QUALIFICATIONS: N/A

1.06 RESPONSIBILITIES: The CONTRACTOR shall not conceal or cover any ground connections until the FWC has established that every grounding connection conforms to the Contract Documents and has given the CONTRACTOR written confirmation.

1.07 TESTING:

- A. Measure and test the ground impedance in accordance with IEEE Standard 81 after installation but before connecting the electrode to the remaining grounding system. Verify all ground potentials on drawings and submit to the FWC for final approval.
- B. Test the grounding system per NETA ATS section 7.13 and called for in SECTION 16950.
- C. INSPECTIONS COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours advance notice of its intention to begin new WORK activities.

1.08 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 GENERAL: Components of the grounding electrode system shall be manufactured in accordance with ANSI/UL467 and shall conform to the applicable requirements of National Electrical Code Article 250 and local codes.

2.02 GROUNDING ELECTRODE SYSTEM:

- A. Grounding loop conductors shall be bare annealed copper conductors suitable for direct burial. Conductors shall be #2/0 AWG unless indicated otherwise.
- B. Ground Rods
 - 1. Unless indicated otherwise, the ground rod shall be a minimum of 3/4-inch in diameter, 20 feet long with pointed end to facilitate driving, and have a uniform covering of electrolytic copper metallically bonded to a rigid steel core. The copper to steel bond shall be corrosion resistant. The rod length shall be clearly stamped near the top of the rod.
 - 2. Conform to ANSI/UL 467.
 - 3. Sectional type joined by threaded copper alloy couplings.
- C. Buried cable-to-cable and cable-to-ground rod connections shall be made using exothermic welds or compression connectors suitable for direct burial.
- D. Exposed grounding connectors shall be of the compression type (connector to cable), made of high copper alloy, and be manufactured specifically for the particular grounding application.
- E. Grounding clamps shall be used to bond each separately derived system to the grounding electrode conductors.
- F. Equipment Grounding Circuit Conductors
 - 1. These conductors shall be the same type and insulation as the load circuit conductors. The minimum size shall be in accordance with the NEC-Article 250, unless indicated otherwise.

2. Present in all raceways. The conduit system is not an allowable equipment ground.
3. Cable to equipment ground lugs shall be compression type, bolted to the equipment with silicon bronze bolts and lock washers.

2.03 COATINGS:

- A. Coal Tar:
 1. All underground grounding connections shall be coated with coal tar as specified herein.
 2. Coating shall be of Polyamide Epoxy-Coal Tar with high build corrosion resistance. Resulting coat shall conform to the performance requirements of AWWA C210.

PART 3 - EXECUTION:

3.01 WIRE, CABLE AND RACEWAY GROUNDING:

- A. Provide a separate grounding conductor, securely grounded in each raceway independent of raceway material as well as in each raceway with parallel feeder run.
- B. Size shall be as given on the conduit schedule and in accordance with the NEC-Article 250.
- C. Provide the duct bank ground system indicated, including, trenching, splices, ground rods, and connections to equipment and structures.
- D. Grounding Wires and Cables:
 1. Install using as few joints as possible.
 2. Protect against abrasion by several wrappings of rubber tape at all points where cable leaves concrete in exposed areas.
 3. Suitably protect cable against damage during construction.
 4. Replace or suitably repair cable if damaged by anyone before final acceptance.

3.02 GROUNDING BOXES, MOTORS AND ELECTRICAL EQUIPMENT:

- A. Provide a separate grounding conductor for each motor and connect at motor box. Do not use bolts securing motor box to frame or cover for grounding connectors.
- B. Provide a grounding type bushing for secondary feeder and branch circuit conduits which originate from the secondary section of each motor control center (MCC) section, switchboard, or panelboard.
- C. Individually bond these raceways to the ground bus in the secondary section.
- D. Provide solid copper green insulated wire as grounding jumper from the ground screw to a box grounding screw and, for grounding type devices, to equipment grounding conductor.
- E. Interconnect the secondary switchgear neutral bus to the ground bus in the secondary switchgear compartment only at service entrance point or after a transformer.

3.03 GROUNDING SYSTEMS:

- A. Embedded Ground Connectors
 1. The connection shall be made in accordance with the MANUFACTURER's instructions.
 2. Lay in bottom of trench or in other excavations at least 18 inches below finished grade.
 3. Maintain clearance of at least 12 inches from all underground metal piping or structures, except where connections thereto are specifically indicated.
 4. Duct Bank Ground: A grounding conductor shall be embedded in every duct bank as indicated.
- B. Ground Ring
 1. Furnish trenching and materials necessary to install the ground ring as indicated.
 2. Bonding conductor shall be in direct contact with the earth and be of the size indicated.
 3. Minimum burial depth 30 inches or as indicated on the Drawings, whichever is greater.

4. Re-compact disturbed soils to original density in six (6) inches layers.
- C. Ground Rods
1. Ground rods forming an individual ground array shall be equal in length.
 2. The CONTRACTOR shall install rods as indicated by driving and not by drilling or jetting.
 3. The CONTRACTOR shall drive rods into unexcavated portion of the earth where possible.
 4. In excavated areas, the CONTRACTOR shall drive grounding rods after compaction and backfill is completed.
 5. The CONTRACTOR shall drive to a depth such that top of rods will be approximately **[30]** inches below final grade, or subgrade, and connect main grid ground cable thereto.

3.04 SHIELD GROUNDING:

- A. Shielded instrumentation cable shall have its shield grounded at one end only unless Shop Drawings indicate the shield will be grounded at both ends.
- B. The grounding point shall be at the control panel or otherwise at the receiving end of the signal carried by the cable.
- C. Termination of shield drain wire shall be on its own terminal screw.
- D. All terminal screws shall be jumpered together using manufactured terminal block jumpers.
- E. Connection to the ground bus shall be via a green No. 12 conductor to the main ground bus for the panel.

END OF SECTION

PART 1 - GENERAL1.01 SCOPE:

A. Summary of Work:

1. Furnish and install a standby power system, herein called "the generator set", to supply electrical power in event of failure of normal supply. The generator set (Genset) shall consist of a diesel fueled, liquid cooled engine, an AC (alternating current) alternator, and system controls with all necessary accessories for a complete operating system including but not limited to the items as specified herein. Quantity as specified in Equipment Parameter Schedule, Specification Section 2.02A.
2. Furnish and install an automatic transfer switch (ATS) described elsewhere in this specification that will initiate a signal to start the generator engine on primary power failure and automatically transfer the load to the generator source. On restoration of primary power, the switch must automatically retransfer the load back to primary power and signal the generator engine to begin a timed cool down period followed by a shut down and a return to readiness for another operating cycle. Quantity as specified in Equipment Parameter Schedule, Specification Section 2.14A.

B. Related Work Specified Elsewhere:

1. SECTION 01300 – Submittals

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

A. Standards or Codes: The edition of the standards of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. See the various paragraphs for the specified standard. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail.

1. Federal Communications Commission (FCC)
 - a. Part 15, Subpart B
2. Environmental Protection Agency (EPA)
3. International Electrotechnical Commission (IEC)
4. Institute of Electrical and Electronics Engineers (IEEE)
 - a. 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - b. C62.41.1 - Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
5. International Organization for Standardization (ISO)
 - a. 9001 - Requirements for Quality Management Systems
6. Military Standard
 - a. Mil-Std-461D - Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility
7. National Electrical Manufacturers Association (NEMA)
 - a. ICS 10 - AC Generator sets
8. National Fire Protection Association (NFPA)

- a. 70 - National Electrical Code
 - i. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - b. 99 - Essential Electrical Systems for Health Care Facilities
 - c. 110 – Standard for Emergency and Standby Power Systems
 - i. Prototype tests required by this standard shall have been performed on a complete and functional unit; component level type tests will not substitute for this requirement.
9. Underwriters Laboratories, Inc. (UL)
- a. 508 - Safety Standard for Industrial Control Equipment
 - i. The entire control system of the generator set shall be UL508 listed and labeled.
 - b. 1008 - Transfer Switch Equipment
 - i. Transfer switch shall be UL-1008 listed and all switch accessories shall be UL listed for factory or field installation.
 - c. 2200 – Standard for Stationary Engine Generator Assemblies
 - i. The genset shall be listed to UL2200.
- B. The generator set and transfer switch MANUFACTURER shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.03 SUBMITTALS: Submit the following to the FWC in accordance with SECTION 01300.

- A. Specification and data sheets
- B. MANUFACTURER's certification of prototype testing
- C. MANUFACTURER's published warranty documents
- D. Shop Drawings showing plan and elevation views with certified overall and interconnection point dimensions and anchorage requirements
- E. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner
- F. Generator Service Manual, Parts Manual, O&M Manual, and Installation Manual. One of each manual shall ship with the engine-generator

1.04 WARRANTY:

- A. The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

1.05 SUPPLIERS: The supplier shall be the MANUFACTURER's authorized distributor, who shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier shall have 24-hour service availability and factory-trained service technicians authorized to do warranty service on all warrantable products.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER: Cummins ONAN, Caterpillar, Kohler, Generac, Baldor or FWC approved equal.

2.02 GENSET PARAMETERS:

- A. Quantity of generator set(s) to be furnished: 1
- B. Generator output voltage/Frequency: 277/480 V
- C. Generator set shall have a standby rating: 60 kW based on Site conditions of 100 feet elevation and ambient temperatures up to 122 degrees Fahrenheit (F) (50 degrees Centigrade (C))
- D. Generator set enclosure shall be NFPA 110 rated, Class 168, Type 10, Level 2
- E. Minimum motor starting capability: 75 kVA
- F. Engine muffler grade: industrial

2.03 PERFORMANCE:

- A. Voltage regulation shall be plus or minus 1% for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 1%.
- B. Frequency regulation shall be isochronous to maintain alternator frequency within 0.5% from no load to rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
- C. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
- D. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.
- E. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5% above or below rated voltage.
- F. The permanent magnet generator (PMG) and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than ten (10) seconds.
- G. The diesel engine-generator set shall be capable of single step load pick up of 100% nameplate kilowatt (kW) and power factor, less applicable derating factors, with the engine generator set at operating temperature.

2.04 AC GENERATOR:

- A. The AC generator shall be: broad range, 12 lead reconnectable, four (4) pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc.
- B. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees C.

- C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance.

2.05 ENGINE:

- A. The engine shall be diesel, four (4) cycle. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two (2) cycle engines are not acceptable.
- B. The engine shall be cooled by a shell and tube type water-to-water heat exchanger. The cooling system shall be rated for full load operation in 122 degrees F (50 degrees C) ambient with 90 degrees F cooling water. Cooling water will be strained canal water supplied by a raw water pump at 15 gallons per minute (gpm) minimum. A continuous duty rated direct acting bronze-bodied electrically actuated solenoid valve shall be mounted at the inlet of the heat exchanger. The solenoid shall be electrically interlocked with the generator RUN command.
- C. The engine cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment MANUFACTURER. Rotating parts shall be guarded against accidental contact.
- D. Emission Requirements Emergency: The engine-generator set furnished installation shall comply with EPA emissions requirements. A letter shall be submitted to the FWC by the engineer-generator set MANUFACTURER, certifying the installed system satisfies all emission regulations.

2.06 ENGINE ACCESSORY EQUIPMENT: The engine generator-set shall include the engine accessories as follows:

- A. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.
- B. Electric starter capable of three (3) complete cranking cycles without overheating.
- C. Positive displacement, mechanical, full pressure lubrication oil pump.
- D. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
- E. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element.
- F. Replaceable dry element air cleaner indicator housed with an enclosure with restriction indicator.
- G. Engine mounted battery charging alternator, 40-ampere (amp) minimum, and solid-state voltage regulator.
- H. The subtransient reactance of the alternator shall not exceed 12%, based on the steady-state rating of the generator set.
- I. Engine mounted thermostatically controlled coolant heater for each engine. Heater voltage shall be as shown on the Drawings.
 - 1. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heater shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick

disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

2. The coolant heater shall be provided with a 24 VDC (volt direct current) thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.
 3. The coolant heater(s) shall be sized as recommended by the engine MANUFACTURER to warm the engine to a minimum of 100 degrees F (40 degrees C) in a 40 degrees F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this SECTION.
- J. Starting battery shall be calcium/lead antimony type, size and voltage as recommended by the engine MANUFACTURER, complete with battery box, cables, and connectors.
- K. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set MANUFACTURER and approved by the engine MANUFACTURER. Reference Equipment Parameter Schedule in Section 2.02.A of this SECTION for required grade of muffler. Exhaust system shall be furnished and installed according to the engine MANUFACTURER's recommendations, applicable codes and standards, and constructed in its entirety of grade 304 SS.

2.07 BASE:

- A. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
- B. Furnish vibration isolators, spring/pad type, quantity as recommended by the generator set MANUFACTURER to isolate the skid-mounted genset and sub-base day tank from the concrete floor where the unit will be installed.

2.08 DAY TANK:

- A. Furnish a sub-base mounted day tank for each generator set with a capacity of 800 gallons.
- B. Day tank shall be equipped for automatic unattended operation. The day tank shall be furnished with the following:
1. UL certification for double wall steel construction.
 2. The day tank shall incorporate separate supply and return fuel pumps mounted on the tank; 1/4 HP (horsepower), 120/240 Volt (V), 1-phase, four (4) gpm minimum against 20 foot of head.
 3. Normally closed direct acting electrically actuated solenoid valve on the suction side of the supply pump that opens only when the supply pump runs.
 4. Properly sized flexible fuel lines for the supply and return line from the engine to the day tank.
 5. The day tank shall be furnished with a UL listed control panel with the following:
 - a. On/Off/Emergency Run Switch for the supply pump
 - b. Test/Reset Switch - The test shall illuminate all indicating and energize both the supply and return pumps via the panel's DC logic
 - c. AC Circuit Breaker
 - d. DC Circuit Breaker
 - e. Ready (green) - Illuminates when both AC supply & DC control power are available to operate the system.

- f. High Fuel (red) - Illuminates and latches when a high fuel condition exists, and closes a set of form 'C' N/O dry contacts. Contacts shall be rated not less than two (2) amps at 30 VDC and 0.5 amps at 120 VAC
 - g. Low Fuel (red) - Illuminates and latches when a low fuel condition exists, and closes a set of form 'C' N/O dry contacts. Contacts shall be rated not less than two (2) amps at 30 VDC and 0.5 amps at 120 VAC
 - h. Low Fuel Shutdown (red) - Latching fault, indicates near empty tank, closes N/O contacts which is used to shutdown engine to avoid air in the injection system.
 - i. Interstitial space leak (red) - Latching fault, indicates fuel in overflow/rupture basin, shuts down supply pump and starts return pump, closes N/O dry contacts.
 - j. Spare (red) - with N/O and N/C dry contacts
 - k. Supply Pump Running (green)
 - l. Return Pump Running (green)
6. UL listed control panel shall receive inputs from individual float switches (reference contract drawings) or a stem(s) with multiple floats mounted within the day tank that changes state at the following conditions:
- a. High Fuel
 - b. Supply pump start
 - c. Supply pump stop
 - d. Return pump start
 - e. Return pump stop
 - f. Low fuel
 - g. Low fuel shutdown
 - h. Interstitial space leak

2.09 GENERATOR SET AUXILIARY EQUIPMENT AND ACCESSORIES:

- A. The generator set shall be provided with a mounted main line circuit breaker, sized to carry the rated output current of the generator set on a continuous basis. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided. Generator main circuit breaker shall be 4-pole, rating: 277 volts, 200 amperes.
- B. Connections: The generator set load connections shall be made to a main line NEMA rated thermal magnetic molded case circuit of the size indicated on the contract drawings. The circuit breaker shall be mounted in an enclosure bolted to the alternator.

2.10 GENERATOR SET CONTROL AND MONITORING:

- A. The generator set shall be provided with an integrated microprocessor-based control system that is designed to provide governing, voltage regulation, starting, engine protection and operator interface functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification SECTION. The control shall be mounted on the generator set and shall be vibration isolated, prototype tested and UL, CSA, and CE compliant. The control panel shall be in compliance with and include the following:

1. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 V.
2. MODE SELECTOR switch: The mode select switch shall initiate the following control modes. When in the RUN or Manual position, the generator set shall start and accelerate to rated speed and voltage as directed by the operator. In the OFF position, the generator set shall immediately stop, bypassing all time delays. In the AUTO position, the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
3. EMERGENCY STOP switch: The emergency stop switch shall be Red “mushroom-head” push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
4. ALPHA-NUMERIC DISPLAY: The alpha-numeric display shall be used with push button access for viewing engine and alternator data and providing setup, controls, and adjustments.
5. RESET switch: The reset switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
6. PANEL LAMP TEST switch: Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
7. Bar graph voltmeter, ammeter, frequency meter, and kilowatt meter: Voltmeter and ammeter shall display all three phases. Ammeter and kW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
8. Alpha-numeric, 0.5% accuracy, to indicate generator root mean square (RMS) voltage and current, frequency, output current, output kW, kW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
9. Generator Set Alarm and Status Display: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps shall be high-intensity LED (light-emitting diode) type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
 - a. Low oil pressure (alarm)
 - b. Low oil pressure (shutdown)
 - c. Oil pressure sender failure (alarm)
 - d. Low coolant temperature (alarm)
 - e. High coolant temperature (alarm)
 - f. High coolant temperature (shutdown)
 - g. Engine temperature sender failure (alarm)
 - h. Low coolant level (alarm or shutdown—selectable)
 - i. Fail to crank (shutdown)
 - j. Fail to start/overcrank (shutdown)
 - k. Overspeed (shutdown)
 - l. Low DC voltage (alarm)
 - m. High DC voltage (alarm)

- n. Weak battery (alarm)
 - o. Low fuel-day tank (alarm)
 - p. High AC voltage (shutdown)
 - q. Low AC voltage (shutdown)
 - r. Under frequency (shutdown)
 - s. Over current (warning)
 - t. Over current (shutdown)
 - u. Short circuit (shutdown)
 - v. Over load (alarm)
 - w. Emergency stop (shutdown)
10. Provisions shall be made for indication of four (4) customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions.
 11. Provide data logging and display provision to allow logging of the last ten (10) warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.
 12. Engine Status Monitoring: The following information shall be available from a digital status panel on the generator set control:
 - a. Engine oil pressure (pounds per square inch or kilopascal (psi or kPA))
 - b. Engine coolant temperature (degrees F or C)
 - c. Engine oil temperature (degrees F or C)
 - d. Engine speed (revolutions per minute (rpm))
 - e. Number of hours of operation (hours)
 - f. Number of start attempts
 - g. Battery voltage (DC volts)

2.11 ENGINE CONTROL FUNCTIONS:

- A. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for three (3) cranking periods of 15 seconds each, with 15 second rest period between cranking periods.
- B. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
- C. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
- D. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature, which is capable of discriminating between failed senders or wiring components, and an actual failure condition.

2.12 ALTERNATOR CONTROL FUNCTIONS:

- A. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine MANUFACTURER with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58 hertz (Hz). The voltage regulator shall include adjustments for gain, damping, and frequency roll-off.
- B. Provisions shall be provided to shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 article 445.
- C. Controls shall be provided to monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.
- D. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than ten (10) seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than ten (10) seconds.
- E. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 15 VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two (2) seconds, a “weak battery” alarm shall be initiated.

2.13 CONTROL INTERFACES FOR REMOTE MONITORING:

- A. All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:
 - 1. Form “C” dry common alarm contact set rated two (2) amps @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.
 - 2. One set of contacts rated two (2) amps @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.
 - 3. A fused ten (10) amps switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
 - 4. A fused 20 amps 24 VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
 - 5. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.14 TRANSFER SWITCH EQUIPMENT:

- A. Quantity of automatic transfer switch(es) to be furnished: One.
- B. Automatic transfer switch shall be 3-pole design rated for 200 amperes continuous operation at 480 VAC in ambient temperatures of 20 degrees F to 120 degrees F, relative humidity up to 95%.

2.15 AUTOMATIC TRANSFER SWITCH:

- A. The transfer switch shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Normal and Emergency positions.
- B. The withstand and close rating of the switch shall be the rating listed in the UL listing.
- C. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and shall close to start the generator set. Output contacts shall be form 'C', for compatibility with any generator set.
- D. Provide one set form 'C' auxiliary contacts on both the Normal and the Emergency sides, operated by transfer switch position, rated ten (10) amps 250 VAC.
- E. The transfer switch shall provide relay contacts to indicate the following conditions: Normal source available, load connected to Normal source, Emergency source available, Emergency source connected to load.
- F. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
- G. Transfer switches shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.
- H. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
- I. Transfer switch shall be provided with Al/Cu mechanical lugs sized to accept the full output rating of the generator set.
- J. Transfer switch equipment shall be provided in a NEMA 1 or better enclosure. The cabinet shall provide code-required wire bend space when both sources and the load are all connected from either the top or bottom of the transfer switch. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non-key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

2.16 TRANSFER SWITCH CONTROL AND MONITORING:

- A. Solid-state under voltage sensors shall simultaneously monitor both the Normal and the Emergency sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.
- B. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensor. Solid-state time delay start, adjustable from zero (0) to 15 seconds (factory set at two (2) seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be silver, dry type contacts factory wired to a field wiring terminal block.
- C. The switch shall transfer when the emergency source reaches the set point. Provide a solid-state time delay on transfer, adjustable from two (2) to 120 seconds, factory set at three (3) seconds.
- D. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from six (6) seconds to 30 minutes, factory set at five (5) minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.

- E. Controls shall signal the engine-generator set to stop after a time delay, adjustable from two (2) seconds to ten (10) minutes, and factory set at five (5) minutes, beginning on return to the normal source.
- F. The control system shall include field adjustable provisions to control the speed of the transfer switch.
- G. Power for transfer operation shall be from the source to which the load is being transferred.
- H. The control system shall be designed to continuously monitor phase rotation of the source and shall include loss of single-phase detection with a maximum response time of 0.100 seconds.
- I. The control system shall include voltage imbalance sensing relay, Pick-up and drop-out settings shall be adjustable and time delay shall be adjustable from two (2) to 20 seconds.
- J. The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time, as follows:

Normal Available	Start (Gen Set)	Emergency Available
Transfer Timing	Transfer Complete	Retransfer Timing
Retransfer Complete	Timing for Stop	

- K. Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period.
- L. Provide control switches mounted on cabinet front for:
 - 1. TEST - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.
 - 2. RETRANSFER - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.
 - 3. Provide LED-type switch position and source available indicator lamps on the front of the transfer switch cabinet.
 - 4. Provide manual override switch to bypass the control system and transfer load from source to source when control is disabled.

2.17 OPERATION:

- A. Upon loss of utility power (normal source), the automatic transfer switch shall signal the generator set to start via hardwired connection to the generator set.
- B. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:
 - 1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two (2) attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.
 - 2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this SECTION. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.
 - 3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

4. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system.
 5. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.
 6. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.
 7. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.
- C. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:
1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
 2. When the control system senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
 3. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.
 4. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
 5. The transfer switch shall operate the generator set unloaded for a cool down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Equipment shall be installed by the CONTRACTOR in accordance with final submittals and Contract Documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with MANUFACTURER's instructions and instructions included in the listing or labeling of UL listed products.
- B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The CONTRACTOR shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with MANUFACTURER's instructions.
- D. Equipment shall be initially started and operated by representatives of the MANUFACTURER.
- E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

3.02 FACTORY TESTS:

- A. The generator set MANUFACTURER shall perform a complete operational test on the generator set and transfer switch prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.
- B. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.03 ON SITE ACCEPTANCE TEST:

- A. Following completion of the Site WORK, representatives of the MANUFACTURER shall test the generator and transfer switch for compliance with the specifications. Testing shall be scheduled and witnessed by the FWC. Installation acceptance tests to be conducted on-site by the MANUFACTURER shall include a "cold start" test, a two-hour full load test, and a one-step rated load pickup test in accordance with NFPA 110. MANUFACTURER shall provide a resistive load bank and make temporary connections for full load test.
- B. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least two (2) hours. Coordinate timing and obtain approval for start of test with Site personnel.

3.04 TRAINING:

- A. The equipment supplier shall provide training for the FWC's operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 16 hours in duration and the class size shall be limited to five (5) persons. Training date shall be coordinated with the facility owner.

3.05 SERVICE AND SUPPORT:

- A. The MANUFACTURER of the generator set shall maintain service parts inventory for generator, engine, transfer switch etc. at a central location, which is accessible to the service location 24 hours per day, 365 days per year.
- B. The generator set, including engine, generator, and transfer switch, shall be serviced by an authorized agent of the MANUFACTURER who shall be located within the boundary area of the FWC. The service personnel shall be trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
- C. The MANUFACTURER shall maintain model and serial number records of each generator set provided for at least 20 years.

END OF SECTION

SECTION 16950 FIELD TESTING

PART 1 - GENERAL

1.01 SCOPE:

- A. Summary of Work: This SECTION specifies the WORK necessary to test, commission, and demonstrate that the electrical work satisfies the criteria of these specifications and functions as required by the Contract Documents. The WORK of this SECTION includes furnishing the labor, equipment, and power required to support the testing specified in other divisions of these Specifications. This scope may require the CONTRACTOR to activate circuits, shutdown circuits, and run equipment, make electrical measurements, replace blown fuses, install temporary jumpers, etc.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 16050 - Basic Materials and Methods

1.02 APPLICABLE STANDARDS AND PUBLICATIONS:

- A. Standards or Codes: The edition of the publications of the organizations listed below in effect at the time of the advertisement for bids form a part of this specification to the extent referenced. In the case of a conflict between the requirements of this SECTION and those of the listed document, the requirements of this SECTION shall prevail:
 - 1. Institute of Electrical and Electronics Engineers (IEEE)
 - a. 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
 - 2. National Fire Protection Agency (NFPA)
 - a. 70 - National Electrical Code
 - 3. National Electrical Manufacturers Association (NEMA)
 - 4. International Electrical Testing Association (NETA)
 - a. Acceptance Testing Specifications

1.03 DEFINITIONS: N/A

1.04 SUBMITTALS:

- A. Five (5) bound copies of the certified test reports shall be submitted by the independent testing firm to the CONTRACTOR upon completion of the Project. The final report shall be signed and shall include the following information:
 - 1. Summary of the Project
 - 2. Description of equipment tested
 - 3. Visual Inspection report
 - 4. Description of tests
 - 5. Test data
 - 6. Analysis and recommendations
 - 7. Appendix including appropriate test forms
 - 8. Identification of test equipment used and calibration dates

1.05 QUALIFICATIONS:

- A. The testing CONTRACTOR shall submit appropriate documentation to demonstrate that it satisfactorily complies with the following. The CONTRACTOR shall have a “Full Membership” classification issued by the International Electrical Testing Association. The following criteria shall be met.
 - 1. The testing CONTRACTOR shall be an independent, third party, testing organization which can function as an unbiased testing authority, professionally independent of the MANUFACTURERS, suppliers, and installers of equipment or systems evaluated by the CONTRACTOR.
 - 2. The testing CONTRACTOR shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- B. The testing organization shall utilize technicians who are regularly employed for testing services.
- C. Each on-site crew leader shall hold a current registered certification in electrical testing applicable to each type of apparatus to be inspected or tested. The certification in electrical testing shall be issued by an independent, nationally-recognized, technician certification agency. The following entities shall qualify as independent, nationally-recognized, technician certification agencies:
 - 1. International Electrical Testing Association (NETA)
Accepted certifications:
 - a. Certified Senior Technician/Level IV
 - b. Certified Technician/Level III
 - 2. National Institute of Certification in Engineering Technologies (NICET)
Accepted certifications specifically in Electrical Testing Engineering Technology:
 - a. Senior Engineering Technician/Level IV
 - b. Engineering Technician/Level III

1.06 RESPONSIBILITIES:

- A. The CONTRACTOR shall notify and coordinate scheduling with the Independent Testing SUBCONTRACTOR when equipment becomes available for acceptance tests.
- B. The CONTRACTOR shall provide the Independent Testing SUBCONTRACTOR with a complete set of approved electrical drawings, coordination study (if applicable), settings of all adjustable devices (if applicable), MANUFACTURER’s instruction manuals and any other information necessary for an accurate evaluation of the equipment and systems prior to performance of any tests.
- C. The CONTRACTOR shall provide a suitable source of electrical power as specified by the Independent Testing Firm at each test Site point of need.
- D. The CONTRACTOR shall report to the FWC any system, equipment, material, or workmanship which is found deficient on the basis of acceptance tests.
- E. The CONTRACTOR shall correct deficiencies identified by tests and make ready for retest.
- F. The CONTRACTOR shall hire and pay for the services of the Independent Testing Firm to retest any equipment found to be deficient at initial testing until specified requirements are met.

1.07 TESTING:

- A. The following test requirements supplement test and acceptance criteria that may be stated elsewhere.

1. Lighting: Switching, including remote control, if indicated. Verify circuitry is in accordance with panel schedules. Switches rated less than 600V shall be tested in accordance with NETA ATS Section 7.5.1.1. Switches shall be toggled, back and or side contacts tested for correct wiring, any special features verified.
2. Meters shall be tested as per NETA ATS Section 7.11.
3. Instrument transformers shall be tested as per NETA ATS Section 7.10.
4. Demonstrate mechanical and/or electrical interlocking by attempting to subvert the intended sequence.
5. Activate ground fault tripping by operating test features provided with ground current protective systems and by injecting a known and reasonable current in the ground current sensor circuit. Testing procedures outlined in NETA ATS Section 7.14 - Ground Fault Protection Systems - shall also be used.
6. Surge arrestors rated less than 600V shall be tested as per NETA ATS Section 7.19.1
7. Protective relays shall be tested as per NETA ATS Section 7.9.
8. Transformers dry type rated less than 600 VAC (167kVA single-phase, 500kVA three-phase and smaller) shall be tested according to NETA ATS Section 7.2.1.1.
9. Transformers dry type rated less than 600 VAC (greater than 167kVA single-phase and 500kVA three-phase) shall be tested according to NETA ATS Section 7.2.1.2.
10. Switchgear and switchboard assemblies rated less than 600V shall be tested as per the requirements of NETA ATS Section 7.1.
11. Automatic Transfer Switches shall be tested as per NETA ATS Section 7.22.3.
12. Batteries shall be tested as per NETA ATS Section 7.18.1.
13. Battery chargers shall be tested as per NETA ATS Section 7.18.2.
14. Emergency/Standby generators shall be tested as per NETA ATS Section 7.22.1
15. Uninterruptible Power Systems shall be tested as per NETA ATS Section 7.22.2
16. Motor starters rated less than 600V shall be tested in accordance with NETA ATS Section 7.16.1.1.
17. Motor control centers shall be tested as per NETA ATS Section 7.16.2.
18. Cable Testing: Low voltage 600-volt maximum cable shall be tested for insulation resistance. Testing shall be done after the equipment is terminated. Inspection and test procedures, as outlined in NETA ATS Section 7.3.2 - Cables, shall be followed. Test results, stating equipment used and time of test shall be submitted for review 30 days prior to plant operation and any system testing. Equipment which may be damaged during this test shall be disconnected. Perform tests with all other equipment connected to the circuit. In order to be acceptable, the cable must withstand the test high voltage without breakdown, have steady or decreasing leakage current during the high potential test, and have satisfactory comparable megger readings in each megger test.
19. Metal Enclosed Busways shall be tested as per NETA ATS Section 7.4
20. Test ground interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle MANUFACTURER. Inspection and test procedures outlined in NETA Acceptance Testing Specifications Section 7.14 - Ground Fault Protection Systems - shall also be used.
21. A functional test and check of all electrical components is required prior to performing subsystem testing and commissioning. Compartments and equipment shall be cleaned as required by other provisions of these Specifications before commencement of functional

testing. Inspection and test procedures outlined in NETA ATS Section 8.1 - System Functional Tests - shall be used. Functional testing shall comprise:

- a. Circuit breakers insulated case or molded shall be tested per the requirements set forth in NETA ATS Section 7.6.1.1. Circuit breakers which have adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field adjusted by a representative of the circuit breaker MANUFACTURER. Time and pickup setting shall correspond to the recommendations of the Short Circuit Study provided by the equipment vendor. Setting shall be tabulated and proven for each circuit breaker in its installed position.
 - b. Draw-out circuit breakers rated less than 600V shall be tested per the requirements set forth in NETA ATS Section 7.6.1.1. Circuit breakers which have adjustable time or pick-up settings for ground current, instantaneous overcurrent, short-time overcurrent, or long-time overcurrent, shall be field adjusted by a representative of the circuit breaker MANUFACTURER. Time and pickup setting shall correspond to the recommendations of the Short Circuit Study provided by the equipment vendor. Setting shall be tabulated and proven for each circuit breaker in its installed position.
 - c. Switches rated less than 600V shall be tested in accordance with NETA ATS Section 7.5.1.1. Switches shall be toggled, back and or side contacts tested for correct wiring, any special features verified.
22. Complete ground testing of all grounding electrodes per requirements below prior to operating the equipment. Inspection and test procedures outlined in NETA ATS Section 7.13 - Grounding Systems - shall be used.
- B. Subsystem testing shall occur after the proper operation of alarm and status contacts has been demonstrated or otherwise accepted by the FWC and after process control devices have been adjusted as accurately as possible. It is intended that the CONTRACTOR will adjust limit switches and level switches to their operating points prior to testing and will set pressure switches, flow switches, and timing relays as dictated by operating results.
 - C. After initial settings have been completed, each subsystem shall be operated in the manual mode and it shall be demonstrated that operation is in compliance with the Contract Documents. Once the manual mode of operation has been proven, automatic operation shall be demonstrated to verify such items as proper start and stop sequence of pumps, proper operation of valves, proper speed control, etc.
 - D. Motor operated valves shall be tested after having been phased and tested for correct motor rotation and after travel and torque limit switches have been adjusted by a representative of the valve MANUFACTURER. Tests shall verify status indication, proper valve travel, and correct command control from local and remote devices.
 - E. Provide ground resistance tests on the main grounding electrode or system in the presence of the FWC and submit results. Utilize the fall-of-potential method or alternative, in accordance with IEEE Standard 81.
 - F. Subsystems shall be defined as individual and groups of pumps, chemical feeders, air conditioning units, ventilation fans, air compressors, etc.
 - G. General: Carry out tests indicated herein for individual items of materials and equipment in other Sections.
- 1.08 INSPECTION COORDINATION: The CONTRACTOR shall provide access to the WORK for the FWC as requested for inspection. The CONTRACTOR shall provide 48 hours notice of its intention to begin new WORK activities
- 1.09 WARRANTY: The CONTRACTOR shall warrant the WORK against defects for one (1) year from the date of Substantial Completion and as described in the General Terms and Conditions.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS: The CONTRACTOR shall provide all testing equipment required which includes but are not limited to following:

- A. Wet- and dry-bulb thermometer
- B. 1000V meggers
- C. Battery-powered portable telephone sets and portable radios
- D. Digital High Precision Multimeter
- E. Commercial model three-point ground test set
- F. Miscellaneous cable, test lights, buzzers, bells, switches, receptacles, plugs, and other equipment as required

PART 3 - EXECUTION: N/A

END OF SECTION