SUBMIT BID TO:
PROCUREMENT SERVICES
UNIVERSITY OF FLORIDA
971 ELMORE DRIVE
PO BOX 115250
GAINESVILLE, FL 32611
Phone: (352) 392-1331 - FAX: (352) 392-8837
Web Address: https://procurement.ufl.edu/

UF UNIVERSITY of FLORIDA

INVITATION TO BID

Construction Acknowledgment Form

Page 1 of 536 pages Plus Drawings (254 Pages)	BID WILL BE OPENED: **September 8, 2022 at 3:00 PM** local time and may not be withdrawn within 45 days after such date and time. Mandatory Pre-bid: **August 16, 2022 at 12:00 PM** local time.	BID NO.: ITB23KO-105
DATE: 8/4/2022	PROCUREMENT AGENT: KO	BID TITLE: Reitz Lawn and Inner Road Utility and Roadway Improvements
VENDOR NAME		
VENDOR MAILING ADDRESS		REASON FOR NOT SUBMITTING BID
CITY - STATE - ZIP CODE		**POSTING OF BID TABULATIONS** Bid tabulations with intended award(s) will be posted electronically for review by interested parties at https://procurement.ufl.edu/ and will remain posted for a period of 72 hours excluding Saturdays, Sundays, or state holidays. Failure to file a protest in accordance with Board of Governors (BOG) Regulation 18.002 or failure to post the bond or other security as required in the BOG regulations 18.002 and 18.003(3), shall constitute a waiver of protest proceedings.
AREA CODE _____ _____	TELEPHONE NO. _____ FAX NO. _____ WEB ADDRESS EMAIL ADDRESS	

I certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm or person submitting a bid for the same materials, supplies, or equipment and is in all respects fair and without collusion or fraud. I agree to abide by all conditions of this bid and certify that I am authorized to sign this bid for the vendor and that the vendor is in compliance with all the requirements of the Invitation to Bid, including but not limited to, certification requirements. In submitting a bid on behalf of the Board of Trustees, hereinafter known as the University, the vendor offers and agrees that if the bid is accepted the vendor will convey, sell, assign, or transfer to the University all rights, title and interest in and to all causes of action it may now or hereafter acquire under the Anti-trust laws of the United States and the University for price fixing relating to the particular commodities or services purchased or acquired by the University. At the University's discretion, such assignment shall be made and become effective at the time the purchasing agency tenders final payment to the vendor.

_____
AUTHORIZED SIGNATURE (MANUAL)

_____
NAME AND TITLE (TYPED)

GENERAL CONDITIONS

SEALED BIDS: All bid sheets and this form must be executed and submitted in a sealed envelope. (DO NOT INCLUDE MORE THAN ONE BID PER ENVELOPE.) The face of the envelope shall contain, in addition to the above address, the date, and time of the bid opening and the bid number. Bids not submitted on the attached bid form shall be rejected. All bids are subject to the conditions specified herein. Those which do not comply with these conditions are subject to rejection.

1. **EXECUTION OF BID**: Bid must contain an original manual signature of authorized representative in the space provided above. Bid must be typed or printed in ink. Use of erasable ink is not permitted. All corrections to prices made by vendor must be initialed.

2. **NO BID**: If not submitting a bid, respond by returning only this vendor acknowledgment form, marking it "NO BID", and explain the reason in the space provided above. Failure to respond to a procurement solicitation without giving justifiable reason for such failure, nonconformance to contract conditions, or other pertinent factors deemed reasonable and valid shall be cause for removal of the supplier's name from the bid mailing list. NOTE: To qualify as a respondent, vendor must submit a "NO BID", and it must be received no later than the stated bid opening date and hour.

3. **BID OPENING**: Shall be public, on the date, location and the time specified on the bid form. It is the vendor's responsibility to assure that the bid is delivered at the proper time and place of the bid opening. Bids which for any reason are not so delivered will not be considered. A bid may not be altered after opening of the bids. NOTE: Bid tabulations will be posted electronically at https://procurement.ufl.edu/ . Bid tabulations will not be provided by telephone.

4. **PRICES, TERMS AND PAYMENT**: Firm prices shall be bid and will include all packing, handling, shipping charges, and delivery to the destination shown herein.
(a) TAXES: The University does not pay Federal Excise and Sales taxes on direct purchases of tangible personal property or services. The Florida Tax Exempt Number is 11-06-024056-57C. This exemption does not apply to purchases of tangible personal property or services made by vendors who use the tangible personal property or services in the performance of contracts for the improvement of University-owned real property as defined in Chapter 192, F.S.
(b) DISCOUNTS: Vendors are encouraged to reflect trade discounts in the unit prices quoted; however, vendors may offer a discount for prompt payment. Prompt payment discounts will not be considered in the bid award. However, every effort will be made to take the discount within the time offered.
(c) MISTAKES: Vendors are expected to examine the specifications, delivery schedule, bid prices, extensions, and all instructions pertaining to supplies and services. Failure to do so will be at vendor's risk. In case of a mistake in extensions the unit price will govern.
(d) INVOICING AND PAYMENT: Payment will be made by the University of Florida after the items awarded to a vendor have been received, inspected, and found to comply with award specifications, free of damage or defect and properly invoiced. All invoices shall bear the purchase order number. Payment for partial shipments shall not be made unless specified. An original invoice shall be submitted. Failure to follow these instructions may result in delay in processing invoices for payment. Payment shall be made in accordance with Section 215.422 (1) (2) F.S. VENDOR OMBUDSMAN: The University's vendor ombudsman, whose duties include acting as an advocate for vendors may be experiencing problems in obtaining payment from the University, may be contacted at 352-392-1241.
(e) ANNUAL APPROPRIATIONS: The University's performance and obligation to pay under any contract awarded is contingent upon an annual appropriation by the Legislature.
(f) CONDITION AND PACKAGING: It is understood and agreed that any item offered or shipped as a result of this bid shall be a new, current standard production model available at the time of this bid. All containers shall be suitable for storage or shipment, and all prices shall include standard commercial packaging.
(g) SAFETY STANDARDS: Unless otherwise stipulated in the bid, all manufactured items and fabricated assemblies shall comply with applicable requirements of Occupational Safety and Health Act and any standards hereunder.

5. CONFLICT OF INTEREST: The award hereunder is subject to the provisions of Chapter 112, F.S. All vendors must disclose with their bid the name of any officer, director, or agent who is also an employee of the University of Florida. Further, all vendors must disclose the name of any University employee who owns, directly or indirectly, an interest of five percent (5%) or more in the vendor's firm or any of its branches.

6. AWARDS: As the best interest of the University may require, the right is reserved to make award(s) by individual item, group of items, all or none or a combination thereof; to reject any and all bids or waive any minor irregularity or technicality in bids received. When it is determined there is no competition to the lowest responsible vendor, evaluation of other bids are not required. Vendors are cautioned to make no assumptions unless their bid has been evaluated as being responsive.

7. INTERPRETATIONS/DISPUTES: Any questions concerning conditions or specifications shall be directed in writing to Procurement Services. Inquiries must reference the date of bid opening and bid number. No interpretations shall be

considered binding unless provided in writing by the University in response to requests in full compliance with this provision.

8. NOTICE OF BID PROTEST BONDING REQUIREMENT; Any person or entity who files an action protesting a decision or an intended decision pertaining to a competitive solicitation shall at the time of filing the formal protest, post with the University a bond payable to the University in an amount equal to: 10% of the estimated value of the protestor's bid or proposal; 10% of the estimated expenditure during the contract term; $10,000.00; or whichever is less. The bond shall be conditioned upon the payment of all costs which may be adjudged against the person or entity filing the protest action. In lieu of a bond, the University may accept a cashier's check, bank official check or money order in the amount of the bond. FAILURE OF THE PROTESTING PERSON OR ENTITY TO FILE THE REQUIRED BOND, CASHIER'S CHECK, BANK OFFICIAL CHECK OR MONEY ORDER AT THE TIME OF THE FILING THE FORMAL PROTEST SHALL RESULT IN DENIAL OF THE PROTEST.

9. GOVERNMENTAL RESTRICTIONS: In the event any governmental restrictions may be imposed which would necessitate alteration of the material, quality, workmanship or performance of the items offered in this bid prior to their delivery, it shall be the responsibility of the successful vendor to notify the purchaser at once, indicating in writing the specific regulation which requires an alteration. The University reserves the right to accept any such alteration, including any price adjustments occasioned thereby, or to cancel the contract at no expense to the University.

10. LEGAL REQUIREMENTS: Applicable provision of all Federal, State, county and local laws, and of all ordinances, rules and regulations shall govern development, submittal and evaluation of all bids received in response hereto and shall govern any and all claims and disputes which may arise between person(s) submitting a bid response hereto and the University, by and through its officers, employees and authorized representatives, or any other person, natural or otherwise: and lack of knowledge by any vendor shall not constitute a cognizable defense against the legal effect thereof.

11. LOBBYING: Vendor is prohibited from using funds provided under any contract or purchase order for the purpose of lobbying the Legislature or any official, officer, commission, board, authority, council, committee, or department of the executive branch or the judicial branch of state government.

12. ADVERTISING: In submitting a bid, the vendor agrees not to use the results therefrom as a part of any commercial advertising. Vendor may not use the names, logos, or trademarks of the University, its employees, or affiliates without the prior written consent of the University.

13. ASSIGNMENT: Any contract or purchase order issued pursuant to this Invitation to Bid and the monies which may become due hereunder are not assignable except with the prior written approval of the purchaser.

14. LIABILITY: The vendor agrees to indemnify and save the University of Florida, the State of Florida and the Florida Board of Governors, their officers, agents, and employees harmless from any and all judgments, orders, awards, costs and expenses, including attorney's fees, and also all claims on account of damages to property, including loss of use thereof, or bodily injury (including death) which may be hereafter sustained by the vendor, its employees, its subcontractors, or the University of Florida, the State of Florida and the Florida Board of Governors, their officers, agents, or employees, or third persons, arising out of or in connection with any contract awarded and which are the result of the vendor's breach of contract or of the negligent acts of the vendor, its officers, agents, and employees. This clause does not apply to contracts between government agencies.

15. FACILITIES: The University reserves the right to inspect the vendor's facilities at any time with prior notice.

16. ADDITIONAL QUANTITIES: For a period not exceeding ninety (90) days from the date of acceptance of any offer by the University of Florida, the right is reserved to acquire additional quantities up to but not exceeding those shown on bid or the bid level at the prices bid in this invitation. If additional quantities are not acceptable, the bid sheets must be noted "BID IS FOR SPECIFIED QUANTITY ONLY".

17. SERVICE AND WARRANTY: Unless otherwise specified, the vendor shall define any warranty service and replacements that will be provided during and subsequent to this contract. Vendors must explain on an attached sheet to what extent warranty and service facilities are provided.

18. SAMPLES: Samples of items, when called for, must be furnished free of expense, on or before bid opening time and date, and if not destroyed, may upon request, be returned at the vendor's expense. Each individual sample must be labeled with vendor's name, manufacturer's brand name and number, bid number and item reference. Request for return of samples shall be accompanied by instructions which include shipping authorization and name of carrier and must be received with the bid. If instructions are not received within this time, the commodities shall be disposed of by the University.

19. INSPECTION, ACCEPTANCE AND TITLE: Inspection and acceptance will be at destination unless otherwise provided. Title and risk of loss or damage of all items shall be the responsibility of the contract supplier until accepted by the University, unless loss or damage results from negligence by the University. The contract supplier shall be responsible for filing, processing and collecting all damage claims. However, to assist him in the expeditious handling of damage claims, the University will:

(a) Record any evidence of visible damage on all copies of the delivering carrier's Bill of Lading.
(b) Report damage (Visible or Concealed) to the carrier and contract supplier confirming such reports in writing within 15 days of delivery, requesting that the carrier inspect the damaged merchandise.
(c) Retain the item and its shipping container, including inner packing material until inspection is performed by the carrier, and disposition given by the contract supplier.
(d) Provide the contract supplier with a copy of the carrier's Bill of Lading and damage inspection report.

20. PATENTS, COPYRIGHTS, TRADEMARKS, ROYALTIES and other Intellectual Property: The vendor, without exception, shall indemnify and save harmless the University and its employees from liability of any nature or kind, including cost and expenses for or on account of any copyrighted, patented, or unpatented invention, process, or article manufactured or used in the performance of the contract, including its use by the University of Florida. If the vendor uses any design, device, or materials covered by letters, patent or copyright, it is mutually agreed and understood without exception that the bid prices shall include all royalties or costs arising from the use of such design, device, or materials in any way involved in the work.

21. CONFLICT BETWEEN DOCUMENTS: If any terms and conditions contained within the documents that are a part of this ITB or resulting contract are in conflict with any other terms and conditions contained therein, then the various documents comprising this ITB or resulting contract, as applicable, shall govern in the following order of precedence: change order, purchase order, addenda, special conditions, general conditions, specifications, departmental description of work, and bid.

22. MANUFACTURERS' NAMES AND APPROVED EQUIVALENTS: Any manufacturer's names, trade names, brand names, information and/or catalog numbers listed in a specification are for information and not intended to limit competition. If bids are based on equivalent products, indicate on the bid form the manufacturer's name and number. Vendor shall submit with the bid, cuts, sketches, and descriptive literature, and/or complete specifications. Reference to literature submitted with a previous bid will not satisfy this provision. The vendor shall also explain in detail the reasons why the proposed equivalent will meet the specifications and not be considered an exception thereto. The University of Florida reserves the right to determine acceptance of item(s) as an approved equivalent. Bids which do not comply with these requirements are subject to rejection. Bids lacking any written indication of intent to quote an alternate brand will be received and considered in complete compliance with the specifications as listed on the bid form.

23. NONCONFORMANCE TO CONTRACT CONDITIONS: Items may be tested and/or inspected for compliance with specifications by any appropriate testing facilities. Should the items fail, the University may require the vendor to reimburse the University for costs incurred by the University in connection with the examination or testing. The data derived from any tests for compliance with specifications are public records and open to examination thereto in accordance with Chapter 119, F.S. Items delivered not conforming to specifications may be rejected and returned at vendor's expense. These items and items not delivered as per delivery data in bid and/or purchase order may result in vendor being found in default in which event any and all reprocurement costs may be charged against the defaulting vendor. Any violation of these conditions may also result in the vendor's name being removed from the University of Florida's vendor file.

24. PUBLIC RECORDS: Any material submitted in response to this Invitation to Bid will become a public document pursuant to Section 119.07 F.S. This includes material which the responding vendor might consider to be confidential or a trade secret. Any claim of confidentiality is waived upon submission, effective after opening pursuant to Section 119.07 F.S.

25. DELIVERY: Unless actual date of delivery is specified (or if specified delivery cannot be met), show number of days required to make delivery after receipt of purchase order in space provided. Delivery time may become a basis for making an award (see Special Conditions). Delivery shall be within the normal working hours of the University of Florida, Monday through Friday, unless otherwise specified.

26. PUBLIC PRINTING - PREFERENCE GIVEN PRINTING WITHIN THE STATE: The University of Florida shall give preference to vendors located within the state when awarding contracts to have materials printed, whenever such printing can be done at no greater expense than, and at a level of quality comparable to, that obtainable from a vendor located outside of the state.

(a) CONTRACTS NOT TO BE SUBLET: In accordance with Class B Printing Laws and Regulations "Printing shall be awarded only to printing firms. No contract shall be awarded to any broker, agent, or independent contractor offering printing manufactured by other firms or persons."
(b) DISQUALIFICATION OF VENDOR: Reasonable grounds for believing that a vendor is involved in more than one bid for the same work will be cause for rejection of all bids in which such vendors are believed to be involved. Any or all bids will be rejected if there is reason to believe that collusion exists between vendors. Bids in which the prices obviously are unbalanced will be subject to rejection.
(c) TRADE CUSTOMS: Current trade customs of the printing industry are recognized unless accepted by Special Conditions or Specifications herein.
(d) COMMUNICATIONS: It is expected that all materials and proofs will be picked up and delivered by the printer or his representative, unless otherwise specified. Upon request, materials will be forwarded by registered mail.
(e) RETURN OF MATERIAL: All copy, photos, artwork, and other materials supplied by the University of Florida must be handled carefully and returned in good condition upon completion of the job. Such return is a condition of the contract and payment will not be made until return is affected.

27. E-VERIFY COMPLIANCE. Agency is obligated to comply with the provisions of Section 448.095, Fla. Stat., "Employment Eligibility." Compliance with Section 448.095, Fla. Stat., includes, but is not limited to, utilization of the E-Verify System to verify the work authorization status of all newly hired employees. Vendor affirms and represents that it is registered with the E-Verify system and are using same, and will continue to use same as required by Section 448.095, Fla. Statute.

END OF SECTION

Bid Number: ITB23KO-105

Title: Reitz Lawn and Inner Road Utility and Roadway Improvements

UF Project Numbers: UF-644, UF-644A and UF-644B

AUTHORIZED REPRESENTATIVES AND CONTACT INFO:

UF PROCUREMENT SERVICES:
Karen Olitsky
971 Elmore Drive / PO Box 115250
Gainesville, FL 32611-5250
(352) 294-1163
kolitsk@ufl.edu

NON-TECHNICAL SPECIFICATIONS TABLE OF CONTENTS

00020 - INVITATION TO BID

The Invitation to Bid shall be in accordance with the University of Florida, Procurement Services "Invitation to Bid Acknowledgement Form" with all relevant information provided therein.

END OF SECTION

00100 - INSTRUCTIONS TO BIDDERS

1.1 RELATED SECTIONS

A. Documents affecting the work of this Section include, but are not necessarily limited to, the General Terms & Conditions and other Sections in Divisions 0 and 1 of these Specifications.

1.2 THE WORK

PROJECT TITLE: Reitz Lawn and Inner Road Utility and Roadway Improvements

1.3 SECURING DOCUMENTS

Copies of the proposed Contract Documents may be obtained from:

University of Florida Procurement Services website.
https://procurement.ufl.edu/vendors/schedule-of-bids/

1.4 BID FORM

To be considered responsive and responsible, make bids in strict accordance with the following:

A. Make bids upon the forms provided, properly signed and with all items completed. Do not change the wording of the bid form and do not otherwise alter or add words to the bid form. Unauthorized conditions, limitations, or provisions attached to the bid may be cause for rejection of the bid.

B. Include with bid a completed and signed Invitation to Bid Construction Acknowledgment Form.

C. Include qualifications and references as described below in 1.6 Proof of Competency and Qualification of Bidders.

D. Include completed Section 00310 - Bid Form.

E. Include list of subcontractors as described below in 1.7 Subcontractors.

F. **Bids must be submitted no later than September 8, 2022 at 3:00 PM, local time**. No bids received after the time fixed for receiving them will be considered. Late bids will be returned to the bidder unopened.

G. Address bids to Karen Olitsky, Procurement Agent III, and deliver to:

University of Florida
Procurement Services
971 Elmore Drive / PO Box 115250
Gainesville, FL 32611-5250

Submit bid in a sealed envelope that includes the bid number, contractor name and date and time of the bid opening on the outside of the envelope. Submit one (1) original bid and one (1) electronic copy on flash drive or CD/DVD. It is the sole responsibility of the bidder to see that bids are received on time. Faxed and/or emailed bids will not be accepted.

1.5 WITHDRAWAL OF BIDS

A. A bidder may withdraw their bid, either personally or by written request, at any time prior to the scheduled time for opening bids.

B. No bidder may withdraw their bid for a period of 90 calendar days after the date set for opening thereof, and bids shall be subject to acceptance by the Owner during this period.

1.6 PROOF OF COMPETENCY AND QUALIFICATION OF BIDDERS

A. A bidder may be required to furnish evidence, satisfactory to the Owner, that the bidder and the bidder's proposed subcontractors have sufficient means and experience in the types of work required to assure completion of the Contract in a satisfactory manner.

B. A contract will be awarded only to a responsible, properly licensed, bidder, qualified by appropriate experience, with the ability, capacity, skill and financial resources to perform the work specified.

C. Bidder should submit, with their bid, the following documentation:

1. Evidence that bidder is licensed by the appropriate government agency to perform the work specified and in good standing at the time of the receipt of bids.

2. List and briefly describe five (5) projects of similar size and/or complexity which have been satisfactorily completed over the last five (5) years, including location, dates of contracts, names of contracts, and names, addresses, phones and emails of Owners.

3. References:

   a. Trade References

   b. Bank References

   c. Surety

      - Name of bonding company
      - Name and address of agent
      - Proof that surety and/or its agent is licensed to conduct business in the State of Florida and has a Best Rating of “A” and a financial size of “Class X” or better.
      - Letter from Surety or its agent licensed to do business in Florida verifying the bidder’s capability to provide performance and payment bonds for this project.
      - Letter stating whether or not, within the past five (5) years, a contract or any portion of the Work connected to a contract was completed by the Owner or the applicant’s Surety. If so,

attach an explanation providing the name and location of the project, the name and address of the owner's representative and all pertinent details of the matter.

1.7 SUBCONTRACTS

If the Bidder intends to subcontract any of the Work:

A. Each bidder shall furnish with its bid a list of all subcontractors for subcontracted scopes/packages of work valued at more than $10,000.

B. This list shall identify, for each subcontracted package in excess of $10,000, the name and address of the proposed subcontractor and the approximate value of the subcontract.

C. If the bidder does not intend to subcontract portions of the Work in amounts greater than $10,000, then a statement to that affect shall be furnished with the bid.

D. Each subcontractor performing work more than $10,000 must present evidence of being qualified in and licensed for the applicable trade. Such proof of subcontractor licensure shall be provided by the successful bidder after award, but prior to commencement of Work.

1.8 PERFORMANCE AND PAYMENT BONDS

See General Terms & Conditions, Article 20.

1.9 BID DEPOSIT

Not required.

1.10 AWARD OR REJECTION OF BIDS

The Contract, if awarded, will be awarded to the responsible and responsive bidder who has proposed the lowest Contract Sum, subject to the owner's right to reject any or all bids and to waive informality and irregularity in the bids and in the bidding. Alternates may be accepted in any order or not at all. Acceptance or rejection of any bid will be at the owner's sole discretion.

1.11 MANDATORY PRE-BID CONFERENCE:

A mandatory Pre-bid Conference will be held prior to the scheduled bid opening for the purpose of considering questions posed by bidders. The conference is open to interested bidders, prospective subcontractors, and any other interested parties. This conference will be held **August 16, 2022 at 12:00 PM, local time. The conference will begin promptly at 12:00 PM on the corner of Newell Drive and Inner Road on the University of Florida campus, Gainesville, Florida.**

1.12 EXECUTION OF AGREEMENT

A. A Purchase Order (PO) will be issued for purposes of fiscal encumbrance and payment.

B. The contract will consist of UF's "Owner-Contractor Agreement" and the PO. The terms and conditions contained in both documents are non-negotiable.

C. Upon notice of Bid Award, the bidder to whom the Contract is awarded shall deliver to UF those Certificates of Insurance and Payment & Performance Bonds required by the Contract

Documents.

D. Bonds and Certificates of Insurance shall be approved by UF before the successful bidder may proceed with the Work.

1.13 INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING

A. If any person contemplating submitting a bid for construction of the Work is in doubt as to the true meaning of any part of the Contract Documents, or finds discrepancies in or omissions from any part of the Contract Documents, they may submit a written request for interpretation thereof no later than **August 23, 2022 at 5:00 PM**, local time, to Karen Olitsky, Procurement Agent III at kolitsk@ufl.edu. The person submitting the request shall be responsible for its prompt delivery.

B. Interpretations or corrections of proposed Contract Documents will be made only by Addendum and will be available on the Procurement Services "Schedule of Bids" webpage https://procurement.ufl.edu/vendors/schedule-of-bids/. The Owner will not be responsible for any other explanations or interpretations of the proposed Contract Documents.

1.14 TIME OF COMPLETION:

A. See project-specific schedule requirements in the attached 100% Construction Documents, Section 01 31 00 Construction Schedules, 2.1.G.

END OF SECTION

00310 - BID FORMS

BID PROPOSAL

FROM: _____
(Name of Bidder)

TO: UNIVERSITY OF FLORIDA
PROCUREMENT SERVICES
971 Elmore Drive
P.O. Box 115250
Gainesville, Florida 32611-5250

The undersigned, hereinafter called "Bidder", having reviewed the Contract Documents for the Project entitled **ITB23KO-105 Reitz Lawn and Inner Road Utility and Roadway Improvements** and having visited and thoroughly inspected the site of the proposed Project and familiarized himself/herself with all conditions affecting and governing the construction of said Project, hereby proposes to furnish all labor, materials, equipment and other items, facilities and services for the proper execution and completion of the Project, in strict compliance with the Contract Documents, Addenda, and all other Documents relating thereto on file in Procurement Services, and, if awarded the Contract, to complete the said Work within the time limits called for in the Documents and as stated herein, for the sums as enumerated on this and the following pages:

BASE BID:

_____Dollars

Figures: $_____

ALTERNATE #1:
ADD OR DEDUCT (CIRCLE ONE)

_____Dollars

Figures: $_____

ALTERNATE #2:
ADD OR DEDUCT (CIRCLE ONE)

_____Dollars

Figures: $_____

ALTERNATE #3:
ADD OR DEDUCT (CIRCLE ONE)

_____Dollars

Figures: $_____

ADDENDA:
Receipt of the following Addenda to the Construction Documents is acknowledged:

ADDENDUM #_____ Dated _____

ADDENDUM #_____ Dated _____

ADDENDUM #_____ Dated _____

COMPLETION DATE:

All Work covered by the Bidding Documents and the foregoing Base Bid shall be completed and ready for Owner's occupancy as specified in the contract documents.

SIGNATURE:

I hereby certify that for all statements and amounts herein made on behalf of

_____
(Name of Bidder)

a (Corporation) (Partnership) (Individual) organized and existing under the laws of the State of Florida, I have carefully prepared this Bid Proposal from Contract Documents described hereinbefore, I have examined Contract Documents and local conditions affecting execution of Work before submitting this Bid Proposal, I have full authority to make the statements and commitment herein and submit this Bid Proposal in (its) (their) behalf, and all statements are true and correct.

Signed this_____day of_____, 2022.

_____
(Signature of Bidder)

_____ _____
(Print Name) (Title)

END OF SECTION

REITZ LAWN INNER ROAD IMPROVEMENTS

UF-644 – INNER ROAD AND US HIGHWAY 441 SURFACE TREATMENTS

UF-644A – INNER ROAD UNDERGROUND UTILITIES IMPROVEMENTS

UF-644B – REITZ LAWN UNDERGROUND UTILITIES IMPROVEMENTS

UF | UNIVERSITY of FLORIDA

Specifications

JUNE 10, 2022

100% CONSTRUCTION DOCUMENTS

RMF Engineering
Reliability. Efficiency. Integrity.

5520 Research Park Dr. 3rd Flr.
Baltimore, Maryland 21228

OFFICE 410.576.0505
WEB rmf.com

PROJECT MANUAL

INCLUDING SPECIFICATIONS FOR

PROJECT: REITZ LAWN INNER ROAD IMPROVEMENTS
UF-644 – INNER ROAD AND US HIGHWAY 441 SURFACE TREATMENTS
UF-644A – INNER ROAD UNDERGROUND UTILITIES IMPROVEMENTS
UF-644B – REITZ LAWN UNDERGROUND UTILITIES IMPROVEMENTS

SUBMISSION: 100% CONSTRUCTION DOCUMENTS

UF PROJECT NO: UF-644, UF-644A, UF-644B

DATE: 06/10/2022

PREPARED BY: RMF ENGINEERING, INC.
5520 RESEARCH PARK DRIVE
BALTIMORE, MD 21228

PREPARED FOR: UNIVERSITY OF FLORIDA
PLANNING, DESIGN & CONSTRUCTION DIVISION
245 GALE LEMERAND
GAINESVILLE, FL 32611-5050

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DIVISION 07 - THERMAL AND MOISTURE CONTROL

SECTION 00 81 00 - VENDOR DIVERSITY

1.1 The University of Florida is an equal opportunity institution and, as such, encourages the use of small businesses, woman-owned businesses, and minority-owned businesses in the provision of construction-related services. Such businesses should have a fair and equal opportunity to compete for dollars spent by the University of Florida to procure construction-related services. Competition ensures that prices are competitive and a broad vendor base is available.

1.2 The Builder shall use good faith efforts to ensure opportunities are available to small, woman-owned, and minority-owned businesses on the Project.

1.3 Contact the UF Division of Small Business and Vendor Diversity Relations for more information.

END OF SECTION 00 81 00

SECTION 00 84 20 - SAFETY REQUIREMENTS

1.1 HEALTH AND SAFETY REQUIREMENTS

A. Builders shall ensure that all activities carried out on behalf of the University or on University property are in compliance with all applicable Federal, state and local regulations (OSHA, EPA, FDEP) pertaining to worker and site safety.

B. The Builder shall have a written health and safety program that outlines safe work practices and procedures expected to be followed by workers and shall have it available for review by the University's project manager or by representatives of the Environmental Health and Safety division upon request. Project managers and superintendents/supervisors shall have obtained an OSHA 30-hour Construction Safety Outreach Training card within 5 years of the date of the applicable project. The Builder is solely responsible for ensuring that all workers have received any required safety-related training. Training documentation shall be made available for review upon request.

C. The Builder shall have a competent person or persons as defined by OSHA 29CFR1926.32(f) on the job site to monitor hazardous work activities such as, but not limited to, crane operations, electrical safety, excavations, fall protection, scaffolding, and confined space entry.

D. The Builder shall have an updated Safety Data Sheet (SDS) for all chemical products used on the job site. The SDSs shall be readily accessible to all project workers and to University staff on request. If the use of any chemical product has the potential for harmful exposure to University of Florida staff, students or visitors, UF Environmental Health and Safety (EH&S) shall be notified and exposure controls will be discussed prior to the use of that chemical product.

1.2 HAZARDOUS SUBSTANCES

A. Refer to the General Terms & Conditions.

1.3 TRENCH SAFETY ACT

A. It is the responsibility of the Builder to comply with F.S. 553.60.

END OF SECTION 00 84 20

SECTION 00 90 20 - PUBLIC ENTITY CRIMES

1.1 Per F.S. 287.133, any person or affiliate who has been placed on the convicted vendor list by the Florida Department of Management Services may not submit a bid on a contract to provide any goods or services – including construction, repairs, or leases – and may not be awarded or perform work as a contractor (Builder), supplier, subcontractor, or consultant for the University of Florida for a period of 36 months from the date of being placed on the convicted vendor list. A "person" or "affiliate" includes any natural person or any entity, including predecessor or successor entities or an entity under the control of any natural person who is active in its management and who has been convicted of a public entity crime.

END OF SECTION 00 90 20

SECTION 00 90 30 - ASBESTOS

1.1 BACKGROUND

A. Asbestos is a confirmed human carcinogen that was previously used in many different types of building materials. It is important to note that asbestos in an undisturbed state is not considered hazardous. Due to the potential hazards associated with asbestos exposure if the material becomes airborne, Federal and State regulations are in place to control activities impacting asbestos containing materials. Various asbestos products can still be found in University of Florida buildings.

1.2 SURVEYS

A. An asbestos survey meeting the requirements of Federal and State regulations shall be completed prior to the commencement of any renovation, remodeling, or demolition project involving a University-owned building, a component of a University-owned building, or a building scheduled to be purchased by the University. A survey is required regardless of the age of the building. Asbestos surveys must be conducted by a Florida Licensed Asbestos Consultant (LAC) or their appointed representative.

B. All surveys are required to be submitted to EH&S for review prior to the start of a construction project. EH&S reserves the authority to reject a survey based on incomplete content or failure to follow regulatory requirements.

C. A limited survey, based on a review of the project scope of work, may be authorized by UF Environmental Health and Safety (EH&S).

D. A copy of the completed asbestos survey must be kept on site for the duration of a construction project.

1.3 ASBESTOS REMOVAL

A. Any removal or altering of asbestos containing material must be completed by a licensed asbestos abatement contractor.

B. Asbestos-containing roofing may be removed by a State-certified or registered roofing contractor provided that all removal activities are performed under the direction of an onsite roofing supervisor. The supervisor must remain on site at all times while removal activities are taking place. The supervisor is required to have completed an approved asbestos roofing course prior to engaging in the removal of asbestos containing roofing materials, and copies of training documentation shall be provided to EH&S before job commencement.

C. All activities involving the removal of asbestos containing materials require the submission of an Asbestos Project Notification Form (APNF) to Environmental Health and Safety at least ten days prior to the start of an asbestos project.

D. The asbestos abatement contractor or demolition contractor actually performing the work is responsible for submitting an additional notification to the designated regulatory authority, typically either the Florida Department of Environmental Protection or the Florida Department of Business and Professional Regulation.

END OF SECTION 00 90 30

SECTION 01 01 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, and Division 1 Specification Sections, apply to this Section.

1.2 RELATED TRADES

A. The Contractor is responsible for providing all trades per the requirements listed in the specifications manual, on the drawing sheets, and as necessary to complete the project.

1.3 WORK COVERED

A. This section includes the following:

1. Work covered by the Contract Documents
2. Instructions
3. Use of premises
4. University occupancy requirements
5. Work restrictions
6. Specification formats and conventions
7. Scope of Work

1.4 WORK COVERED BY THE CONTRACT DOCUMENTS

A. Project Identification: Reitz Lawn Inner Road Improvements

1. UF-644 – Inner Road and US Highway 441 Surface Treatments
2. UF-644A – Inner Road Underground Utilities Improvements
3. UF-644B – Reitz Lawn Underground Utilities Improvements
4. The Work covered by the Contract Documents identified as UF-644, UF-644A and UF-644B are funded by multiple funding sources. An additional “Project” may be added due to funding needs. Therefore, the Work will be segregated to different “Projects” for billing and documentation purposes. As a result, multiple monthly pay applications will be required. The Contractor shall work with the Owner and Architect/Engineer during Contract negotiations and/or prior to Pay Application #1 to define the scopes of work and develop the Schedule of Values for each “Project”. Also, as a result of the

bidding process, the allocation of the scopes of work for each "Project" as identified in paragraphs 1.4.E.1., 1.4E.2., 1.4.E.3., and 1.4.E.4 of this section, may change.

B. Project Location: University of Florida, Gainesville, FL

C. Owner: University of Florida, Planning, Design & Construction Division, 245 Gale Lemerand, Gainesville, FL 32611-5050

1. University Project Manager: Tom Feather

D. Architect/Engineer: RMF Engineering Inc., 5520 Research Park Drive, Baltimore, MD 21228.

E. Work shall consist of the following:

1. UF-644 – Inner Road and US Highway 441 Surface Treatments

a. Conversion of Inner Road from one-way eastbound traffic to two-way traffic.
b. Modification of Inner Road and Newell Drive Intersection.
c. Modification of Inner Road and US 441/SR 25/SW 13th Street Intersection.
d. Hardscape and landscape improvements along Inner Road.
e. Alternate #1 – Pedestrian Drop-off Area at Fine Arts.

2. UF-644A – Inner Road Underground Utilities Improvements

a. New steam manholes to replace existing steam manholes SM-3D3-14, SM-3D3-15, SM-3D3-16, SM-3D3-18, SM-3D3-21, SM-3D3-23, SM-3D3-24/25.
b. Replacement of existing steam distribution and condensate return system from SM-3D3-8 to the west side of the SW 13th Street pedestrian tunnel.
c. Safety improvements to the steam system within the SW 13th Street pedestrian tunnel.
d. All disturbed areas outside of the Inner Road Improvements will be restored to pre-existing conditions.

3. UF-644B – Reitz Lawn Underground Utilities Improvements

a. Rehabilitation of steam manholes SM-3D4-53 and SM-3D3-12.
b. New steam manholes to replace existing steam manholes SM-3D3-1/3, SM-3D3-6, and SM-3D3-8.
c. Replacement of existing steam distribution and condensate return system from SM-3D4-53 to SM-3D3-12.
d. Replacement of electrical cabling connecting to EL-17.
e. New electrical ductbank along Inner Road for future use.
f. Hardscape/flatwork (sidewalk) improvements in accordance with LMP within project limits in Reitz Union Lawn that is disturbed by the utility installation.
g. New 10" reclaimed water pipe from Reitz Lawn to east of Steinbrenner Band Building, connecting to existing system on either end.

h. New chilled water supply and return piping from CW-3D3-12 to CW-3D3-20 to south side of Inner Road for future use.
i. Alternate #3 – Chilled Water Insulation Deduct.

4. Alternate #2 – Electric to Norman Lawn

1.5 INSTRUCTIONS

A. University of Florida Division 00 and 01 documents use the term “Builder”. The word “Contractor” in these documents has the same meaning as “Builder”.

B. The Contractor shall review the complete set of Contract Documents for this project prior to bidding. There will be no changes to the Contract for missed Scope of Work.

C. The Contractor is strongly encouraged to visit the site during the bidding period.

D. All correspondence shall be communicated through the University Project Manager.

E. The word “provide” means to furnish and install.

F. Construction must be supervised by a competent superintendent when any work is being performed. This includes any subcontracted work.

G. Contractor is required to clean site and laydown areas daily. Work areas shall be broom cleaned.

H. All materials needed for the project shall be neatly stacked and organized.

I. No connections or utilities will be provided for a construction trailer or office.

1.6 USE OF PREMISES

A. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to Contract limits.
2. University Occupancy: Allow for University occupancy of Project site and use by the public.
3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to University, University's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.7 UNIVERSITY'S OCCUPANCY REQUIREMENTS

A. Full University Occupancy: University will occupy portions of the premises during entire construction period, including areas under construction. Cooperate with University during construction operations to minimize conflicts and facilitate University usage. Perform the Work so as not to interfere with University's operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways and other adjacent occupied or used facilities including electrical rooms freight elevators, and similar items. Do not close or obstruct walkways or other occupied or used facilities without written permission from University and authorities having jurisdiction.
2. Provide not less than 14 days notice to University of activities that will affect University's operations.

1.8 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed on site during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except as otherwise indicated. The Contractor can work later with the prior written approval of the University.

1. Weekend Hours: 8:00 a.m. to 7:00 p.m., Saturday and Sunday.
2. Early Morning Hours: Not before 7:00 a.m.
3. Hours for Utility Shutdowns: Weekends or holidays in June, July, or August for critical utilities and during normal weekday work hours for non-critical utilities.
4. Hours for Core Drilling and other noisy activities: During normal weekday work hours.
5. Contractor must be aware and plan work around campus activities (i.e.: home football games, student move-in, etc.). Contractor work shall not occur during home football games or student move-in.
6. Contractor shall coordinate their work with the University so that it does not interfere with other University activities, operations, and adjacent construction projects in the area.

B. Existing Utility Interruptions

1. Do not interrupt utilities serving facilities occupied by University or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
2. Notify Engineer and University not less than 14 days in advance of proposed utility interruptions.
3. Do not proceed with utility interruptions without Engineer's and University's written permission.

1.9 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

A. The Contractor is responsible for: all demolition and new work shown on the entire set of drawings including all general notes, drawing notes and coded notes; as described in the specifications and any additional items listed herein. Contractor is also responsible for temporary utilities and facilities necessary for the scope of work including provisioning, transport, obtaining permits, and coordination.

B. In addition to maintaining current access, other projects within or adjacent to the project area are anticipated to be in construction or awarded for construction during the project. Contractor is responsible for ensuring that sequencing and/or maintenance of traffic do not impede progress of other projects. Contractor shall request site plans of other projects from the University Project Manager (of this contract) and coordinate work areas that interfere with other projects.

C. Provide, maintain and remove temporary barricades and other forms of protection to protect University and tenants and general public from injury due to construction work performed by Contractor.

D. Contractor is responsible for legally disposing of all materials removed at off-site facilities. Removed and unused material is not permitted to be stockpiled on site and shall be promptly removed from the site.

E. Vehicles parked on-site without a valid permit will not be tolerated. Contractor must apply for and purchase all permits necessary for vehicles needed during the project. See Contractor Parking Information section in this Project Manual.

F. Contractor is responsible for all field layout, measurements, and engineering required to complete the work in compliance with the specifications and drawings.

G. Contractor is to protect and maintain work performed as part of this Contract until accepted by the University and/or Engineer.

END OF SECTION 01 10 00

SECTION 01 01 10 - PROJECT PHASING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and provisions of the Contract including General and Supplementary General Conditions and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. The intent of this Section is to:

1. Identify the general requirements for the Contractor's Site Construction Phasing Plan.
2. Identify major tie-ins to existing systems and inform the Contractor of known restrictions that will affect the timing of the Contractor's work and provide general phasing guidelines. The Contractor ***may not*** elect to perform sequences shown on the drawings in a different manner than what is proposed without approval by the Owner. All phasing within sequences as well as sequences must be reflected in the construction schedule and approved by the Owner prior to proceeding.

B. Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

C. Some Work in this Section is included in Alternates. Refer to Section 01 23 00 – ALTERNATES.

1.3 SITE CONSTRUCTION PHASING PLAN

A. The Contractor shall prepare a Site Construction Phasing Plan. This plan will be prepared in accordance to the latest edition of the Manual Uniform Traffic Control Devices. The plan shall include maintenance of traffic for pedestrian and vehicular traffic for each construction phase.

B. The Site Construction Phasing Plan will be coordinated with the Construction Schedule.

C. The Site Construction Phasing Plan shall be prepared taking into account/addressing the following, but not limited to:

1. The following dates:

a. 2022 Fall Semester Move In: August 18 – August 22, 2020. **NO WORK ALLOWED.**

b. 2022 Fall Semester Holidays: November 11, November 24 – November 25, 2022. Construction activities allowed, **no inspections**.
c. 2022 Homecoming: TBD. **Limited Work Hours.**
d. 2022 Fall Reading Days: December 8 – December 9, 2022. **No noise 8pm – 10am, no vibratory work.**
e. 2022 Fall Exams: December 10 – December 16, 2022. **No noise 8pm – 10am, no vibratory work.**
f. 2022 Fall Commencement: December 16 – December 17, 2022.
g. 2022 Fall Semester Move Out: December 10 – December 17, 2022.
h. 2023 Spring Semester Move In: January 2 – January 9, 2023. **Limited Work Hours.**
i. 2023 Holidays: January 16, May 29, July 4, September 4, November 10, November 22 – November 25, 2023. Construction activities allowed, **no inspections.**
j. 2023 Spring Reading Days: April 27 – April 28, 2023. **No noise 8pm – 10am, no vibratory work.**
k. 2023 Spring Exams: April 29 – May 5, 2023. **No noise 8pm – 10am, no vibratory work.**
l. 2023 Spring Commencement: May 5 – May 7, 2023.
m. 2023 Spring Semester Move Out: April 29 – May 7, 2023.
n. Fall Semester Move In: August 16 – August 20, 2023. **NO WORK ALLOWED.**
o. 2023 Homecoming: TBD. **Limited Work Hours.**
p. 2023 Fall Reading Days: December 7 – December 8, 2023. **No noise 8pm – 10am, no vibratory work.**
q. 2023 Fall Exams: December 9 – December 15, 2023. **No noise 8pm – 10am, no vibratory work.**
r. 2023 Fall Commencement: December 15 – December 16, 2023.
s. 2023 Fall Semester Move Out: December 9 – December 16, 2023.

2. The Contract C-6 series drawings “Phasing and Traffic Control” which consist of:

   a. General pedestrian, including ADA route/movement around each construction phase; and accessible pedestrian, ADA, and emergency response routes to/from:

      1) Marston Science Library
      2) Aquatic Food Pilot Plant
      3) Food Science & Human Nutrition
      4) Field and Fork Food Pantry
      5) Rinker Hall
      6) Steinbrenner Band Building
      7) Broward Hall
      8) Architecture Building
      9) Broward Dinning Facility
      10) Fine Arts Building
      11) Mallory Hall

12) Reid Hall
13) Yulee Hall
14) Crossing and along Inner Road

b. Building emergency exits
c. Disconnection of emergency blue phones
d. Access to fire department connections (FDC) and post indicator valves (PIV)
e. Maintaining traffic (pedestrian and vehicular) during the construction within Newell Drive
f. Phasing of the construction in Inner Road

1) Vehicle, loading areas/docks, deliveries, and solid waste handling truck access at:

a) Fine Arts Building
b) Rinker Hall/Broward Hall
c) Broward Dinning Facility
d) Mallory Hall
e) Reid Hall

g. Vehicle, loading areas/docks, deliveries, and solid waste handling truck access at:

1) Marston Science Library
2) Aquatic Food Pilot Plant
3) Food Science & Human Nutrition
4) Field and Fork Food Pantry

h. A temporary shuttle bus stop adjacent to existing steam manhole SM-3D3-12.

D. If Alternate #2, Electric to Norman Lawn is accepted, the Site Construction Phasing Plan and the Construction Schedule shall factor in that formal approval/permitting/obtaining easement (permit or temporary) must be obtained from the Florida Department of Transportation (FDOT) prior to any construction activities within the FDOT SW 13th Street (US Highway 441) right of way.

1.4 OWNER STEAM AND CHILLED WATER OPERATIONS

A. Steam is used in campus buildings for heating, for generating domestic hot water, re-heat for air conditioning, and for various process loads such as sterilizers and other critical services within each building. Chilled water is used in campus buildings for cooling. Maintaining adequate service to support the demand of all of these services is required. Due to seasonal temperatures, the period of lowest steam demand is in the shoulder months of spring and fall when ambient temperatures are mild. The UF campus has a large steam demand in the summer due to re-heat. The chilled water demand is highest in the

summer months. Steam and chilled water availability is critical all year long. Construction activities shall be scheduled and performed in a manner to avoid any disruption of any service except as described in this Section.

B. In accordance with the restrictions stated in this Section, temporary shutdown or isolation of portions of systems may be allowed when appropriately planned, requested, and approved.

C. GENERAL

1. The Contractor shall notify the Owner whenever piping must be shut down or removed. The Contractor shall follow the Contractor's submitted OSHA compliant lock-out/tag-out procedures and comply with any additional Owner requirements. The actual shut down of equipment will be performed by the Owner's personnel. The Owner will energize and deenergize the Owner's piping and operate valves in coordination with the Contractor's work. The Contractor shall never open or close any valve where live steam or chilled water is present. The Contractor shall not use any water for filling for hydrostatic testing or cleaning until approved by the Owner each time.

    a. In most cases, phasing assumes single valve isolation. If the Contractor requires more than single valve isolation, provide temporary blind flanges or isolation valves and remove them when the outage work is complete. No additional outages or outage time will be granted for the blind flange and valve work.

2. Unless specifically stated on the drawings, hot tapping (also known as wet tapping) is prohibited for this project for phasing or otherwise. Note there is at least one instance that hot tapping is required for this project to maintain service to critical buildings.
3. Temporary piping, fittings, valves, insulation, and pipe supports for project phasing do not have to be new, but it shall satisfy the specification requirements. The Contractor shall be responsible to maintain all temporary piping. All temporary piping shall be removed prior to final completion.
4. Owner personnel must have access to all active piping and equipment in the manholes during each phase of construction. Provide OSHA compliant ladders and temporary access platforms to allow Owner personnel access to equipment. Train Owner staff on safety procedures for using Contractor's temporary access components.
5. Keep water out of manholes – both existing and new. Never allow any manhole to flood, regardless of how large of a rain event. Cover all manholes. Provide sump pumps if water has a chance of entering. Protect all existing and new insulation and new direct buried underground steam and condensate piping systems from water.
6. All disciplines (including abatement and demolition activities) shall coordinate tightly for all work.
7. The Contractor is required to provide a detailed phasing plan for the work. Provide this schedule in the time specified in the General Requirements of the Contract. This will include a very detailed "critical path" schedule showing phasing. The Contractor shall walk through the entire phasing, item by item (including all civil related work and

mechanical work, how work will occur in manholes and keep buildings on line throughout the project, how condensate will be returned, and how trapped condensate will continue to function) with the Engineer and the Owner to demonstrate the understanding of the systems and how the work is to be phased. Prior to beginning any major work requiring phasing, the Contractor shall obtain written approval from the Owner before any outage work can occur. Written acceptance will not be given until a phasing plan is established, these walk-throughs occur, and both are deemed acceptable. In addition, written acceptance will not be granted until all related submittals are approved and there is assurance that all materials will be on-site when it is their time to be installed. Under no circumstance should work be phased where a building does not have steam, condensate, or chilled water service with no work being performed without a scheduled reason. It is extremely important that the Contractor include and constantly update the critical path in the scheduling.

D. ISOLATION VALVE TESTING REQUIRED FOR PHASING

1. Existing isolation valves shall be utilized to isolate piping segments during the construction phasing. The Contractor shall schedule with the Owner the time to exercise and verify the shutoff capability of all isolation valves required to operate and perform during construction activities prior to needing to rely on the valve(s) to hold for tie-in work. Any valve or valves not allowing tight shutoff are to be immediately reported to the Engineer and Owner so that they can witness the failed service of the shutoff valve. If a valve is found to not provide tight shut-off service, the Engineer will provide further direction. This may include replacing the failed valve or making a hot tap connection. It is the responsibility of the Contractor that testing of the existing valves occurs early in the construction activities so that proper planning can be made. Schedule the testing to occur within the first 30 calendar days after Notice to Proceed.

E. Outages

1. Entire Plant Outage: There are no scheduled outages of the entire steam or chilled water distribution systems. None will be granted for this project.
2. Individual Building Outages:

    a. The scheduling of building outages is dependent on weather. The scheduling of each outage is solely at the discretion of the Owner who will communicate with the Contractor and provide 3 days' notice of when the outage will begin. The Contractor shall request and coordinate outage. The Owner has the right to cancel a scheduled outage at any time prior to the outage.
    b. Most steam outages should be scheduled for mild periods of weather in the spring and fall which are the months of March, April, May, September, October, and November. Some may be granted in the summer, but it depends on the building demand for reheat or steam for process loads such as cooking. Chilled water outages should be scheduled for the winter months of December, January, and February. Outage periods will be limited in time and overtime work

by the Contractor is expected to fully man the work until the outage required work is completed. The outage period will begin when the Owner valves off the system(s). Time to de-pressurize, drain, vent, empty, and cool down is included in the stated allowable outage periods. For bidding purposes, The Contractor should consider that the Owner will force outage periods to be scheduled on weekends, holiday periods, and night times. The quantity of outage for each building and segment need to be limited. The Contractor shall have the foresight to schedule as many items in the outage period as possible to minimize the number of outages.

c. Manpower: Each outage shall be fully manned throughout the duration of the outage. The Contractor shall work straight through the outage to minimize the outage time. The Contractor shall provide adequate assurance that the work can be performed in the allotted outage period.
d. Outages cannot be scheduled until the phasing plan has been submitted and approved. Outages cannot begin until the Contractor shows all materials and labor forces are on-site for the outage.

F. GENERAL PHASES DESCRIPTION

1. A detailed phasing plan has been created for steam, condensate, and chilled water. Work shall be phased and coordinated to minimize shutdowns/outages to all affected buildings/end users. In addition to the installation of the steam, condensate, and chilled water piping, phasing shall be coordinated to minimize the impact to the campus life (events, pedestrians, vehicles, etc.).
2. Phasing work is captured in the mechanical drawings in “PHX-XXX” series drawings, whereby the first X is the phase number, the second X is 4 for demolition and 5 for new work and the remaining Xs are page numbers. These drawings show key isolation valves. They do not show all the components in the piping such as steam trap stations, expansion joints, and other items. Refer to the individual manhole demolition and new work drawings (schematics, plans, and sections) for all components.
3. Steam Phasing Requirements: Prior to all outages, all work inside of the steam manholes and temporary piping shall be pre-fabricated and ready for installation to minimize outage times. Outages shall not begin until pre-fabrication has been completed. Work in piping and manholes must be complete before steam is allowed to enter the piping – this includes hydrostatic testing, weld testing, insulation, and approval by the Engineer and the Owner. Start-up of each piping segment will be done by the Owner.
4. Condensate Phasing Requirements: For the most part, the condensate phasing plan follows the steam phasing plan. The major differences are that there is no redundancy in the existing condensate piping like there is in some of the steam piping where two pipes run side-by-side. Returning condensate to the Rabon Heating Plant is important, but it is not as essential as the steam feed to the buildings, so when there are outages, the first responsibility is to get the steam up and running. However, keep in mind that all steam traps of the distribution piping dump into the condensate pipe. So if the condensate pipe is not complete but the steam pipe is put in service, steam traps will have to be dumped into the manholes, or the Owner will direct the Contractor to pipe

the traps outside of the manhole so they can be safely entered. This is highly undesirable and will only be allowed for very short times (1 to 2 days maximum).

G. STEAM PHASING plan

1. PHASE 1 – Enabling Work (Establishing Temporary Service for Future Work): The work listed below is included in Phase 1. Different aspects of the work can occur independently as it affects different areas of the project. Note: The 6” 70S steam main header is currently out of service and isolated between SM-3D4-53 and SM-3D3-9/13.

    a. First Outage to the Hub (Installation of the Temporary Service). Affected Buildings: The only building affected by this outage will be the Hub (BLDG 32), which will require two outages at separate times, one for installation of the temporary service and then again for the removal of the temporary service and connection of permanent service. The first outage is described below. The second outage is described in Phase 3. This outage shall last no more than 8 hours.

        1) Start 1st Outage to Hub. Isolate and de-energize the 6” 70S main header from the Stadium Road Tunnel at SM-3D4-34 to SM-3D4-53. Maintain service from the energized 8” 70S piping from SM-3D4-34 to SM-3D3-9/13 which shall keep the loop connected.
        2) In SM-3D4-53, isolate the 4” 70S branch feed to the Hub (BLDG 32) from both steam main headers.
        3) In the underground 6” 70S main header to the west of SM-3D4-53, cut pipe and provide a 6” x 6” x 4” 70S temporary reducing tee with a 4” isolation valve and cap the pipe towards SM-3D4-53.
        4) In the underground 4” 70S branch to the north of SM-3D4-53, cut pipe and provide a 4” 70S temporary tee with a 4” isolation valve and cap the pipe towards SM-3D4-53. The 6” 70S main header inside SM-3D4-53 shall be disconnected as a result of this work.
        5) Provide 4” 70S temporary piping between the new isolation valves so that steam service can be fed from SM-3D4-39 to the Hub (BLDG 32). All temporary work shall occur outside of SM-3D4-53.
        6) In SM-3D4-39, remove the blind flange on the tee off the 6” 70S main header. Provide a new 6” 70S flange, a 6” x 4” reducer, and 4” 70S piping to a valve with a blind flange to set up future by-pass connection to Williamson Hall (BLDG 100).
        7) Also in SM-3D4-39, disconnect 6” 70S valve to the abandoned feed to Williamson Hall (BLDG 100) and provide blind flanges on feed from 6” and 8” 70S to removed abandoned service to Williamson Hall (BLDG 100).
        8) Also in SM-3D4-39, disconnect and cap the abandoned 6” 70S to Williamson Hall (BLDG 100). Note this task does not have to occur in the outage period.

9) Energize the 6” 70S main from SM-3D4-34 to the west of SM-3D4-53 which will feed the Hub through the new temporary feed outside of the manhole.
10) End 1st outage to HUB.

b. Outage to the Aquatic Food Producing Pilot Plant, and Hot Tapping the Aquatic Food Products Laboratory and Food Science and Human Nutrition Building (SM-3D3-7 to SM-3D3-17) Temporary Service. Affected Buildings: The only building affected by this outage will be the Aquatic Food Producing Pilot Plant (AFPPP; BLDG 120) which will require a single outage for that shall last no more than 8 hours. The Aquatic Food Products Laboratory (AFPL; BLDG 461) and the Food Science and Human Nutrition Building (FSHNB; BLDG 475) are critical buildings utilized for research. Hot tapping shall be used to eliminate the need for an outage.

1) AFPPP

a) Start Outage to AFPPP.
b) In SM-3D3-6, isolate and de-energize the 2-1/2” 70S branch from SM-3D3-6 to SM-3D3-7 which serves the Aquatic Food Producing Pilot Plant (AFPPP; BLDG 120).
c) In SM-3D3-7, cut pipe and provide new 2-1/2” 70S piping, a 2-1/2” 70S tee, a 2-1/2” permanent isolation valve, and a 2-1/2” isolation valve for temporary service.
d) In SM-3D3-6, energize the 2-1/2” 70S branch from SM-3D3-6 to SM-3D3-7 which will feed the AFPPP (BLDG 120).
e) End outage to AFPPP.

2) AFPL and FSHNB

a) Start Hot Tapping Branch to AFPL and FSHNB.
b) In SM-3D3-17, hot tap the 4” 70S branch with a 2-1/2” steam service including hot tap valve, downstream of the two existing isolation valves in SM-3D3-17 which serves the 3” 70S branch to the Aquatic Food Products Laboratory (AFPL; BLDG 461) and the 4” 70S to the Food Science and Human Nutrition Building (FSHNB; BLDG 475).
c) End hot tapping branch to AFPL and FSHNB.

c. Route the 2-1/2” 70S temporary pipe from the new 2-1/2” isolation valve in SM-3D3-17, above ground, to the new 2-1/2” isolation valve in SM-3D3-7. Provide double-braided, Metraflex Metraloop expansion joints designed for steam service to allow for the piping to thermally expand properly only if the piping is routed in a straight line from Point A to Point B. The routing suggested on the civil drawings has flexibility that will not require flexible hose expansion joints.

1) Calculation Notification for Information Only: Winter Loads for AFPPP, AFPL, and FSHNB are approximately 600 LB/HR 450 LB/HR, and 1000 LB/HR respectively, based on meter data taken from UF GIS data. This totals to 2,050 LB/HR. At 2,500 LB/HR for steam at 70 PSIG and 350 Deg. F, the velocity is 7,362 FT/MIN with a pressure drop of 2.561 LB/100 FT in a 2-1/2" 70S pipe.

2. PHASE 2 – SM-3D4-39 8" 70S Work, SM-3D4-53 Rehabilitation, New SM-3D3-78, and Secondary Enabling Work: The work listed below is included in Phase 2. Affected Buildings include Williamson Hall (BLDG 100) shall experience an outage at the beginning of this phase to facilitate the completion of the 4" 70S by-pass feed from the 6" 70S header directly to Williamson Hall (BLDG 100). This outage shall last no more than 8 hours.

   a. De-energize the 8" 70S main header from SM-3D4-34 to SM-3D3-1/3.

      1) Maintain service to the Hub (BLDG 32) from the energized 6" 70S main header from SM-3D4-34 to the northwest.
      2) Maintain service to the Computer Science and Engineering building (BLDG 42), Marston Science Library (BLDG 43), and McCarty Halls A to D from SM-3D3-1/3 through the 8" 70S main header from the east.

   b. In SM-3D4-39, remove 4" 70S valve and blind flange to the Williamson feed by-pass and then complete the by-pass started in Phase 1. Remove the abandoned 6" 70S valve and blind flange and provide 6" 70S blind flange. This is the end of the outage work to Williamson Hall (BLDG 100). Steam shall now be fed to Williamson Hall (BLDG 100) through the by-pass from the 6" 70S main. The 8" 70S main through SM-3D4-39 shall remain out of service during this phase.
   c. In SM-3D4-39, remove the 8" 70S expansion joint and anchor and provide new. Do not weld both ends of the expansion joint until the direct buried piping to the east (SM-3D4-53) is complete.
   d. Remove piping and perform rehabilitation work inside of SM-3D4-53.
   e. Provide new steam manhole SM-3D3-78.
   f. Provide new direct-buried, underground main header piping (8" 70S and 4" PC) from rehabilitated SM-3D4-53 to new SM-3D3-78. Piping shall be interconnected, and the valves shall be closed in new SM-3D4-78 for future connection.
   g. Provide two pairs of new direct-buried, underground branch piping (3" 70S and 2" PC) from new SM-3D3-78 north to Computer Science and Engineering Building (BLDG 42) and Marston Science Library (BLDG 43), and south to McCarty Halls A to D (BLDG 495, 496, 497, and 498). These pipes shall not be interconnected to the direct-buried, underground piping systems yet as this will require an outage. Cap new piping near connection points to minimize future outage time.
   h. Energize the 8" 70S main header from SM-3D4-34 to rehabilitated SM-3D4-53.

3. PHASE 3 – Multiple Building Outage for Future Work. The work listed below is included in Phase 3.

    a. Outage to Computer Science and Engineering, Marston Science Library, and McCarty Halls (SM-3D4-53 to SM-3D3-9/13). Affected Buildings: The buildings affected by this outage will be the Computer Science and Engineering (BLDG 42), Marston Science Library (BLDG 43), and McCarty Halls A to D (BLDG 495, 496, 497, and 498) which will require a single outage to allow for the removal from SM-3D3-1/3 and connection to SM-3D3-78. This outage shall last no more than 8 hours.

        1) Start Outage to Buildings.
        2) De-energize the 8” 70S main header from SM-3D3-1/3, SM-3D3-77, to SM-3D3-9/13 by closing the isolation valves in SM-3D3-1/3, SM-3D3-77, and SM-3D3-9/13.
        3) During this time, the Music Building (BLDG 117) and the University Auditorium (BLDG 1) will need to be fed steam from the north (SM-3D3-32 in the Union Road Tunnel).
        4) Cut caps off the 3” 70S and 2” PC branch pipes on the new direct-buried, underground piping systems and connect to the existing feeds to the Computer Science and Engineering (BLDG 42), Marston Science Library (BLDG 43), and McCarty Halls A to D (BLDG 495, 496, 497, and 498). Branches to the north and south of SM-3D3-1/3 shall be abandoned as part of this outage. END OUTAGE TO BLDGs
        5) In SM-3D3-8, cut 8” and 6” 70S piping leading west towards SM-3D3-6 and SM-3D3-77 and provide blind flanges. Leave piping to the west open to be abandoned.
        6) Energize the 8” 70S main header from SM-3D4-53 to new SM-3D3-78. At the Owner’s discretion, energize from SM-3D3-9/13 to SM-3D3-77 through SM-3D3-8.

    b. Second Outage to the Hub (Temporary Service Removal). Affected Buildings: The only building affected by this outage will be the Hub (BLDG 32) which will be the second and final outage to the Hub to allow for the removal of the temporary service and installation of the permanent service. The second outage is described below. The outage to the Hub shall last no more than 24 hours.

        1) Start 2nd Outage to Hub.
        2) Isolate and de-energize the 6” 70S main header from the Stadium Road Tunnel at SM-3D4-34 to the Hub.
        3) Remove temporary tees in the underground 6” 70S main header, the underground 4” 70S branch, and the temporary piping that was installed previously to the north and west of rehabilitated SM-3D4-53.

4) Provide new 4" 70S underground direct-piping to connect the existing to new from SM-3D4-53 to the Hub (BLDG 32) connections. Feed the Hub (BLDG 32) from the 8" 70S main from SM-3D4-39. End 2nd outage to Hub.
5) Complete the underground 6" 70S piping between SM-3D4-39 and SM-3D4-53.
6) In SM-3D4-39, remove the 6" 70S expansion joint and anchor and provide new. Do not weld both ends of the expansion joint until the direct buried piping to the east (SM-3D4-53) is complete.
7) Energize the 6" 70S main header from SM-3D4-34 to rehabilitated SM-3D4-53.

4. PHASE 4 – New Steam Manholes and Connections to the Existing Underground Steam System. The work listed below is included in Phase 4. A majority of this work, excluding the individual building outages to connect the new piping to the existing underground feeds, can occur simultaneously with any of the previous phases to this point.

a. New Steam Manholes and Civil Work: Affected Buildings: See below for the individual outages dependent on the steam manhole and building connections. The following steam manholes can be provided without affecting the operations of the existing steam system until the building connection will need to be made. All outages listed below shall last no more than 8 hours. The entire east side Inner Road system shall be constructed, tested, and energized before the building switchovers can be scheduled.

1) SM-3D3-6R Outage requirements: No outage required for buildings. Temporary work has already been established for the Aquatic Food Producing Pilot Plant (BLDG 100) to the south.
2) SM-3D3-79 Outage requirements: No outage required for buildings. Isolate valves in SM-3D3-77 prior to connection work in SM-3D3-79. Coordinate this work with the SM-3D3-12 rehabilitation work.
3) SM-3D3-80 Outage requirements: Steinbrenner Band Building (BLDG 110) to the north and Rawlings Hall (BLDG 553) to the south.
4) SM-3D3-81 Outage requirements: Broward Hall (BLDG 11) to the south. **This building connection cannot be completed until all building connections east of SM-3D3-81 have been completed due to the need to remove the existing steam system**.
5) SM-3D3-82 Outage requirements: Architecture Building (BLDG 268) to the north and Broward Dining Facility (BLDG 1011) to the south.
6) SM-3D3-83 Outage requirements: Fine Arts Building (BLDG 599) to the north.
7) SM-3D3-84 Outage requirements: Mallory Hall (BLDG 41), Reid Hall (BLSG 20), and Yulee Hall (BLDG 39) through SM-3D3-26 to the south.
8) SM-3D3-85 Outage requirements: Outage required for Norman Trio buildings as described below.
9) Note: Ensure that all valves to the buildings are isolated from service to the future building connections. Individual building outages must be

coordinated over a weekend for each service that will be interconnected. All buildings affected by each tie-in have been listed above for each steam manhole.

b. Outage to Norman Hall, Norman Gym, and Norman Hall Addition (SM-3D3-24 to SM-4D-1). Affected Buildings: The buildings affected by this outage will be Norman Hall (BLDG 101), Norman Gym (BLDG 102), and the Norman Hall Addition (BLDG 103) which will require a single outage to allow for the removal of existing piping and connection to piping from SM-3D3-85 at the 13th Street Pedestrian Tunnel. The outage shall last no more than 8 hours.

1) Start outage to Norman Trio.
2) De-energize the 4" 70S main header running from SM-3D3-24 to SM-4D-1 through the pedestrian tunnel by closing the isolation valves in SM-3D3-24 and then SM-4D-1 after the pressure has decreased.
3) At the Pedestrian Tunnel, cut pipe and remove the existing 4" 70S pipe.
4) Route the new 6" 70S main header from SM-3D3-85 on the west side of the Pedestrian Tunnel and connect into the 6" 70S on the west of SM-4D-1.
5) End outage to Norman Trio.

5. PHASE 5 –Tertiary Enabling Work. The work listed below is included in Phase 5. Affected Buildings: Rinker Hall (BLDG 272) and the Office Building (BLDG 866) will require two outages at separate times.

a. Remove existing direct-buried, underground piping from SM-3D3-12 to SM-3D3-8 to allow for new piping to be installed from SM-3D3-79 to SM-3D3-12.
b. Multiple Building Outage for Future Work (Temporary Service). Affected Buildings: The buildings affected by this outage will be Rinker Hall (BLDG 272) and the Office Building (BLDG 866) which will require two outages at separate times for installation and then again for the removal of the temporary service. The first outage is described below. The second outage is described later in the phasing. The outage shall last no more than 8 hours.

1) Start 1st outage to Rinker Hall (BLDG 272) and the Office Building (BLDG 866).
2) De-energize the 8"/10" 70S main header running from SM-3D3-12 to SM-3C2-4 by closing the isolation valves in SM-3D3-9/13, SM-3D3-12, and SM-3C2-4.

a) At this point, the Aquatic Food Producing Pilot Plant, the Aquatic Food Products Laboratory, and the Food Science and Human Nutrition Building can be back-fed through the 2-1/2" 70S temporary piping from the new system to the west.

3) In the underground 10” 70S main header to the south of SM-3D3-12, cut pipe and provide a 3” 70S weld-o-let with a 3” isolation valve for temporary service to Rinker Hall and cap the 10” piping to the north of this connection. Piping to the north shall be abandoned in SM-3D3-12 to allow for rehabilitation.
4) In the underground 3” 70S branch to the east of SM-3D3-12, cut pipe and provide a 3” 70S temporary tee with a 3” isolation valve for temporary service to Rinker Hall and cap the 3” piping to the west of this connection. Piping to the west shall be abandoned in SM-3D3-12 to allow for rehabilitation.
5) Provide 3” 70S temporary piping from the first isolation valve to the second. All temporary work shall occur outside of SM-3D3-12.
6) Energize the 10” 70S main header from SM-3C2-4 to Rinker Hall through the temporary which will allow for the rehabilitation work to occur associated with SM-3D3-12.
7) End 1st outage to Rinker Hall (BLDG 272) and the Office Building (BLDG 866).

6. PHASE 6 – SM-3D3-12 Rehabilitation Work. The work listed below is included in Phase 6. Affected Buildings: None. No outages are required for this work.

   a. Remove piping and perform rehabilitation work inside of SM-3D3-12.
   b. Provide new direct-buried, underground main header piping (8” 70S and 4” PC) from rehabilitated SM-3D3-12 to new SM-3D3-79.
   c. Connect the piping in rehabilitated SM-3D3-12 to SM-3D3-17.
   d. Energize the 4” 70S pipe from rehabilitated SM-3D3-12 to SM-3D3-17 to the Aquatic Food Products Laboratory (AFPL; BLDG 461) and the Food Science and Human Nutrition Building (FSHNB; BLDG 475).

7. PHASE 7 – Second Multiple Building Outage. The work listed below is included in Phase 7. Affected Buildings: The buildings affected by this outage will be Rinker Hall (BLDG 272) and the Office Building (BLDG 866) to allow for the removal of the temporary service. The second outage is described below. The outage shall last no more than 24 hours.

   a. Start 2nd outage to Rinker Hall (BLDG 272) and the Office Building (BLDG 866).
   b. De-energize the 3” 70S/10” 70S main header running from Rinker Hall (BLDG 272) to SM-3C2-4 by closing the isolation valves in SM-3C2-4.
   c. Remove temporary tees in the underground 10” 70S main header, the underground 3” 70S branch, and the temporary piping that was installed previously to the south and the east of rehabilitated SM-3D3-12.
   d. Provide new 10” 70S and 3” 70S underground, direct-buried spool pieces to connect the existing to the new.
   e. Energize the 10” 70S main header from SM-3C2-4 to rehabilitated SM-3D3-12.

f. Energize the 3” 70S branch from rehabilitated SM-3D3-12 to Rinker Hall (BLDG 272).
g. End 2nd outage to Rinker Hall (BLDG 272) and the Office Building (BLDG 866).

8. PHASE 8 – Final Temporary Service Removal. The work listed below is included in Phase 8. Affected Buildings: None. No outages are required for this work. New system is online and feeding all buildings.

a. Isolate 2-1/2” 70S valves in SM-3D3-17 and SM-3D3-7.
b. Remove 2-1/2” 70S temporary service from SM-3D3-17 to SM-3D3-7.
c. At this point, all buildings shall be fed from the new steam system and all temporary services shall be removed.

H. CONDENSATE PHASING PLAN

1. PHASE 1

a. First Outage to the Hub and Williamson. Affected Buildings: The only buildings affected by this outage will be Williamson Hall (BLDG 100) and the Hub (BLDG 32), which will require two outages at separate times, one for installation of the temporary service and then again for the removal of the temporary service and connection of permanent service. The first outage is described below. The second outage is described in Phase 3. This outage shall last no more than 8 hours.

1) Start 1st Outage to Williamson and Hub. Isolate and de-energize the 4” PC main header from the Stadium Road Tunnel at SM-3D4-34 to SM-3D4-53. Maintain service from the energized 4” PC piping from SM-3D4-53 to SM-3D3-9/13 which shall keep the loop connected.
2) In SM-3D4-53, isolate the 2” PC branch feed to the Hub (BLDG 32).
3) In the underground 4” PC header to the west of SM-3D4-53, cut pipe and provide a 4” connection to a 2” reducer and 2” isolation valve. Cap the piping towards SM-3D4-53.
4) In the underground 2” PC branch to the north of SM-3D4-53, cut pipe and provide a 2” PC connection to with a 2” isolation valve. Cap the piping towards SM-3D4-53.
5) Provide 2” PC temporary piping between the new isolation valves so that condensate can be fed from the Hub (BLDG 32) to SM-3D4-39. All temporary work shall occur outside of SM-3D4-53.
6) In SM-3D4-39, remove the 4” valve and abandoned connection to Williamson Hall (BLDG 100) and provide a blind flange of the active 4” PC main and cap the pipe to Williamson Hall.
7) Energize the 4” PC main from SM-3D4-34 to the west of SM-3D4-53 which will serve the Hub through the new temporary feed outside of the manhole.
8) End 1st Outage to Williamson and Hub.

b. Outage to the Aquatic Food Producing Pilot Plant, and Hot Tapping the Aquatic Food Products Laboratory and Food Science and Human Nutrition Building (SM-3D3-7 to SM-3D3-17) Temporary Service. Affected Buildings: The only building affected by this outage will be the Aquatic Food Producing Pilot Plant (AFPPP; BLDG 120) which will require a single outage for that shall last no more than 8 hours. The Aquatic Food Products Laboratory (AFPL; BLDG 461) and the Food Science and Human Nutrition Building (FSHNB; BLDG 475) are critical buildings utilized for research. Hot tapping shall be used to eliminate the need for an outage.

1) AFPPP

a) Start Outage to AFPPP.
b) In SM-3D3-6, isolate and de-energize the 1-1/2" PC branch from SM-3D3-6 to SM-3D3-7 which serves the Aquatic Food Producing Pilot Plant (AFPPP; BLDG 120).
c) In SM-3D3-7, cut pipe and provide new 1-1/2" PC piping, a 1-1/2" PC tee, and a 1-1/2" PC isolation valve for temporary service.
d) In SM-3D3-6, energize the 1-1/2" PC branch from SM-3D3-6 to SM-3D3-7 which will serve the AFPPP (BLDG 120).
e) End outage to AFPPP.

2) AFPL and FSHNB

a) Start Hot Tapping Branch to AFPL and FSHNB.
b) In SM-3D3-17, hot tap the 2" PC branch with a 1-1/2" PC service including hot tap valve, downstream of the two existing isolation valves in SM-3D3-17 which serves the 1-1/2" PC branch to the Aquatic Food Products Laboratory (AFPL; BLDG 461) and the 2" PC branch to the Food Science and Human Nutrition Building (FSHNB; BLDG 475).
c) 3) End hot tapping branch to AFPL and FSHNB.

c. Route the 1-1/2" PC temporary pipe from the new 1-1/2" isolation valve in SM-3D3-17, above ground, to the new 1-1/2" isolation valve in SM-3D3-7. Provide double-braided, Metraflex Metraloop expansion joints designed for steam service to allow for the piping to thermally expand properly only if the piping is routed in a straight line from Point A to Point B. The routing suggested on the civil drawings has flexibility that will not require flexible hose expansion joints.

2. PHASE 2. The work listed below is included in Phase 2. Affected Buildings: None

a. De-energize the 4" PC main header from SM-3D4-53 to SM-3D3-1/3.
b. Remove piping and perform rehabilitation work inside of SM-3D4-53.
c. Provide new steam manhole SM-3D3-78.

d. Provide new direct-buried, underground main header piping (4" PC) from rehabilitated SM-3D4-53 to new SM-3D3-78. Piping shall be interconnected, and the valves shall be closed in new SM-3D4-78 for future connection.
e. Provide new direct-buried, underground branch piping (2" PC) from new SM-3D3-78 north to Computer Science and Engineering Building (BLDG 42) and Marston Science Library (BLDG 43), and south to McCarty Halls A to D (BLDG 495, 496, 497, and 498). These pipes shall not be interconnected to the direct-buried, underground piping systems yet as this will require an outage. Cap new piping near connection points to minimize future outage time.

3. PHASE 3. The work listed below is included in Phase 3.

a. Outage to Computer Science and Engineering, Marston Science Library, and McCarty Halls (SM-3D4-53 to SM-3D3-9/13). Affected Buildings: The buildings affected by this outage will be Computer Science and Engineering (BLDG 42), Marston Science Library (BLDG 43), and McCarty Halls A to D (BLDG 495, 496, 497, and 498) which will require a single outage to allow for the removal from SM-3D3-1/3 and connection to SM-3D3-78. This outage shall last no more than 8 hours.

1) Start Outage to Buildings.
2) De-energize the 4" PC header from SM-3D3-1/3, SM-3D3-77, to SM-3D3-9/13 by closing the isolation valves in SM-3D3-1/3, SM-3D3-77, and SM-3D3-9/13.

a) During this time, the Music Building (BLDG 117) and the University Auditorium (BLDG 1) will need to run north (SM-3D3-32 in the Union Road Tunnel) or dump.

3) Cut the caps off the 2" PC branch pipes on the new direct-buried, underground piping systems and connect to the existing feeds to the Computer Science and Engineering (BLDG 42), Marston Science Library (BLDG 43), and McCarty Halls A to D (BLDG 495, 496, 497, and 498). Branches to the north and south of SM-3D3-1/3 shall be abandoned as part of this outage. End outage to Buildings.
4) In SM-3D3-8, cut 4" PC piping leading west towards SM-3D3-9/13 and SM-3D3-77 and provide blind flange. Leave piping to the west open to be abandoned.
5) Energize the 4" PC main header from SM-3D4-53 to new SM-3D3-78.

b. Second Outage to the Williamson and the Hub (Temporary Service Removal). Affected Buildings: The only buildings affected by this outage will be Williamson Hall (BLDG 100) and the Hub (BLDG 32) to allow for the removal of the temporary service and installation of the permanent service. The second outage is described below. The outage to Williamson and the Hub shall last no more than 24 hours.

1) START 2nd outage to Williamson and the Hub.
2) Isolate and de-energize the 4" PC main from the Stadium Road Tunnel at SM-3D4-34 to the Hub.
3) Remove temporary connection in the underground 4" PC header, the underground 2" PC branch, and the temporary piping that was installed previously to the north and west of rehabilitated SM-3D4-53.
4) Provide new 2" PC underground direct-piping to connect the existing to new from SM-3D4-53 to the Hub (BLDG 32) connections. Feed the Hub (BLDG 32) from the 4" PC main from SM-3D4-39.
5) Complete the underground 4" PC piping between SM-3D4-39 and SM-3D4-53.
6) Energize the 4" PC main header from SM-3D4-34 to rehabilitated SM-3D4-53. End 2nd outage to Williamson and the Hub.

4. PHASE 4. The work listed below is included in Phase 4. A majority of this work, excluding the individual building outages to connect the new piping to the existing underground feeds, can occur simultaneously with any of the previous phases to this point.

   a. New Steam Manholes and Civil Work. Affected Buildings: See below for the individual outages dependent on the steam manhole and building connections. The following steam manholes can be provided without affecting the operations of the existing condensate system until the building connection will need to be made. All outages listed below shall last no more than 8 hours. The entire east side Inner Road system shall be constructed, tested, and energized before the building switchovers can be scheduled.

      1) SM-3D3-6R: Outage requirements: No outage required for buildings. Temporary work has already been established for the Aquatic Food Producing Pilot Plant (BLDG 100) to the south.
      2) SM-3D3-79: Outage requirements: No outage required for buildings. Isolate valves in SM-3D3-77 prior to connection work in SM-3D3-79. Coordinate this work with the SM-3D3-12 rehabilitation work.
      3) SM-3D3-80: Outage requirements: Steinbrenner Band Building (BLDG 110) to the north and Rawlings Hall (BLDG 553) to the south.
      4) SM-3D3-81: Outage requirements: Broward Hall (BLDG 11) to the south.
      5) SM-3D3-82: Outage requirements: Architecture Building (BLDG 268) to the north and Broward Dining Facility (BLDG 1011) to the south.
      6) SM-3D3-83: Outage requirements: Fine Arts Building (BLDG 599) to the north.
      7) SM-3D3-84: Outage requirements: Mallory Hall (BLDG 41), Reid Hall (BLSG 20), and Yulee Hall (BLDG 39) through SM-3D3-26 to the south.
      8) SM-3D3-85: Outage requirements: Outage required for Norman Trio buildings as described below.

9) Note: Ensure that all valves to the buildings are isolated from service to the future building connections. Individual building outages must be coordinated over a weekend for each service that will be interconnected. All buildings affected by each tie-in have been listed above for each steam manhole.

b. Outage to Norman Hall, Norman Gym, and Norman Hall Addition (SM-3D3-24 to SM-4D-1). Affected Buildings: Note that the existing condensate pipe from Norman Hall (BLDG 101), Norman Gym (BLDG 102), and the Norman Hall Addition (BLDG 103) is out of service because it has a hole in it. There is no stated outage period because it is already out of service. No description is provided. The work steps follow the steam line description.

5. PHASE 5. The work listed below is included in Phase 5. Affected Buildings: Rinker Hall (BLDG 272) and the Office Building (BLDG 866) will require two outages at separate times.

a. Remove existing direct-buried, underground piping from SM-3D3-12 to SM-3D3-8 to allow for new piping to be installed from SM-3D3-79 to SM-3D3-12.
b. Multiple Building Outage for Future Work (Temporary Service): Affected Buildings: The buildings affected by this outage will be Rinker Hall (BLDG 272) and the Office Building (BLDG 866) which will require two outages at separate times for installation and then again for the removal of the temporary service. The first outage is described below. The second outage is described later in the phasing. The outage shall last no more than 8 hours.

1) Start 1st outage to Rinker Hall (BLDG 272) and the Office Building (BLDG 866).
2) De-energize the 4”/5” PC main running from SM-3D3-12 to SM-3C2-4 by closing the isolation valves in SM-3D3-9/13, SM-3D3-12, and SM-3C2-4.
3) At this point, the Aquatic Food Producing Pilot Plant, the Aquatic Food Products Laboratory, and the Food Science and Human Nutrition Building can be back-fed through the 1-1/2” PC temporary piping from the new system to the west.
4) In the underground 5” PC main to the south of SM-3D3-12, cut pipe and provide a 2” PC weld-o-let with a 2” isolation valve for temporary service to Rinker Hall and cap the 5” piping to the north of this connection. Piping to the north shall be abandoned in SM-3D3-12 to allow for rehabilitation.
5) In the underground 2” PC branch to the east of SM-3D3-12, cut pipe and provide a 2” 70S temporary tee with a 2” isolation valve for temporary service to Rinker Hall. Piping to the west shall be abandoned in SM-3D3-12 to allow for rehabilitation.
6) Provide 2” PC temporary piping from the first isolation valve to the second. All temporary work shall occur outside of SM-3D3-12.

7) Energize the 5” PC main header from SM-3C2-4 to Rinker Hall through the temporary which will allow for the rehabilitation work to occur associated with SM-3D3-12.
8) End 1st outage to Rinker Hall (BLDG 272) and the Office Building (BLDG 866).

6. PHASE 6. The work listed below is included in Phase 6. Affected Buildings: None. No outages are required for this work.

   a. Remove piping and perform rehabilitation work inside of SM-3D3-12.
   b. Provide new direct-buried, underground main header piping (4” PC) from rehabilitated SM-3D3-12 to new SM-3D3-79.
   c. Connect the piping in rehabilitated SM-3D3-12 to SM-3D3-17.
   d. Energize the 2” 70S pipe from rehabilitated SM-3D3-12 to SM-3D3-17 to the Aquatic Food Products Laboratory (AFPL; BLDG 461) and the Food Science and Human Nutrition Building (FSHNB; BLDG 475).

7. PHASE 7. The work listed below is included in Phase 7. Affected Buildings: The buildings affected by this outage will be Rinker Hall (BLDG 272) and the Office Building (BLDG 866) to allow for the removal of the temporary service. The second outage is described below. The outage shall last no more than 24 hours.

   a. Start 2nd outage to Rinker Hall (BLDG 272) and the Office Building (BLDG 866).
   b. De-energize the 2” PC/6” PC main running from Rinker Hall (BLDG 272) to SM-3C2-4 by closing the isolation valves in SM-3C2-4.
   c. Remove temporary tees in the underground 6” PC main, the underground 2” PC branch, and the temporary piping that was installed previously to the south and the east of rehabilitated SM-3D3-12.
   d. Provide new 6” PC and 2” PC underground, direct-buried spool pieces to connect the existing to the new.
   e. Energize the 6” PC main header from SM-3C2-4 to rehabilitated SM-3D3-12.
   f. Energize the 2” PC branch from rehabilitated SM-3D3-12 to Rinker Hall (BLDG 272).
   g. End 2nd outage to Rinker Hall (BLDG 272) and the Office Building (BLDG 866).

8. PHASE 8. The work listed below is included in Phase 8. Affected Buildings: None. No outages are required for this work. New system is online and feeding all buildings.

   a. Isolate 1-1/2” PC valves in SM-3D3-17 and SM-3D3-7.
   b. Remove 1-1/2” 70S temporary service from SM-3D3-17 to SM-3D3-7.
   c. At this point, all buildings shall be fed from the new condensate system and all temporary services shall be removed.

I. CHILLED WATER PHASING PLAN

1. The chilled water work in this project is limited in scope compared to steam and condensate. The work in CW-3D-12 will cause an outage of Rinker Hall (Bldg 272), Broward Dining Center (1011), Architecture (Bldg 268). The work in CW-3D-20 will cause an outage to just Rinker Hall (Bldg 272). Limit the outage to these CW-3D-12 and affected buildings to 36 hours. Limit the outage to CW-3D-20 and affected buildings to 48 hours. All chilled water outage work shall occur in the winter months.

1.5 ELECTRICAL OUTAGES

A. There is no designated phasing plan for the electrical outages in this project. The electrical work in this project will require outages to UF campus buildings. The Contactor shall provide and operate temporary generators to back-up all buildings that require outages as part of the construction work in this project. Generators shall be sized for the distribution transformer sizes provide below. Generators shall be connected to the secondary feeders of the building transformers and located in areas approved by UF. The Contractor shall provide manned coverage on-site 24-hours a day while generators are operational. Outages to connect/disconnect generators shall last no longer than 90 minutes. The Contractor shall be responsible for all fuel and other expenses incurred in the operation of the generators during the duration of the construction work. Construction work shall include all work in the scope of this project, including testing. An outage plan shall be prepared and presented by the contractor and approved by UF no fewer than 14 days before the proposed outage is to occur. Building outages required for this project are listed below with the applicable feeder work the outage will be associated with.

1. Feeder 1-8

    a. 2-phase, 150kVA transformer bank feeding Home Economics Office (BLDG 87), Agricultural Engineering Offices (BLDG 150), McCarty Hall Annex A (BLDG 810), and F.R.E.D. Building (BLDG 851)

2. Feeder 3-6

    a. 3-phase, 750kVA transformer bank feeding Reid Building (BLDG 20)
    b. 3-phase, 500kVA transformer bank feeding Yulee Building (BLDG 39) and the Pool (BLDG 356)
    c. 3-phase, 225kVA transformer bank feeding Mallory Building (BLDG 41)

3. Feeder 4-1

    a. 3-phase, 300kVA transformer bank feeding McCarty Hall A (BLDG 495)
    b. 3-phase, 500kVA transformer bank feeding McCarty Hall B (BLDG 496) and McCarty Hall C (BLDG 497)
    c. 3-phase, 225kVA transformer feeding McCarty Storage Building (BLDG 476) and the CSE Fiber Hut (BLDG 500)

d. 3-phase, 750kVA transformer feeding the Food Science Building (BLDG 475) and McCarty Hall D (BLDG 498)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 01 10

SECTION 01 01 40 - BUILDER'S USE OF THE PREMISES

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

B. Refer to section 01 01 60 for information regarding utility outages and dig permits.

C. Refer to section 01 31 00 for requirements regarding the coordination of work with the University of Florida Schedule.

D. Refer to section 01 50 00 for requirements related to Temporary Facilities & Controls.

1.2 DESCRIPTION OF WORK INCLUDED

A. This Section applies to situations in which the Builder or his representatives including, but not necessarily limited to, suppliers, subcontractors, employees, and field engineers, enter upon the Owner's property.

1.3 QUALITY ASSURANCE

A. Promptly upon award of the Contract, notify all pertinent personnel regarding requirements of this Section.

B. Require that all personnel who will enter upon the University's property certify their awareness of and familiarity with the requirements of this Section.

C. Builder shall strictly enforce the University’s **Tobacco Free** policy.

1.4 TRANSPORTATION FACILITIES

A. See section 01 50 00 for information on the maintenance of safe and accessible paths of travel in and around the job site.

B. Builder’s Vehicles:

1. Builder's vehicles, vehicles belonging to employees or subcontractors of the Builder, and all other vehicles entering the Owner's property in performance of the Work shall only use agreed-upon access route(s).
2. All vehicles parked on campus (including construction sites) must have a valid parking permit issued through Transportation and Parking Services in accordance with University of Florida Police Department (UFPD) requirements. Permits –for remote/offsite worker parking, onsite staff parking, and remote/offsite storage containers – shall be requested through the University Project Manager.

    a. Remote/offsite worker parking is provided at a paved lot near the Hilton on SW 34th Street. See map on the "Forms & Standards" page of the Planning Design & Construction website (www.facilities.ufl.edu).
    b. Trailer/storage containers parked in an assigned/approved remote/offsite by permit shall be clearly marked with the following information: Project Number, Project Name, Company Name, and Phone Number.
    c. Remote parking and trailer/storage container area must be kept clean and free of debris at all times. All trailers/storage containers must be removed prior to completion of the projects.
    d. See part 1.10 of this Specification regarding home football game weekends.
    e. Vehicles not following this policy may be ticketed or towed.

3. Within the University approved fenced-in construction site area, the Builder shall manage all site use, including parking by construction staff and employees (if approved). Do not permit vehicles to park on any street or other area of the Owner's property except in areas designated by the University.

    a. Within the approved fenced area, the number of vehicles will be limited and be a function of the size of the project. The number of vehicles allowed will be discussed as part of the site utilization plan with the UF Project Manager and in consultation with the University Transportation & Parking Services and Facilities Services Grounds Department.

4. Absolutely no parking is permitted outside the designated construction site area and all University regulations regarding parking and accommodations for pedestrian use shall be strictly enforced.
5. Exceptions for temporary parking for construction delivery and construction access on curb side, walkways, vehicular parking, roadways and service drives that restricts or impedes normal traffic flow or use must be obtained from UF Transportation & Parking Services through the University Project Manager. This exception is granted only for construction vehicles, not for private passenger vehicles. Any temporary use of pedestrian pathways that exceeds 24 hours duration will require provision for equal alternate pathways around the impediments and UFPD review. In addition, any temporary use of the site (exceeding 24 hours duration) that impedes building occupant egress must be reviewed by UF Environmental Health & Safety (EH&S) prior to implementation.

6. The University Project Managers shall not seek waivers of any sort for ticketed and towed vehicles in violation of the University parking regulations. Knowledge of the University Parking Regulations is the personal responsibility every individual who commutes to and works on campus.
7. Provide adequate protection for curbs, sidewalks, pavers and landscape over which trucks and equipment must pass to reach the job site.

1.5 INSPECTIONS AND TESTS

A. Facilities Services inspections shall be requested 48 hours in advance of inspection through Facilities Services Operations Engineering. The inspection request form and supporting checklists can be found on the “Forms & Standards” page of the Planning Design & Construction website (www.facilities.ufl.edu). Inspection checklists shall be tailored by the Owner and Builder to the specific requirements of the project.

B. Environmental Health & Safety (EH&S) inspections shall be requested 24 hours in advance. Also see section 01 06 00.

C. Office of Information Technology (OIT): Contact Telecommunications and Infrastructure (TNI) 24-48 hours in advance to request inspections for all telecom, cabling, and network infrastructure work. The inspection checklist – with notification timeframes and contact information – can be found on the “Forms & Standards” page of the Planning Design & Construction website (www.facilities.ufl.edu).

D. HealthNet: For Health Science Center projects only, contact HealthNet 24-48 hours in advance to request inspections for all telecom, cabling, and network infrastructure work. The inspection checklist – with notification timeframes and contact information – can be found on the “Forms & Standards” page of the Planning Design & Construction website (www.facilities.ufl.edu).

E. Office of Academic Technology (OAT): Where applicable, contact OAT 48 hours or more in advance to request inspections for all work related to classroom audio/visual systems. The inspection checklist – with notification timeframes and contact information – can be found on the “Forms & Standards” page of the Planning Design & Construction website (www.facilities.ufl.edu).

F. University of Florida Police Department (UFPD): UFPD must verify construction fencing, exterior lighting, landscaping, and other items during construction and closeout.

G. State Elevator Inspector inspections: None required for this project.

H. Architect / Engineer inspections: Refer to individual Specification Sections.

I. Tests

1. The Builder shall notify Facilities Services and EH&S of all scheduled tests at least 48 hours in advance.
2. Properly completed test reports shall be provided at the conclusion of each test. It is the responsibility of the Builder to maintain such reports through Final Completion, at which point they shall be submitted with other closeout materials, such as Operation & Maintenance manuals.

1.6 SECURITY

A. Construction sites located on the University of Florida campus fall under the jurisdiction of the UFPD. Any incident requiring police service should be immediately reported to the UFPD at (352) 392-1111.

B. Builders and employees are to obey all laws and rules of the State of Florida and the University of Florida when on University property.

C. Students, faculty, and staff shall not be harassed, disturbed, or in any way disrupted in their lawful pursuits. Sexual harassment shall be reported to the University's Title IX Coordinator and Deputy Title IX Coordinator for Students as per the following policy: https://titleix.ufl.edu/

D. Restrict the access of all persons entering upon the Owner's property in connection with the Work to the access route and to the actual site of the Work. Employees are not permitted to enter University buildings unless such entry is directly related to their job duties.

E. Restrict activities of employees to authorized areas. Employees shall not be allowed to mingle in student or public areas.

F. Builders and employees shall secure all property to reduce theft or damage to equipment or property. Builders shall work with the UFPD as necessary and participate in crime prevention efforts.

G. The Builder shall at all times guard against damage or loss to the property of the University or other vendors or contractors and shall be held responsible for replacing or repairing any such loss or damage. The University may withhold payment or make such deductions as deemed necessary to insure reimbursement or replacement for loss or damaged property through negligence of the successful bidder or his agents.

H. The Builder shall provide identification badges for all personnel working on the site and shall require continuous use (wearing) of same at all times. Badge shall display photograph, name of employee, and company for which employee works.

I. The Builder shall keep a daily log of all employees, visitors, and other personnel that enter the Project site. Said log shall be accessible to UFPD upon request.

J. Items that could be used as projectiles, rocks, bricks, other masonry, should be stored in a secure location.

1.7 PERSONNEL SCREENING

The following requirements are to be met by Builders and their subcontractors and vendors while engaged in construction projects at the University of Florida:

A. A criminal history check shall be performed on all jobsite personnel, including subcontractors and temporary day laborers, at least once every two years. Prior to personnel entering the Project site, an initial criminal history background check shall be submitted to and performed by a private company trained to perform employment screening. The results of each criminal history check shall be reported to the Builder, which shall screen the results for the following disqualifying offenses to determine a person's eligibility to work on the University of Florida campus.

1. Drug distribution activity or felony drug possession
2. Sexual offenses, including, but not limited to, indecent exposure and voyeurism
3. Crimes of violence involving physical injury to another person
4. Murder
5. Kidnapping
6. Felony theft

B. The following searches shall be performed to document types of convictions listed above that will render an individual ineligible to perform work on campus unless a waiver is granted:

1. SSN Trace plus address history
2. Sexual Offender database check
3. National Criminal Database search
4. 7-year County Court Check in the employee's County of residence

C. Entities seeking to use an employee with one or more revealed convictions must apply for a written waiver from the UFPD Chief at (352) 392-1111 or updinfo@admin.ufl.edu.

D. The UFPD Chief will consider the following factors when determining whether or not a waiver will be granted:

1. The nature and gravity of any criminal offense(s);
2. The individual's age at the time of the offense(s);
3. The number and type of offense (felony, misdemeanor, traffic violations, etc.);
4. The sentence or sanction for the offense and compliance with the sanction(s);
5. The amount of time that has passed since the offense and/or completion of the sentence(s);
6. Whether there is a pattern of offenses;

7. Whether the offense arose in connection with the individual's prior employment or volunteer activities;
8. Information supplied by the individual about the offense(s);
9. Work record and references after the offense(s);
10. Subsequent criminal activity; and
11. Truthfulness of the individual in disclosing the offense(s).

E. Builders shall certify that all personnel have been subject to a criminal background check and shall continuously track, monitor, and re-certify throughout construction as new trades and personnel begin work.

F. The cost of the criminal background check shall be borne by the Builder, but is compensable as a General Conditions expense for CMs and D/Bs.

G. The Builder shall maintain copies of background checks at their home office, with background checks electronically accessible at the Project site. The names and pertinent information of all screened and approved employees shall be posted to the PD&C Sharepoint site at: https://uflorida.sharepoint.com/sites/pdc/prj/Lists/Background%20Checks/AllItems.aspx

1.8 WORK HOURS

A. Regular work hours shall be between 7:00 AM and 5:00 PM, Monday through Friday, excluding holidays.

B. Work outside these hours must be requested in writing and approved by the Owner.

1.9 UNMANNED AIRCRAFT

A. The use of unmanned aircraft systems (e.g., drones or model aircraft) over University property is prohibited without the written approval of UF EH&S.

B. For a complete explanation of the policy, procedures, and requirements, see http://www.ehs.ufl.edu/?s=unmanned+aircraft+systems&sa.x=0&sa.y=0

1.10 HOME FOOTBALL GAME WEEKENDS

A. Approximately 100,000 people converge upon the campus on each of 6-7 Fall weekends for Gator football games. To safeguard both the public and the Work, jobsites on campus shall be secured, left clean, and free of safety hazards by 4:00 PM Friday on such weekends, with no work taking place on or around the site until Monday morning.

B. Likewise, remove all vehicles parked at the paved remote lot near the 34th Street Hilton by 4:00 PM Friday on such weekends and do not permit parking there again until Monday morning.

C. See www.gatorzone.com for the football game schedule and incorporate these dates into the construction schedule.

D. The Builder may request special exceptions to this policy with written justification at least one week in advance, but the Owner is under no obligation to approve such requests.

1.11 PRE-CONSTRUCTION MEETING

A. Prior to commencing Work at the site, the Builder shall attend a pre-construction conference with the University Project Manager, the Design Professional(s), other UF officials, and external agency representatives, if applicable (such the District Engineer on a Federally-funded project).

B. Builder attendees shall include all field staff (project manager, superintendent(s), project engineer(s), and clerical assistants), plus major trade subcontractors as directed by the University Project Manager.

C. The parties will discuss the administrative, logistic, fiscal, and procedural requirements for the Work, and for work in general at the University of Florida.

D. The template agenda for the meeting shall be provided by the University Project Manager, who shall also arrange for attendance by other UF officials and outside agencies, if any. The Builder shall record and distribute minutes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 01 40

SECTION – 01 01 60 UTILITY OUTAGES AND DIG PERMITS

PART 1 - – GENERAL

1.1 RELATED SECTIONS

A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

B. Refer to Section 01 31 00, Construction Schedule for related requirements regarding the coordination of utility outages with the University of Florida Schedule.

1.2 UTILITIES OUTAGES

A. Planned utility outages are occasionally required for repairs, maintenance or construction. In order to avoid unexpected inconveniences, property damage, safety hazards, or loss of information or research, the Facilities Services Division has instituted a utility outage notification system.

B. When the Work requires an outage, the Builder shall submit – at least ten (10) business days for major project outages and five (5) business days for minor project outages. – a written request to Facilities Services via the University Project Manager on an Owner-furnished form. Outages shall not proceed until authorized by Facilities Services.

C. Utility outages will be performed by Facilities Services Systems personnel. The project will pay the applicable costs. However, the costs associated with an outage that becomes necessary to correct deficient work performed during a previous outage will be back-charged to the Builder. Contact Facilities Services Operations Engineering as necessary to determine these costs.

D. Unplanned utility outages occur on occasion as the unwelcome result of repair, maintenance, or construction activities. Report all unplanned utility outages immediately to the Facilities Services Work Management Center (Telephone: 392-1121) and to the University Project Manager.

E. For any projects within the Health Science Center, IFAS, Housing Divisions, the construction manager shall coordinate well in advance of 10 days prior to any outage request with the project manager and the appropriate divisions and coordinate those planned outages.

1.3 DIG PERMITS

A. All trenching, excavation, digging operations, or other penetration of the ground within the confines of the University campus or in any area for which the University has responsibility, requires the Builder to obtain a Dig Permit, Facilities Services Form 611, which can be retrieved from the Facilities Services website at www.facilitiesservices.ufl.edu .

B. The person, Builder, agency, or organization that will be performing the trenching, excavation, digging, or other ground-penetrating activity is responsible for requesting and obtaining permission to perform that activity.

C. *C.* All Dig Permits shall be applied for 72 hours prior to the start of any work that penetrates the ground. Contact the Dig Permit Office at (352) 392-5781 located at Utilities and Energy Services 902 Magnolia Drive, Building 702, Rm 130G in the Utilities Department, Gainesville, Florida 32611- 7700. The CM Representative will need to meet with a Line Locate Technician to discuss the exact request and to present a sketch or picture what is being requested to determine if a permit will be required or what other steps may be needed.

1. If a permit is required, the construction manager will need to call the Sunshine State One-Call (811) with the dig information. Sunshine State One-Call (811) will coordinate with the Dig Permit Office to locate utilities not under control of the Dig Permit Office and they will notify the Dig Permit Office of their utilities information.
2. The Dig Permit Office will have 2-3 business days to respond to this request. Once notification has been received from Sunshine State One-Call (811), the Dig Permit Office will send an email notification with application and requirement information to the construction manager. The construction manager shall read the Dig Permit Procedures for complete definitions and procedures.
3. To complete the Dig Permit application, the construction manager shall have the sunshine state ticket number that was provided when called available for this application in order to complete the Dig Permit application form. This form is available electronically and the form will need to be signed and submitted electronically with a valid digital signature. Facilities Services is no longer accepting handwritten applications. Please note that the application is not a valid permit until it is signed by the Dig Permit Office. The Line Locate Technician will mark the location and will complete the application form and email it to the contact information provided. Construction manager will need to call the Dig Permit office to meet at the jobsite prior to the work beginning. The Dig Permit must be visible at all times at the work site.

D. Sunshine State One-Call (800-432-4770) shall be utilized for utilities owned by others, including Cox Cable, and Gainesville Regional Utilities (GRU) and others communications firms.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 06 00 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design- Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

1.2 BUILDING CODE ENFORCEMENT PROGRAM

A. TITLE XLVIII (Florida K-20 Education Code) and Chapter 553.80(6) F.S. assign responsibility to the State University System for the enforcement of the Florida Building Code and the Florida Fire Prevention Code during building construction and renovation at State universities. At the University of Florida, the Environmental Health and Safety Division (EH&S) has been assigned the responsibility to implement and administer the Building Code Permit and Inspection Program. Program compliance requires that construction plans/specifications and permit application documents be submitted to the UF Building Code Administrator (EH&S) for review. Construction shall not begin on the project until a building permit has been issued by EH&S and the permit posted at the construction site.

B. A more complete description of the University of Florida's Building Code Enforcement Program may be obtained from the University's Building Code Administrator.

EH&S Building Code Enforcement
Building 179, 916 Newell Drive, P.O. Box 112190, Gainesville, FL, 32611-2200
Phone: (352) 392-1591; Fax (352) 392-3647
Internet: www.ehs.ufl.edu

C. RESPONSIBILITIES

1. The duly licensed State of Florida contractor shall apply to the UF Division of Environmental Health & Safety for a building permit. At the time of application for a permit, the Builder shall provide two sets of signed and sealed construction documents and specifications, a list of all subcontractors with appropriate license numbers and proof of Worker’s Compensation insurance, and the "letter of code compliance" indicating the plans have been reviewed by EH&S and all outstanding code and safety-related items have been resolved. If a "letter of code compliance" has not been issued by EH&S, two copies of the final construction (bid) documents and specifications must accompany the application. A building permit will be issued after the documents have been reviewed for code compliance by the Building Code

Administrator/staff. One of the submitted sets of plans and specifications will be returned with the building permit placard and shall be stamped by EH&S stating "Reviewed for Code Compliance." This set of documents shall be protected and kept on site by the contractor for use by EH&S code enforcement.

2. When the contractor has completed the project per the permit documents and submitted all required tests and reports, their authorized representative shall request in writing a certificate of completion or certificate of occupancy from the UF/EH&S Building Code Administrator as required by the Florida Building Code.

1.3 LIFE SAFETY & FIRE SAFETY PLAN REVIEW

A. In conjunction with review of plans for Building Code Compliance EH&S has been assigned the duty of life safety & fire safety plan review and inspection of UF construction projects.

B. Plan review shall be conducted as each project is submitted for building code compliance review. A separate submission will not be required for this review phase as it will be conducted simultaneously with the building code compliance review.

C. Inspections of life safety items shall be scheduled through EH&S's normal inspection process.

D. Prior to issuance of the certificate of occupancy or completion EH&S's fire plans reviewer and inspector shall certify that the project meets or exceeds all life and fire safety minimum codes and standards.

1.4 FLORIDA PRODUCT APPROVAL

A. As required by Florida Statutes, the Builder shall provide information on certain structural and building envelope products and components. See "Florida Product Approval Info Sheet" on the "Forms" page of the EH&S Building Code Enforcement website (www.ehs.ufl.edu/buildcode).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 06 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate #1: Pedestrian Drop-off Area at Fine Arts.

1. Base Bid: No changes to the north west portion of the Fine Arts parking area.
2. Alternate: Seven parking spaces from the north west portion of the Fine Arts parking area will be removed to create a pedestrian drop-off area with new curbing and sidewalks.

B. Alternate #2: Electric to Norman Lawn.

1. Base Bid: Electrical infrastructure improvements end at the west end of the SW13th Street pedestrian tunnel as indicated on the civil and mechanical plans.
2. Alternate: Electrical infrastructure improvements extend through the pedestrian tunnel to the Norman lawn area as indicated on the civil plans.

C. Alternate #3: Chilled Water Insulation Deduct.

1. Base Bid: Direct buried HDPE chilled water piping insulated with polyurethane foam and wrapped in HDPE jacket.
2. Alternate: No insulation and jacket on HDPE chilled water piping.

END OF SECTION 01 23 00

SECTION 01 31 00 - CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

B. Refer to Section 01 01 60, Utility Outages, for related requirements regarding the pre-planning of utility outages.

1.2 QUALITY ASSURANCE

A. Employ, if necessary, a scheduler who is thoroughly trained and experienced in compiling construction schedules, and in preparing and issuing periodic reports as required.

PART 2 - PRODUCTS

2.1 CONSTRUCTION ANALYSIS

A. Graphically show by bar chart the order and interdependence of all activities necessary to complete the Work, and the sequence in which each activity is to be accomplished, as planned by the Builder in coordination with all subcontractors whose work is shown on the diagram.

B. Highlight the “critical path” through the schedule to illustrate those inter-dependent activities that cannot be delayed without impacting the overall completion time.

C. Builder shall coordinate the Work with the University of Florida schedule. The Work shall be scheduled and carried out such that the normal operations of the University are given first priority. This applies particularly to outages of utilities and restrictions of access. The University may require such construction operations to be executed outside of normal working hours and by overtime, weekend, and holiday working. It shall be the Builder's responsibility to provide for this in the Cost of Work.

D. See Section 01 01 40 for information on home football game restrictions, and account for same in the construction schedule.

E. Incorporate commissioning requirements and milestones.

F. Provide amplifying information as needed, such as reports on “float,” or as requested by the Owner or Professional.

G. Project-specific schedule requirements: Work shall be completed by February 6, 2023.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

B. Utility outages and dig permits are covered in Section 01 01 60. Permanent installation and hookup of the utility lines are described in the University of Florida Design and Construction Standards.

1.2 DESCRIPTION

A. WORK INCLUDED

1. Provide temporary facilities and controls needed for the Work, including, but not necessarily limited to:

    a. Temporary utilities such as water, electricity, and telephone;
    b. Field offices and sanitary facilities for the Builder's personnel;
    c. Enclosures such as tarpaulins, barricades, and canopies; traffic control and pedestrian control devices;
    d. Erosion control measures; and
    e. Directional and informational signage.

B. WORK NOT INCLUDED

1. Except for the requirement that equipment furnished by subcontractors shall comply with pertinent safety regulations, such equipment as normally furnished by the individual trades in execution of their own portions of the Work, is not part of this Section.
2. The permanent installation and hookup of utility lines are described in other sections and are not part of this Section except as related to the metered cost of such utilities once established.

1.3 PRODUCT HANDLING

A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

1.4 SUBMITTALS

A. The Builder shall present a jobsite management plan in the form of a scaled, marked-up site plan for the Owner's review at or prior to the Pre-Construction Conference. This drawing shall identify, at a minimum:

1. Temporary fencing with gated point(s) of access
2. Materials delivery & storage areas
3. Field office or storage trailers
4. Temporary accessibility features including paved or unpaved roads, sidewalks, bicycle paths, ramps, curb cuts, canopies, barricades, or other means of maintaining safe and ADA-accessible routes through or around the site
5. Waste collection (dumpsters)
6. Signage and striping
7. Paths for emergency egress
8. Onsite staff parking
9. Tree protection
10. Restricted access routes for vehicles and equipment belonging to the Builder and its subcontractors, vendors, and employees entering upon the UF Campus

B. As construction progresses, the Builder shall identify any required disruptions or restrictions of roads, sidewalks, bicycle lanes, or other means of access. Approval for such disruptions shall be secured prior to scheduling related work by submitting a written request to the University project manager. This request shall be accompanied by a site sketch, start and end dates, an explanation of the reasons(s) for the request, and an illustration or description of the temporary controls to be used to maintain safe access. The full closing of vehicular roads (i.e., all lanes) on the UF campus shall be planned several weeks in advance of panned scheduled restrictions and has gone through the approval process by the University project manager.

C. A formal traffic control plan – including credentials of plan developer – shall be submitted for review when lane closures are anticipated. See paragraph 3.1 of this section.

PART 2 - PRODUCTS

2.1 TEMPORARY UTILITIES

A. USAGE, ESTABLISHMENT, and COST

1. The Builder shall include in the Cost of Work both the installation of any temporary utilities and the (monthly) usage fees for same. This includes, but is not limited to: potable water for drinking and/or construction trailers; water for cleaning, construction, flushing, commissioning, and testing of plumbing and mechanical systems; convenience power for tools, lighting, and/or construction trailers; temporary power for construction and testing; telecommunications lines for phone, fax, or Internet service. Current Facilities Services utility rates can be viewed at https://www.facilitiesservices.ufl.edu/information/rates.shtml.
2. For use of University-owned utilities, the Builder shall establish an account with Facilities Services by contacting Facilities Services Billing at (352) 294-0628 to learn the process for creating the account.
3. Prior to beginning work that involves connections to the University's utilities systems, the Builder shall submit – at least 48 hours in advance – a work request to Facilities Services Work Management (392-1121) for installation of temporary meter(s) by Facilities Services Utility Services.

B. WATER

1. The point(s) of connection shall be designated by Facilities Services.
2. A temporary potable water meter will be furnished and installed by Facilities Services Water Distribution group when water connection is to a Fire Hydrant.
3. All other water connections will be billed off existing meters.
4. Builder shall furnish and install all necessary temporary piping and water supply and, upon completion of the Work, remove same.

C. ELECTRICITY

1. The point(s) of connection shall be designated by Facilities Services.

    a. **PLEASE NOTE:** Any remodeling/renovation or project that requires Temporary Power for contractor's trailers onsite it is Mandatory that Facilities Services Utilities Department shall be contacted for requirements for metering, no other entity shall decide or grant if meter is required!

2. A temporary electric meter will be furnished by Facilities Services Utility Services, which shall also energize service, but installed by the Builder. Allow 14 days lead time for the Owner-furnished meter. The Builder shall furnish and install all necessary related accessories (CTs, compatible meter socket/can, etc.).

    a. All Accessories (CT's, Compatible meter socket/can) to be designated exclusively any Facilities Services Meter Department prior to installation of any electric metering equipment.

3. Builder shall furnish and install all necessary temporary wiring and, upon completion of the Work, remove same.

a. Facilities Services Meter Department shall be notified prior to temp Electric meter being removed from service and once removed shall be returned to Facilities Services Meter Department
b. All temporary wiring provided by the Builder must conform to the requirements of the National Electric Code (NEC), the Industrial Safety Commission, and local requirements. In addition, all wire used shall be fused to adequately protect that wire according to the NEC.
c. The Builder shall have an adequate number of outlets and each outlet shall be properly and clearly labeled with the maximum voltage and fuse protection.
d. Where temporary lighting is used, outlets shall consist of a weatherproof socket properly insulated and provided with a locking type wire guard.
e. All devices shall be properly grounded.

4. Provide area distribution boxes located such that the individual trades may furnish and use extension cords 100 feet in length (maximum) to obtain power and lighting at points where needed for work, inspection, and safety.
5. Temporary electric facilities shall be inspected and approved by Facilities Services and EH&S prior to energizing by Facilities Services Utility Services.
6. In keeping with UF sustainability policies, and to minimize the cost of utility services, the Builder shall minimize the use of temporary or permanent lighting, particularly when the jobsite is inactive. The use of energy efficient lamps is encouraged if the energy savings justifies any additional expense.

D. TELEPHONE and INTERNET

1. The Builder shall make arrangements with UF Information Technology (UF IT) or HealthNet – as applicable – or the local utility for temporary phone, fax, and/or Internet service lines.

E. SANITARY FACILITIES

1. Furnish and install temporary sanitary facilities for use by all construction personnel.
2. The Builder shall provide and maintain in a neat and sanitary condition such accommodations for the use of employees and subcontractors as may be necessary to comply with the regulations of the State Board of Health.
3. Unless expressly allowed by the Owner, existing sanitary facilities may not be used by construction personnel, subcontractors, or vendors.

2.2 PERMANENT (BUILDING) UTILITIES

A. Once permanent power, chilled water, and other permanent metered utilities are established, the cost of such utilities shall be borne by the Builder as a cost of the Work.

B. Utility services will not be provided until new meters are installed and certified to be operating properly by Facilities Services Utility Services.

2.3 FIELD OFFICES AND SHEDS

A. TRAILERS – Provide a field office/trailer and any necessary Storage. The field office/trailer shall minimally be equipped/supplied with:

1. A conference room with a large enough table with chairs for 16 people.
2. Heat and AC
3. Electricity
4. Wireless Internet
5. Provide stairs and railings as required by OSHA.
6. An office within the field office/trailer for Engineer's on-site representative which shall include:

    a. One desk equal to HON model HON-38180ML, each with commercial-quality steel frame with 30" x 72" plastic laminate work surface, box drawer, file drawer, keyboard shelf
    b. One commercial-quality, swivel cloth upholstered desk chairs with pneumatic seat-height adjustment, adjustable padded arms, padded back with adjustable height/depth/angle, contoured lumbar support equal to HON-2072BW19T.
    c. One heavy-duty, 2-drawer, 42" long, letter size lateral locking file cabinets with high-sided drawers to accept hanging "Pendaflex file folders".
    d. One 60" x 36" dry-erase marker board with marker holding try, installed as directed by Engineer Representative.
    e. One 5-gallon trash cans and one recycle bin.
    f. Electricity
    g. Access to wireless internet

2.4 ENCLOSURES

A. GENERAL: Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

B. DUMPSTER ENCLOSURES: For all projects requiring dumpsters, where the dumpster is located within the geographical area of campus bounded by SW 13th Street, West University Avenue, Gale Lemerand Drive, and Stadium Road, the dumpster shall be enclosed by a solid wooden fence installed around the entire perimeter. This fence shall be

a minimum of 6' high and shall be constructed of vertical 1 x 6's on a 2 x 4 frame. Pre-fabricated sections are acceptable.

1. Protection of all hardscape and landscape must be provided for the storage and removal of all dumpsters.

C. TREE PROTECTION: See tree protection guidelines, Appendix I, University of Florida Construction Standards, Volume 1. Tree protection applies for all trees, weather they are inside or outside any fenced areas.

2.5 TEMPORARY FENCING

A. Provide and maintain for the duration of construction a temporary fence to prevent entry of the public into the jobsite. Fencing shall be six-foot high chain link fencing with dark green-colored inlaid fabric mounted on fixed posts of metal for temporary parking and work area. Open trenches and other hazards shall be enclosed in a fixed wire fence with flashing lights.

B. Maintain the security, lighting and appearance of fencing throughout construction.

2.6 EROSION AND SEDIMENTATION CONTROL

A. The Builder shall develop a “Sedimentation and Erosion Control Plan” per the UF Design & Construction Standards (Appendix C).

B. This plan shall be submitted for review and approval prior to beginning any onsite work or applying for dig permits.

C. The Builder shall erect and maintain control measures as outlined in the plan throughout construction. Such measures may include gravel “wash-down stations” at jobsite entry and exit points, silt fencing, and temporary grass seeding.

D. See Section 31 25 00 for more information.

2.7 SIGNAGE

A. Install and maintain the appearance of the standard University of Florida Board of Trustees Project Sign in a location directed by the University Project Manager.

B. Florida Statutes 812.014 and 810.09 require that construction fences be adorned with the following sign: "**WARNING** *(red on white)* - **This area is a designated construction site. Anyone trespassing on this property shall, upon conviction, be guilty of a felony**.” *(black on white)* Signs shall be approximately 14" x 18".

C. Post the following notice on each leg of construction fencing:

"**IMMEDIATELY REPORT SEXUAL HARASSMENT FROM ANYONE AT THIS CONSTRUCTION SITE. STUDENTS CONTACT THE DEPUTY TITLE IX COORDINATOR FOR STUDENTS (352.392.1261). ALL OTHERS CONTACT THE TITLE IX COORDINATOR (352) 273-1094)."**

D. Provide way-finding, directional, and other informational signage as needed to safely accommodate the public's need to pass around or through the Work. This shall include, as needed, directional assistance for ADA-compliant paths of travel throughout the duration of construction.

E. No other signs or advertisements are permitted.

2.8 CLEANLINESS

A. The Builder shall keep the premises free from accumulation of waste material and rubbish, and shall remove from the premises all rubbish, implements, surplus materials, and temporary facilities provided during the course of the Work, leaving spaces broom clean.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Builder shall not mobilize and/or erect temporary facilities until the jobsite management plan has been reviewed and approved by the Owner.

B. Prior to erection of fencing, the Builder shall review the proposed fencing plan onsite with the University Project Manager and representatives of EH&S, UFPD, Facilities Services and the Americans with Disabilities Act Office.

C. Directional signage shall be installed simultaneously with fencing and/or temporary roads or paths.

D. Traffic maintenance devices and procedures (signage, barricades and cones, flagmen, etc.) shall be per Florida Department of Transportation (FDOT) standards (2003 Edition, Manual on Uniform Traffic Control Devices (MUTCD), with Revision No. 1 Incorporated, dated November 2004). Work zone traffic control schemes and devices shall only be implemented or installed in the field by or under the direct supervision of a person who has satisfactorily completed the training requirements prescribed by FDOT Topic No: 625-010-010-f, "MAINTENANCE OF TRAFFIC TRAINING," Work Zone Traffic Control and Maintenance of Traffic Intermediate or Advanced Level as appropriate for the project. All flagmen shall

have successfully completed the Work Zone Traffic Control and Maintenance of Traffic - Basic Level.

3.2 WEATHER PROTECTION

A. Take necessary precautions to ensure that roof openings and other critical openings in the building are secured. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

B. When a warning of gale force (or higher) winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Owner property. Precautions shall include, but are not limited to, closing openings; removing loose materials, tools, and equipment from exposed locations; removing or securing scaffolding and other temporary work; and arranging for all dumpsters to be emptied.

3.3 MAINTENANCE AND REMOVAL

A. Maintain temporary facilities and controls as long as needed for safe, compliant, and proper completion of the Work.

B. Remove temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Owner.

C. Replace any trees, shrubs, lawns, or plantings damaged by Builder or its subcontractors or vendors during work of this project within two (2) weeks of occurrence.

D. Grassed areas generally have irrigation systems below grade; verify location of these systems and all underground utilities in work or staging areas prior to start of construction.

E. Repair utilities damaged by work of this project.

END OF SECTION 01 50 00

SECTION 01 50 50 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

1.2 HAZARDOUS SUBSTANCES

A. The builder is responsible for proper management of hazardous substances used, stored, handled, generated, or disposed of by his own construction activities (e.g., excess or unwanted hazardous construction-related materials, including, but not limited to: equipment lubricants, used oil filters, aerosols, paints, activators, adhesives, caulks, and other hazardous wastes). In no case shall such construction hazardous waste be commingled with demolition hazardous waste. In no case shall such construction hazardous waste be commingled with non-hazardous construction or demolition waste.

B. For renovation or demolition projects, hazardous wastes shall be segregated, collected, labeled, and disposed of via UF Environmental Health & Safety (EH&S). These include light fixture ballasts (PCB and non-PCB), mercury thermostats, and batteries. See www.ehs.ufl.edu/programs/chemrad_waste.

C. Evaluation, on-site storage, transportation, disposal and other aspects of Hazardous Waste Management shall comply with applicable Federal, State, and local laws.

D. Refer to the General Terms & Conditions for requirements related to the discovery of environmental contamination, including, but not limited to, Hazardous Substances.

1.3 CONSTRUCTION WASTE MANAGEMENT

A. In support of Florida Statute 403.7032 and the University's Zero-Waste Goal, the University of Florida requires that its builders maximize the diversion of construction and demolition (C&D) material from landfills. Faculty and students from the UF School of Building Construction and the College of Design, Construction, and Planning may interact with the Builder to facilitate, coordinate, and document such efforts and/or to conduct research.

1. Beyond the provisions for such work in either the basic scope of work or bid alternates, the builder shall salvage materials for reuse, resale, or recycling to the

maximum extent possible. Typical designated waste streams include land clearing debris, concrete and masonry, metals and appliances, dimensional wood & lumber, wooden pallets, gypsum wallboard (unpainted), paper and cardboard, packaging, and asphalt roofing shingles. Depending on the project, other large volume wastes may be included (e.g., bricks, asphalt, carpeting and pad, plastic, glass, beverage containers).

2. For projects seeking a 3rd-party sustainable building certification, the Builder shall establish and adhere to program-specific waste diversion and recycling goals.
3. Prior to mobilization, the Builder shall submit a project-specific Solid Waste Management Plan to the University Project Manager for review by the University Solid Waste Coordinator and Sustainable Building Coordinator. This plan shall include the following elements:

    a. An explanation of how C&D waste will be recycled or reused – by source separation, time-based separation, or commingled for delivery to an offsite separation facility.
    b. A list of materials targeted for recycling and reuse, their estimated quantities, and the predicted end use of the recycled materials, along with a separate list of recyclable or otherwise recoverable materials that must be landfilled.
    c. The overall diversion goal (percentage of waste to be diverted from land- filling or incineration).
    d. The facilities to be used, both landfills and recycling facilities, indicating which of the targeted wastes are to be received, projected quantities, facility addresses and phone numbers, and documentation of the facilities' permit status.

4. Builder shall designate an onsite representative to distribute and implement the approved plan, instruct workers, and provide instruction and supervision on separation, handling, and recovery methods. The onsite representative shall also ensure proper labeling of waste collection receptacles and otherwise monitor compliance with the project-specific Solid Waste Management Plan.
5. Reporting

    a. Submit monthly progress reports using Owner's form (see sample Waste Reporting Log at the end of this specification) to quantify the total amount of collected waste and the percentage recycled.
    b. Maintain accurate records of the final destination of all waste, including manifests, weight tickets, and receipts. Manifests shall be from recycling and disposal site operators who can legally accept the materials for the purpose of reuse, recycling, or disposal. Submit all such records at the end of construction or upon request.

1.4 RECYCLING INITIATIVES

A. For renovation and demolition projects, the builder and its subcontractors shall cooperate with, and participate in, materials-specific recycling initiatives hosted or supported by the

University as required by the UF Design & Construction Standards. See plans and/or technical specifications for more information.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 50 50

UNIVERSITY OF FLORIDA
REITZ LAWN INNER ROAD IMPROVEMENTS
UF-644, UF-644A, UF-644B
100% CONSTRUCTION DOCUMENTS

RMF Engineering, Inc.
RMF No: 120147.B0
June 10, 2022

UF Waste Reporting Log

Project Name:								**Date:**						
			RECYCLED WASTE											
MONTH	**Landfilled Waste (tons)**		**Paper and Cardboard (tons)** white and craft	**Metals (tons)** metal and wire	**Concrete, Asphalt, Masonry (tons)** asphalt, concrete, brick, CMU, etc.	**Comingled Cans & Bottles (tons)**	**Land Clearing Debris (tons)** trees, limbs, landscape, sod, rocks etc	**Pallets (tons)**	**Wood (tons)** recyclable products	**E-Waste (tons)** controls, panels, machinery	**MISC. (tons)** shingles, drywall, ceiling tile, plastics etc			
January	0.00		0.00											
February	0.00		0.00											
March	0.00		0.00											
April	0.00		0.00											
May	0.00		0.00											
June	0.00		0.00											
July	0.00		0.00											
August	0.00		0.00											
September	0.00		0.00											
October	0.00		0.00											
November	0.00		0.00											
December	0.00		0.00											
												Total Recycled Tons	**Total Waste Tons**	**Percent Recycled**
Total	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**#DIV/0!**
Minimum 75% required per F.S. 403.7032														
Builder shall submit this form on or around the 15th of each month to PPD Grounds (damorris@ufl.edu and amasters@ufl.edu), with a copy to the UF PM.														

SECTION 01 70 00 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

1.2 CERTIFICATE OF OCCUPANCY

A. Prior to occupancy of a new building, the Division of Environmental Health & Safety (EH&S) shall issue a Certificate of Occupancy (CO). The CO will state the building is complete, constructed in accordance with the plans and specifications, and meets the minimum code requirements at the time of issuance of the building permit. Project must achieve at least a temporary CO in order to achieve this requirement for the Substantial Completion.

1.3 SUBSTANTIAL COMPLETION

A. Separate and distinct from completion requirements related to life safety and building codes is the contractual obligation to achieve Substantial Completion on or before the specified date. Refer to the “Construction Inspection and Closeout” link under “Forms & Standards” on the Planning Design & Construction website (www.facilities.ufl.edu). Checklists and forms related to closeout shall be tailored by the Owner and design professional (A/E) to the specific needs of the project.

1.4 AS-BUILT DOCUMENTS

A. See the General Terms & Conditions and certain technical specifications for more information regarding as-built / record documents.

1.5 O&M MANUALS

A. Builder shall provide draft operation and maintenance (O&M) manuals and other documents for review by UF (Facilities Services) and the A/E prior to manufacturer startups, testing, and Owner training.

B. Builder shall tailor the O&M documents to the project, excluding or striking through models/types not installed and otherwise including only information pertinent to the products, materials, equipment, or components actually installed. Builder shall clearly identify each item, with references to the construction documents as needed.

C. Builder shall augment O&M documents with the final approved versions of any submittals, shop drawings, or other system/product data not already included.

D. Builder shall finalize turnover/closeout documents (including O&Ms) by addressing review comments and incorporating missing or finalized documents, test reports, and other relevant information.

E. See 1.9 below for content and format requirements.

F. Asset Tagging – Builder shall identify and work with UF to ensure all assets are in Owner CMMS prior to Substantial Completion.

1.6 UTILITY VIDEOS

A. When required by the technical specifications, television camera videos of underground utility lines shall be provided to the engineer of record and the Owner in MPEG or AVI format.

1.7 OWNER TRAINING

A. Training on building systems, equipment, and materials, the specific requirements for which are outlined in the technical specifications, shall be completed prior to Substantial Completion, at which point the Owner assumes the responsibility for operation and maintenance of the facility.

B. Builder shall coordinate the schedule for training with UF and provide a comprehensive schedule for all training sessions at least 30 calendar days prior to the first scheduled session.

C. Builder shall provide – at least two weeks in advance of each scheduled session – a syllabus, outline, or agenda for each training session for review by UF and the A/E.

D. Training shall be conducted with the (draft) O&M manuals in hand and shall be videotaped and turned over to the Owner in MPEG format.

1.8 ATTIC STOCK

A. Coordination of the physical storage location of "attic stock" items shall be made with the building operation & maintenance entity prior to Substantial Completion, and the items and quantities of same (as outlined in the technical specifications) shall be on hand as a requirement of Substantial Completion. The Builder shall develop a spreadsheet itemization of attic stock and other items to be turned over to the Owner, tracking the type and quantity of material, date(s) of turnover, and other relevant information.

B. If attic stock is used during the closeout or warranty period. The Builder must replace these materials prior to the 12 month warranty sign off.

1.9 ENERGY REBATE PROGRAM

A. Builder shall gather product data and other information as needed to assist Owner with its application for energy rebates based on the materials and products installed in the facility.

1.10 CLOSEOUT DOCUMENTS AND OTHER DELIVERABLES

A. The final version of all O&M manuals and other turnover/closeout documents shall be provided in electronic (searchable PDF) form prior to Final Completion, including a Table of Contents for each discreet manual. Provide these to UF and the A/E on CD-ROM or through a file-sharing platform (e.g., Sharepoint), assembled and organized in electronic folders as follows:

010000 – General Requirements *(with subfolders for pre-concealment photos and other general information such as a complete list of subcontractors with contact information, a list/inventory of attic stock, and a final list/inventory of all colors & finishes)*
030000 – Concrete
040000 – Masonry
050000 – Metals
060000 – Wood and Plastics
070000 – Thermal and Moisture Protection *(including roofing)*
080000 – Doors and Windows
090000 – Finishes
100000 – Specialties *(e.g., lockers, window treatment, acoustic wall panels, operable partitions, toilet accessories, fire extinguisher cabinets, mobile storage systems, etc.)*
110000 – Equipment
120000 – Furnishings *(e.g., fixed tables/seating, lab casework, marker boards, foot grilles, etc.)*
130000 – Special Construction
140000 – Conveying Systems
210000 – Fire Protection

220000 – Plumbing
230000 – HVAC
250000 – BAS and Controls
260000 – Electrical
270000 – Telecommunications
274000 – Audio-Visual Systems
280000 – Security & Access Control
283000 – Fire Detection & Alarm
310000 – Earthwork
320000 – Exterior Improvements
330000 – Utilities

B. Other than 010000, each e-folder listed above, where applicable, shall include the following sub-folders to consistently organize the documents and material:

1. IOM Documents and Product Data
   {NOTE: IOM = Installation Operations & Maintenance}
2. Shop Drawings
3. Training (including training agendas, sign-in sheets, and videos)
4. Warranty Documents
5. Other (e.g., test reports, underground utility videos, Master UL labels, meter data sheets, 3rd party certifications or inspections)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 70 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 01 01 00 "Summary of Work" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 31 10 00 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services will not be permitted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Owner's continuing occupancy of existing buildings.

C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify the Owner of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Asbestos-containing materials may be present in piping to be selectively demolished.

1. If applicable and as required, the Contractor shall enlist the services of a subcontractor that is licensed in the State of Florida to perform asbestos abatement. All work associated with the handling and disposal of asbestos-containing materials shall be conducted by the licensed subcontractor.
2. Subcontractor shall comply with all laws, ordinances, codes, rules and regulations of the local, state, and federal authorities.
3. Subcontractor shall execute all notifications and manifests, and obtain all permits and licenses for removing, handling, and disposing of the asbestos-containing materials where shown on the Drawings, or where required to perform the new work.
4. Subcontractor shall submit to the Consultant the following items prior to performing the work associated with asbestos-containing materials.

    a. Submit a copy of the subcontractor's licenses to perform asbestos abatement work.
    b. Submit the OSHA medical surveillance documents conducted within the last 12 months for each worker.
    c. Submit the plan describing the method for performing air monitoring and sampling to be in compliance with OSHA Asbestos Standards.
    d. Submit the name, address, and applicable licenses from the transporter and the landfill that will handle and dispose of the asbestos-containing material.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Consultant.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

2. Before selective demolition, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 01 01 00 "Summary of Work."

B. Existing Services/Systems to Be Removed: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Disconnect, demolish, and remove plumbing, and HVAC systems, equipment, and components indicated to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Equipment to be Removed: Disconnect and cap services and remove equipment.
c. Ducts to be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
d. Ducts to be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
6. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Store items in a secure area until delivery to Owner.
3. Transport items to Owner's storage area designated by Owner.
4. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Protect items from damage during transport and storage.
3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Manholes

1.3 SUBMITTALS

A. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, dry-shake finish materials, and others if requested by Engineer.

B. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

C. Material Test Reports: The Special Inspector or their agent shall interpret test results for compliance of the following with the requirements indicated, based on comprehensive testing of current materials:

1. Laboratory test reports for concrete materials.

D. Material certificates in lieu of material laboratory test reports when permitted by The Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1. Cementitious materials and aggregates.
2. Form materials, form liners and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Bonding agents.
6. Adhesives.
7. Repair materials.
8. Epoxy adhesive system for dowels.
9. Waterstops.

E. Minutes of preinstallation conference.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Testing Service: The Contractor will engage a Special Inspector (SI) responsible for overseeing all the required inspections and material evaluation tests for the project. The SI may subcontract this work to qualified Independent Testing Agencies (ITA's). The independent testing agency shall be acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548. The Contractor shall coordinate testing times and activities with the Special Inspector. Refer to section 014500, 'Special Inspections and Structural Testing' and the Statement of Special Inspections for additional concrete testing and inspection information.

C. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Materials and installed work may require testing and retesting at any time during progress of Work. Retesting of rejected materials for installed Work, shall be done at Contractor's expense.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" and the following:

1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals,

status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

a. Contractor's Superintendent.
b. Special Inspector (SI) and Special Inspector's Independent Testing Agency (ITA) responsible for field quality control.
c. Ready-mix concrete producer.
d. Concrete subcontractor.
e. Primary admixture manufacturers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to support weight of placed concrete without deformation.

D. Form Release Agent: Provide commercial formulation form release agent with a maximum of 46.7 oz. per gal. volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.2 REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.

B. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

a. Fly Ash: ASTM C 618, Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Aggregates:

1. Normal-Weight: ASTM C 33, uniformly graded. Provide aggregates from a single source for exposed concrete. Use Normal-Weight aggregates unless noted otherwise.
2. Nominal maximum aggregate size: ¾ inch
3. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
4. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to the Engineer.

C. Water: Potable and complying with ASTM C94.

D. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent water soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

E. Water-Reducing Admixture: ASTM C 494, Type A.

F. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

G. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

H. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

I. Air-entraining Admixture: ASTM C 260.

J. Concrete Waterproofing Admixture: Xypex Admix C-500, C-1000, C-2000 or approved equal. Mix with concrete in accordance with the manufacturer's recommendation.

2.4 RELATED MATERIALS:

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9-oz./sq. yd., complying with AASHTO M 182, Class 2.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

C. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.11 lbs. per sq. ft. when applied at 200 sq. ft./gal.

D. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 46.7 oz. per gal.

E. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

F. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

G. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

H. Epoxy Adhesive for Dowel Reinforcing:

1. Injectable adhesive shall be used for installation of all reinforcing steel dowels to be drilled in and embedded in concrete. Use SET injection adhesive system by Simpson Strongtie, HIT HY 200 by Hilti Corp. or PE1000+ by Powers Fasteners by or approved equal.

2.5 WATERSTOPS

A. Self-Expanding Hydrophilic Strip Waterstop: Compressible with volumetric expansion 100% or less. Size 3/8” x 3/4” for walls 12” and less in thickness, 3/4” x 1” for walls thicker than 12”. Reproducible swell after cycling. Suitable for use in non-moving joints without the need for reinforcing beside the strip. Strip shall be self-adhered or fastened with manufacturer’s adhesive with manufacturer’s written installation instructions.

1. Synk-flex by Henry.
2. Adcor ES by Grace Construction Products.

2.6 PROPORTIONING AND DESIGNING MIXES:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, an independent testing agency is responsible for performing, preparing and reporting proposed mix designs. This testing agency shall be hired by the Contractor.

B. Submit written reports to the Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been approved by the Engineer.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. Below grade concrete: 4000 psi, 28-day compressive strength; water-cement ratio, 0.45 maximum (non-air-entrained).
2. Exposed, above grade concrete: 4000 psi, 28-day compressive strength; water-cement ratio, 0.45 maximum (air-entrained).

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Slabs, and sloping surfaces: Not more than 3 inches.
2. Curbs and walls: Not less than 2 inches and not more than 4 inches.
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2 - 4 inch slump concrete.
4. Other concrete: Not more than 4 inches.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by the Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Engineer before using in Work.

2.7 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50° F.

C. Use high-range water-reducing admixture in all pumped concrete. Pumping concrete without a high-range water-reducing admixture is not permissible without prior consent of the Engineer.

D. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

E. Use waterproofing admixture in all below-grade concrete structures.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoid cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by the Engineer.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Use sheet stock only. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to the Engineer.

B. Provide keyways at least 1-1/2 inches deep and 3-1/2 wide in construction joints in walls and slabs unless otherwise noted on drawings. Bulkheads designed and accepted for this purpose may be used for slabs and walls.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as foundation walls, column pedestals and other locations, as indicated.

F. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8-inch-wide by one-fourth of slab depth or inserts 1/4-inch-wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Contraction joints in unexposed slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

3.5 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.6 WATERSTOPS

A. Self-Expanding Strip Rubberized Hydrophilic Waterstops: Install in construction joints where indicated on drawings, and position in joint according to manufacturer’s instructions. Locate in center or close to center of wall. Secure waterstop with adhesive bonding or mechanically fasten in place. Provide in longest lengths practicable and lap waterstops per manufacturer’s recommendations.

3.7 PREPARING FORM SURFACES:

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT:

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°F at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90°F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Do not use liquid nitrogen to cool concrete.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to the Engineer.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

A. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F (F) 18 (floor flatness) and F (L) 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screening and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed slabs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

3.13 SHORES AND SUPPORTS

A. General: Comply with ACI 347 for shoring and reshoring and as specified.

B. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

C. Keep reshores in place a minimum of 15 days after placing upper tier, or longer, if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.14 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.15 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to the Engineer.

3.16 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to the Engineer.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1

inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces; where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to the Engineer.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound.

Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of the Engineer for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of the Engineer.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Special Inspector and/or their agent will perform tests and submit test reports. The Contractor shall coordinate testing times and activities with the Special Inspector. Refer to the Statement of Special Inspections for additional concrete testing and inspection information.

B. Sampling and testing for quality control during concrete placement includes the following, as directed by the Engineer.

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 75 cu. yd., plus one set for each additional 75 cu. yd. or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40°F and below and when 80°F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
6. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of five standard cylinder specimens for each composite sample.

    a. Cast and field cure one set of six standard cylinder specimens for each composite sample when early form stripping is to be performed.

7. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days. The fifth specimen will be kept as a spare.

    a. When early form removal is to be performed, test two field-cured specimens at 3 days, two at 7 days and two at 28 days. All field cured specimen testing shall be at the Contractor’s expense. Field cured tests are in addition to lab cured tests.

b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength Test result falls below specified compressive strength by more than 500 psi.

C. Test results will be reported in writing to the Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by The Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. All additional tests of in-place concrete will be at the Contractor's expense.

END OF SECTION 03 30 00

SECTION 03 41 00 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Precast Electric Vaults.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for placing connection anchors in concrete.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Precast structural concrete units and connections shall withstand HS 20 design loadings within limits and under conditions indicated.

B. Engage a fabricator who assumes undivided responsibility for engineering structural precast concrete units by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

C. Shop drawings prepared by or under the supervision of a qualified professional engineer detailing fabrication and installation of precast concrete units. Indicated member dimensions and cross-sections; locations, sizes, and types of reinforcement, including special reinforcement; and lifting devices necessary for handling and erection.

1. Indicate layout and dimensions, and identify each precast concrete unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail loose, cast-in, and field hardware inserts, connections, and joints, including accessories and construction at openings in precast units.
2. For precast concrete units indicated to comply with design loadings or calculated fire-resistance requirements, include structural analysis data sealed and signed by the qualified professional engineer responsible for their preparation.

D. Material certificates signed by fabricator certifying that each material item complies with requirements.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Must participate in Precast/Prestressed Concrete Institute's (PCI) Plant Certification program and be designated a PCI-certified plant as follows:

a. Group C, Category C2 - Prestressed Hollowcore and Repetitively Produced Products

B. Installer Qualifications: A precast concrete installer who has completed structural precast concrete work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Design Standards: Comply with ACI 318 and design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
2. Place adequate dunnage of even thickness between each unit.
3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses that would cause cracking or damage.

D. Lift and support units only at designated points shown on Shop Drawings.

E. Deliver precast concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so that markings are visible.

1.7 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

B. Form Liners: Units of face design, texture, arrangement, and configuration. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, cold-drawn.

C. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

D. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.10 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

F. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.4 CONNECTION MATERIALS

A. Accessories: Provide embedded lifting inserts to facilitate both initial installation and future removal and reinstallation of hollow core plank panels. Insert material shall be

stainless steel and installed flush with the top surface of the panel. The insert shall accommodate a threaded rod/eyebolt or other similar device for attaching a crane hook or chain. Provide a plastic or stainless steel threaded lug which can be easily removed for use in protecting the female ends of the lifting insert device while in place. The lug shall be flush with the panel. The size, capacity, spacing and number of inserts shall be determined by the precast manufacturer.

2.5 GROUT MATERIALS

A. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Normal-Weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, and ACI 301, using materials to be used on the Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.40.

D. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116

1. Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 116.

E. Other Admixtures: Use water-reducing, high-range water-reducing, water-reducing and accelerating, or water-reducing and retarding admixtures according to manufacturer's directions.

F. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.7 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly chamfered.

2.8 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Engineer's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.

2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcement to maintain at least the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses.

G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
5. Protect strand ends and anchorages with a minimum of 1-inch- thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines,

honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 116.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

L. Comply with ACI 306.1 procedures for cold-weather concrete placement.

M. Comply with PCI MNL 116 procedures for hot-weather concrete placement.

N. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that will not show in finished structure.

O. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

P. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Engineer's approval.

2.9 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product dimension tolerances.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting, cast-in-place, building structural framing has attained minimum allowable design compressive strength or until supporting steel or other structure is complete.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, supports, and bracing as required to maintain position, stability, and alignment of units until permanent connection.

1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.

C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Field cutting of precast units is not permitted without approval of the Engineer.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Grouting: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled.

1. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.
2. Fill joints completely without seepage to other surfaces.
3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
4. Place grout end cap or dam in voids at ends of hollow-core slabs.
5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
6. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Engineer.

3.4 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 41 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following metal fabrications:

1. Loose bearing and leveling plates.
2. Miscellaneous framing and supports
3. Steel grating.
4. Ladders.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections. Provide submittals for all expansion type anchors, epoxy anchors and adhesives. Submittals must include manufacturer’s load tables. Provide manufacturer’s product data including lead and span tables for grating.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code—Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and has undergone re-certification within the past 12 months.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of beams, columns and walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Coordinate construction to ensure that actual dimensions correspond to shop drawing dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Steel Plates, Shapes, and Bars: ASTM A992, ASTM A36 or ASTM A 572.

C. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated.

1. Finish: Painted.

D. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B or C.

E. Welding Electrodes: E70XX, comply with AWS requirements.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good

resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 FASTENERS

A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating. Select fasteners for the type, grade, and class required.

B. High-Strength Bolts, Nuts and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.

C. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 4 times the load imposed when installed in concrete.

1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5. Provide Zinc-plated anchors unless noted otherwise on dwgs.

D. Epoxy Adhesive Anchors:

1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5. Provide Zinc-plated anchors unless noted otherwise on dwgs.
2. Adhesive anchors are available from the following manufacturers:

a. Hilti Corp.
b. Simpson Strongtie.
c. Dewalt.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications with a minimum 28-day 5,000 psi compressive strength.

2.5 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Shear and punch metals cleanly and accurately. Remove burrs.

D. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Remove sharp or rough areas on exposed traffic surfaces.

F. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

H. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

I. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

J. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

K. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

C. Galvanize miscellaneous framing and supports in the following locations:

1. Manholes.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.

B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Manholes.

2.9 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.

B. Finish metal fabrications after assembly.

2.10 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick or thicker.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.11 STEEL GRATING

A. Provide steel grating as indicated on the drawings. Grating shall conform to requirements of ASTM A 569, welded steel grating and comply with ANSI/NAAMM MBG 531 “Metal Bar Grating Manual.”

1. Steel Grating:

a. 1 inch bearing bars at 1-3/16 inches on center. Cross bars at 4 inches on center maximum.
b. Finish: Hot-dip galvanized.

2.12 LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, unless otherwise indicated.

B. Siderails: Continuous, 1/2 by 2-1/2 inch steel flat bars, with eased edges, spaced 16 inches apart.

C. Bar Rungs: 3/4 inch diameter steel bars, spaced 12 inches o.c.

D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

E. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets and fasteners to support design loads specified in ANSI A14.3.

F. Provide non-slip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

G. Galvanize ladders, including brackets and fasteners, to G-90 at all locations.

H. Provide extension egress sections to all ladders, “Bilco Ladder-Up” or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

F. Grating: Grating shall be secured to structural supports by means of welding or saddle clips as provided by grating manufacturer. Perform all cutting, fitting, and placement as may be required for installation. Install grating so that cross bars align, provide any additional structural support members and toe plates.

1. Fabricate cutouts in grating sections for penetrations indicated. Where possible, arrange cutouts to permit grating removal without disturbing items penetrating gratings.
2. Edge-band pipe penetration openings in grating that interrupt four or more bearing bars with bars of the same size and material as bearing bars to give a smooth uninterrupted surface to pass piping and insulation through without damage. Coordinate openings with pipe shop drawings.
3. Provide welded stainless steel clips on inside of stainless steel tubs as required for support of circular sections of grating.

3.3 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

1. Use non-shrink, nonmetallic grout in all locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a 2.0-mil minimum dry film thickness.

B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 05 52 13 – PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Decorative Aluminum railings

B. Related Sections include the following:

1. Section 32 13 13 - CONCRETE PAVING for installing items indicated to be cast into concrete.

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data, specifications, component performance data and installation instructions. Submit samples of selected aluminum finish for approval by the Landscape Architect, prior to commencement of work.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Include details of column anchorage.
2. Provide templates for anchors and bolts specified for installation under other Sections.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following except as otherwise indicated:

1. American Society for Testing and Materials, (ASTM).
2. National Association of Architectural Metal Manufacturers, (NAAMM).

B. Installer Qualification: Not less than three (3) years' experience in installation of structure types, quantity and installation methods similar to work of this section.

C. Shop Assembly: Preassemble structures in shop to greater extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark for reassembly and coordinated installation.

D. Welding: Comply with American Welding Society (AWS) Structural Welding Code. Qualify welding procedures, welders, and welding operations in accordance with AWS Standard Qualification Procedure.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Powdercoat aluminum handrail #6930 from Julius Blum & Co., Inc. or equal.

1. Shop manufactured handrails are acceptable but design must match the handrail noted in 2.1.A, above, and as indicated in the UF Landscape Master Plan, October 2018, page 158.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 NONFERROUS METALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

2.4 MISCELLANEOUS METALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Concrete Materials and Properties: Comply with requirements in Division 32 Section "Concrete Paving" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Shop Assembly: When manufacturing in shop, preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

5.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.6 ALUMINIUM FINISHES

A. Provide powder coated finish, black in color.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry or dissimilar metals with a heavy coat of bituminous paint.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean connections. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 52 13

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied asphalt dampproofing for precast electric manholes.

B. Related Requirements:

1. Section 03 41 00 "Precast Structural Concrete" for manhole dampproofing.
2. Section 26 05 43 “Underground Ducts and Raceways for Electrical Systems” for duct-bank dampproofing.
3. Section 03 30 00 “Cast-In-Place Concrete” for manhole dampproofing.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Trowel Coats: ASTM D 1227, Type II, Class 1.

B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

C. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

D. VOC Content: 30 g/L or less.

E. Low-Emitting Materials: Dampproofing shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Cut-Back-Asphalt Primer: ASTM D 41.

C. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

1. Primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

E. Patching Compound of type recommended in writing by dampproofing manufacturer.

F. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch thick.

G. Protection Course: Smooth-surfaced roll roofing complying with ASTM D 6380, Class S, Type III.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

1. Test for surface moisture according to ASTM D 4263.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.

1. Apply dampproofing to provide continuous plane of protection.
2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Concrete Manholes: Apply two brush or spray coats at not less than 2 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat. The final thickness of dampproofing shall be 60 mils thick.

3.5 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.

1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.

3.6 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 11 13

SECTION 07 17 50 - SHEET MEMBRANE WATERPROOFING (EXTERIOR UTILITIES)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Additional Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes waterproofing systems around utility structures.

1. Dual Waterproofing System - HDPE/Bentonite sheet membrane. Bentonite sheet waterproofing is not permitted.

1.3 SYSTEM PERFORMANCE

A. General: Provide sheet-waterproofing products that have been produced and installed to establish and maintain watertight continuous seals at all structure joints, including base slabs, vertical walls and tops.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specifications Sections.

B. Product data and general recommendations from waterproofing materials manufacturer for types of waterproofing required. Include data substantiating that materials comply with requirements. Drawings shall include heights and thickness of waterproofing and protection board. Include joint details at each different condition; show relationship between membrane and joint system at expansion joints. Provide details of end and lap conditions. All materials for the selected waterproofing system must be from the same manufacture and be compatible with each other to provide a continuous barrier to all water infiltration.

C. Samples of sheet membrane waterproofing and auxiliary materials.

D. Manufacturer’s product warranty and contractor’s standard warranty covering workmanship.

1.5 QUALITY ASSURANCE

A. Manufacturer: Obtain primary waterproofing materials of each type required from a single manufacturer, to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Installer: Specialist with not less than 3 years of successful experience in the installation of waterproofing projects similar to requirements for this project with satisfactory in-service performance.

C. Warranty: Deliver to A/E signed copies of the following written warranties against defective materials and workmanship for a period of five years following date of completion. Warrant that installed waterproofing system shall be free of defects including waterproofing failure resulting from substrate cracking up to 1/8 inch.

1. Manufacturer's standard warranty covering materials.
2. Contractor's standard warranty covering workmanship.

1.6 PROJECT CONDITIONS

A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed.

B. Weather: Proceed with waterproofing and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide sheet waterproofing materials complying with required performances.

2.2 DUAL WATERPROOFING SYSTEM

A. General:

1. Provide a dual-waterproofing, resealable, composite sheet membrane system composed of high-density polyethylene with a sodium-bentonite face designed for buried concrete or masonry construction, as manufactured by Tremco International, Inc., or equal system.

2. Obtain primary waterproofing materials of each type required from a single manufacturer to greatest extent possible. Provide accessory materials that are approved by membrane manufacturer.
3. Membrane Properties: Equal to Tremco "Paraseal LG Membrane," or known equal for use on buried vertical and horizontal conditions such as backfilled foundation walls, below slab with bentonite-side up, retaining walls and ponds:

a.	Puncture resistance	155 lbs
b.	Tensile strength	4,000 psi.
c.	Water permeability through membrane	2.7×10^{-13} cm/sec. or 0.03 perms
d.	Water permeability through seam	4.6×10^{-13} cm/sec.
e.	Resistance to hydrostatic head	150 feet-zero leakage
f.	Percent elongation	500 percent
g.	Water migration under membrane	0 at 150 ft. water head
h.	Warranted crack-bridging capability	Developing cracks to 1/8 inch
i.	Sheet size:	24'-0"x4'-0"

2.3 AUXILIARY MATERIALS

A. Adhesives and Joint Tape: Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer for bonding to substrate (if required), for waterproof sealing of seams in membrane, and for waterproofing sealing of joints between membrane and flashings, adjoining surfaces, and projections through membrane.

B. Primers: Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for applications required.

C. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material for flashing as recommended by waterproofing sheet manufacturer.

D. Termination Bars: Provide types of termination bars recommended by the waterproofing sheet membrane manufacturer for the termination/sealing of the waterproofing sheet membrane, as required.

E. Protection Board: Provide type of protection board recommended by waterproofing sheet manufacturer. Include adhesives recommended by manufacturer. At a minimum provide

1” polyisocyanurate board or 1/8” asphaltic hardboard. Protection boards to be installed against completed waterproofing membrane on concrete tunnel walls and top slabs.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Comply with manufacturer's instructions for surface preparation.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for handling and installation of sheet waterproofing materials.

B. Coordinate installation of waterproofing materials and associated work to provide complete system complying with combined recommendations of manufacturers and installers involved in work. Schedule installation to minimize period of exposure of sheet waterproofing materials.

C. Seal to projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.

D. Top Edge Seal: For vertical and sloped wall membrane, finish in reglet; otherwise finish under flashing or under masonry in joint. Caulk exposed edges with mastic or sealant.

E. Expansion Joints: Install joint filler as recommended by manufacturer, with protruding rounded surface. Apply continuous 12-inch wide strip of membrane on joint, followed by membrane application.

F. Coat exposed areas of sheet and flashing materials. Comply with sheet manufacturer's recommendations for application and cure of coating.

G. Install protection board over completed membrane, complying with manufacturer's recommendations for both waterproofing sheet and protection course materials.

H. Do not backfill against or on top of waterproofing system with angular stone. Backfill must be acceptable to waterproofing system manufacturer.

3.3 FIELD QUALITY CONTROL

A. It is required that waterproof membranes are watertight and do not deteriorate in excess of limitations published by manufacturer.

B. Field Inspection: Provide visual inspection for waterproofing membranes on horizontal and vertical surfaces prior to covering by protection course or other work. Any damages found on waterproofing membranes shall be repaired according to manufacturer's recommendations.

3.4 CLEANING

A. After completion, remove any masking materials and stains from exposed surfaces caused by waterproofing installation.

3.5 PROTECTION

A. Provide for protection of completed membrane during installation of other materials or processes over membrane and throughout remainder of construction period. Do not allow traffic of any type on unprotected membrane.

END OF SECTION 07 17 50

SECTION 08 31 00 - HORIZONTAL ACCESS DOOR

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Furnishing and installing factory fabricated vault access doors

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM),
100 Bar Harbor Drive
West Conshocken, PA 19428-2959;
(610) 832-9585, fax (610) 832-9555

1. ASTM A 36-93a: Standard Specification for Structural Steel

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's product data for all materials in this specification.

B. Shop Drawings: Show profiles, accessories, location, and dimensions.

C. Samples: Manufacturer to provide upon request, sized to represent material adequately.

D. Contract Closeout: Vault access door manufacturer shall provide the manufacturer's Warranty prior to the contract closeout.

1.4 PRODUCT HANDLING

A. All materials shall be delivered in manufacturer's original packaging.

B. Store materials in a dry, protected, well-vented area. The contractor shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

C. Remove protective wrapping immediately after installation.

1.5 SUBSTITUTIONS

A. Proposals for substitution products shall be accepted only from bidding contractors and not less than (10) working days before bid due date. Contractor guarantees that proposed substitution shall meet the performance and quality standards of this specification.

1.6 JOB CONDITIONS

A. Verify that other trades with related work are complete before installing vault access door(s).

B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.

C. Refer to the construction documents, shop drawings, and manufacturer's installation instructions.

D. Observe all appropriate OSHA safety guidelines for this work.

1.7 WARRANTY/GUARANTEE

A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of (10) twenty-five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The BILCO Company, P.O. Box 1203 New Haven, CT 06505, or Owner approved equal.

2.2 ACCESS DOOR

A. Furnish and install where indicated on plans vault access door Type J-AL, size 48" x 48". The vault access door shall be single or double leaf. The vault access door shall be pre-assembled from the manufacturer.

B. Performance characteristics:

1. Cover: Shall be reinforced to support an H-20 AASHTO live load.

2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire door, including all hardware components, shall be highly corrosion resistant. Please consult the manufacturer when doors are to be installed in unusually harsh environments or extremely corrosive conditions.

C. Cover: Shall be 1/4" aluminum diamond pattern.Cover shall be reinforced with aluminum structural shapes to achieve live load rating noted above.

D. Frame: Channel frame shall be 1/4" extruded aluminum with bend down anchor tabs around the perimeter. A continuous EPDM gasket shall be mechanically attached to the aluminum frame to create a barrier around the entire perimeter of the cover and significantly reduce the amount of dirt and debris that may enter the channel frame.

E. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.

F. Drain Coupling: Provide a 1-1/2" drain coupling located in the right front corner of the channel frame (note: can be placed at a different location if specified).

G. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate.

H. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug.

I. Hardware:

1. Hinges: Heavy forged aluminum hinges, each having a minimum 1/4" diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame.
2. Cover shall be equipped with an hold open arm which automatically locks the cover in the open position.
3. Cover shall be fitted with the required number and size of compression spring operators. Springs shall have an electrocoated acrylic finish. Spring tubes shall be constructed of a reinforced nylon 6/6 based engineered composite material.
4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.

5. Hardware: Shall be anticorrosion throughout.

J. Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior surfaces of the frame in contact with concrete.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that the vault access door installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

3.2 INSTALLATION

A. Submit product design drawings for review and approval to the architect or specifier before fabrication.

B. The installer shall check as-built conditions and verify the manufacturer's vault access door details for accuracy to fit the application prior to fabrication. The installer shall comply with the vault access door manufacturer's installation instructions.

C. The installer shall furnish mechanical fasteners consistent with the vault access door manufacturer's instructions.

END OF SECTION 08 31 00

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:

1. Exposed interior items and surfaces.
2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the University will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Finished mechanical and electrical equipment.
b. Light fixtures.
c. Distribution cabinets.
d. Control cabinets.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.

c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Painting Schedule: Cross-Referenced Painting schedule listing all exterior and interior substrates to be painted and specified finish paint type, product name and

manufacturer, primer and product number, and finish paint color for each substrate to be painted.

2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Submit MSDS sheets for all products.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Duplicate finish of approved prepared samples.

1. Prior to on-site painting at locations designated by the University, apply field examples of each paint type and color to be applied.

    a. Wall Surfaces: Provide samples on at least 100 sq ft of wall surface.
    b. Small Areas and Items: The University will designate an item or area as required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
3. Final approval of colors will be from job-applied samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).

3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the University.

1. Quantity: Furnish the University with an additional 5 percent, but not less than 2 gal or 1 case, as appropriate, of each material and color applied.

1.9 SPECIAL PAINTING REQUIREMENTS

A. Stack paint selection shall be thoroughly reviewed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

B. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Colors for piping is indicated in Section 44 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT. Colors for the remaining equipment and structures shall be selected by the University to match the existing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the University about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

    a. Prepare steel surfaces as recommended by paint system manufacturer and according to requirements of SSPC-SP 3.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. Sand lightly between each succeeding enamel coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky

under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted (unless they are already prefinished – but even those may require touch-up) include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.
2. Ductwork.
3. Insulation covering.
4. Motors and mechanical equipment.
5. Accessory items.

G. Electrical items to be painted (unless they are already prefinished – but even those may require touch-up) include, but are not limited to, the following:

1. Conduit and fittings.
2. Switchgear.
3. Panelboards.
4. Stacks.

H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness,

spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The University reserves the right to invoke the following test procedure at any time and as often as the University deems necessary during the period when paint is being applied:

1. The University may engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by University.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 INTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Flat Acrylic Finish: 2 finish coats over a primer.

   a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   b. First and Second Coats: Flat, acrylic-latex, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

2. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

   a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

3. Semigloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

   a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
   b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
   c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

4. Full-Gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
b. First and Second Coats: Full-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.

5. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over an enamel undercoater and a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
b. Undercoat: Alkyd, interior enamel undercoat or full-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
c. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

B. Cotton or Canvas Covering over Insulation: Provide the following finish system on cotton or canvas insulation covering:

1. Flat Acrylic Finish: 2 finish coats. Add fungicidal agent to render fabric mildew proof.

a. First and Second Coats: Flat, latex-based, interior paint applied at spreading rate recommended by the manufacturer.

3.8 EXTERIOR PAINT APPLICATION SCHEDULE

A. Ferrous Metal: Provide the following finish systems over ferrous metal such as manhole vent piping and exterior railings. This applies to vent piping in the manhole, in the ground (High and Low Vents), and above ground. The paint system shall be rated for up to 200 degrees F service temperature:

1. Semigloss, Alkyd-Enamel Finish: Two finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for the substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

b. First and Second Coats: Odorless, semigloss, alkyd, exterior enamel. Provide 2 coats over primer with a total dry film thickness of not less than 3.5 mils.

3.9 INTERIOR AND EXTERIOR HOT PIPING PAINT APPLICATION SCHEDULE

A. Ferrous Metal: Provide the following finish systems over hot ferrous metal such as steam safety relief vent piping, steam vent piping, and boiler stacks:

1. High Heat Silicone Alkyd: Two coats (prime coat and one full coat) to achieve a 1.5 mil dry film thickness. Modified silicone alkyd with aluminum paste pigment. System shall be designed for a continuous dry heat resistance temperature of 800 deg F and an intermittent temperature of 900 deg F. Shall be designed to resist thermal shock. Volume solids shall be 40% or greater. Weight shall be 9.0 lb/gallon. Provide aluminum color or silver or grey as directed by the University. One acceptable product is M64 Silicone Alkyd Hi-Heat Coating by Bengamin Moore & Co.
2. High Heat Multipolymeric Matrix Coating: Two coats of PPG H:-Temp 1027, each 5.0 to 6.0 mils dry film thickness. System shall be designed for continuous service to 1200 degrees F and intermittent to 1400 degree F. Shall be designed to resist thermal shock. Volume solids shall be 65% or greater. Weight shall be 16 lb/gallon. Provide black, grey, or light grey as directed by the University.

END OF SECTION 09 91 00

SECTION 22 22 00 – DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions, apply to this Section.

1.2 DESCRIPTION

A. This Section specifies pipe, valves, and fittings for pumped sanitary discharge from steam and chilled water manholes.

1.3 REFERENCED CODES, STANDARDS AND APPLICABLE PUBLICATIONS

A. General: The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

1. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

MSS SP-5	Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-6	Pipe Hangers and Supports - Selection and Application
MSS SP-110	Ball Valves-Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

A. General: Items are referred to by type and shall conform to the latest editions of standards listed below:

B. Pipe Materials:

Type	Designation
1. Copper water tube, Type K (heavy wall), Soft, ASTM B88	A
2. Stainless steel, Schedule 10S, ASTM A312 Type 316L	B

C. Fitting Materials:

	Type	Designation
1.	Wrought copper and bronze drainage fittings, ANSI A16.29	I
2.	Stainless, ASTM A182, F316L, Class 3000 socket weld per ASME B16.11	II

D. Joint Materials:

	Type	Designation
1.	Soldered: ASTM B32 tin-antimony 95-5	a
2.	Welded: stainless	b

E. Piping Assembly: Pipe, fittings, and joints shall be provided for each system based on the table below.

		Service Pipe	Fittings	Joints
1.	Pumped (forced), designated as “PSAN” or “PED” on Contract Drawings.			
a.	Underground	A or B	I or II	a or b
b.	Manholes	A	I	a

2.2 VALVES (SUMP PUMP DISCHARGES AND BEYOND)

A. Shut-Off:

1. 3 inches and Smaller: Three piece, full port ball valve with replaceable internal parts. Valve shall have swing out design, bronze body, stainless steel, ball and stem (ASTM A276 Type 316), reinforced TFE Seats. Provide blow out proof stem and extended stem for insulation thickness. Body bolts and nuts shall be zinc dichromate plated steel. Valve shall be rated for 150 psig saturated steam service. Valve shall be threaded or soldered to suit piping system which it is installed.

B. Check:

1. 3 inches and Smaller: Bronze body and bonnet, ASTM B61, or B62. 125 PSI, threaded or soldered connections. Must be non-slam style.

2.3 MISCELLANEOUS

A. Pipe Sleeves: Refer to Section 40 00 05 – BASIC MECHANICAL MATERIALS AND METHODS.

B. Pipe Hangers and Supports: Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to Steel W or S beams with Type 21, 28, 29, or clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web

steel channel with drilled hole on gauge line and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor.

2.4 DRAINAGE SUMP PUMPS

A. Refer to Section 22 22 29 – DRAINAGE PUMPS.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install piping from sump to sewer as shown on M Series and Civil drawings. Pump discharge pipe shall penetrate the utility structure with a watertight pipe sleeve and seal and extend to approximately 3’-0” below grade and then pitch down at a minimum slope of 2% to the sewer system.
2. Pipe shall be round and straight. Cutting shall be done with proper tools.
3. All pipe runs shall be laid out to avoid interference with other work.
4. Installation of piping system, materials and workmanship shall be in accordance with the applicable Plumbing Code.

B. Pipe Supports

1. Maximum spacing between supports:

a. Vertical Piping: Support piping at 5 feet intervals.
b. Horizontal Piping: Support piping at 10 feet intervals and support piping at each change of direction.

3.2 TESTS

A. General: Test system either in its entirety or in sections.

B. Sump Pump Piping:

1. Water Pressure Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening of section under test, fill each section with water and test with at least 50 PSIG of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System have no leaks.

2. Correct defects and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

END OF SECTION 22 22 00

SECTION 22 22 29 – DRAINAGE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions, and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies steam powered sump ejectors for steam manholes.

1.3 SUBMITTALS

A. General: Submit the following:

1. Product data including certified performance curves, weights (shipping), furnished specialties, and accessories, plus installation and start-up instructions.
2. Shop drawings showing layout of sump pit and connections for sump ejector.
3. Maintenance data for sump ejector, for inclusion in Operating and Maintenance Manuals.

1.4 QUALITY ASSURANCE

A. Design Criteria: The Drawings indicate size, profile, connections, and dimensional requirements of sump pumps and are based on the specific manufacturer type and model indicated. Ejectors having equal performance characteristics by other manufacturers may be considered, provided that deviations in dimensions and profiles do not change the design concept or intended performance as judged by the Engineer. The burden of proof for equality of the pumps is on the Contractor.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pump in a dry location.

B. Retain shipping protective covers and protective coatings during storage.

C. Protect pump internals against damage from sand, grit, and other foreign matter.

D. Comply with manufacturer's rigging instructions for handling

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Steam Powered Sump Ejectors: Armstrong International or approved equal.

2.2 STEAM POWERED SUMP EJECTORS

A. General:

1. Refer to the Contract Drawings for details of the steam powered sump ejector which include the drip leg, drip leg valve, steam trap, and all sump ejector related items.
2. Provide steam operated non-electric, stainless steel sump ejector with a remote linkage to evacuate water that collects in sump pit locations indicated on the Contract Drawings and of type as indicated in the "Sump Ejector Schedule" listed in the Contract Drawings. The capacity of the sump ejector provided shall satisfy the design flow listed on the "Sump Ejector Schedule" for the water temperature in the sump pit, and both the operating and maximum conditions of the motive steam pressure. Connection sizes of sump ejector are provided as a basis of design; however, actual sizes are dependent upon the actual selection of the sump ejector.
3. Sump ejector sizing selection and location is based on the piping layout as presented in the Contract Drawings. The Contractor is responsible for informing the Engineer of any piping layout changes which could affect the sizing, selection, and location of the sump ejectors. This includes the possible inclusion of sump ejectors.

B. Description:

1. Pumps shall be vertical, mechanical steam sump ejector, bottom suction, single stage, remote linkage, complete with integral inlet strainer and float controls. The pump shall be rated to handle liquids in continuous duty up to 200 degrees F. The mechanical sump ejector shall utilize steam as the motive source to remove water from the sump pit collection area. Unit shall be steam powered with no electrical requirements. Operation of non-electric sump pump shall not increase the temperature of water in the sump pit or require pressurization of a vessel. The remote linkage allows the snap-acting mechanism to be suspended over the sump pit to avoid interference with debris that enters the sump pit area. Actuation of sump ejector shall be true ON/OFF operation for longer service and shall operate up to 150 PSIG steam motive pressure. Devices that do not give true steam ON/OFF operation for water evacuation shall NOT be accepted (i.e. "On" defined as full steam flow

through valve orifice, “Off” defined as ANSI class III shut off). The ejector will only operate while using a steam motive. Mounting brackets shall be provided and are required to mount the ejector to the side wall of the sump pit.

C. Basis of Design is Armstrong FH2279 (Pitbull Sump Ejector) “Stainless Steel Sump Ejector with Remote Linkage” and Armstrong FH2146 “3/4” Mounting Bracket Kit.”

D. Performance Parameters:

1. Normal Steam Pressure: 70 PSIG.
2. Normal Steam Temperature: Saturated to 335 Deg. F. (Superheated downstream of pressure reducing valves)
3. Design Steam Pressure: 90 PSIG
4. Design Steam Temperature: Saturated to 474 Deg. F. (Superheated downstream of pressure reducing valves)
5. Maximum Discharge Head: 7 Feet
6. Minimum Capacity: 27 GPM

E. Materials:

1. General: Sump ejector shall consist of all stainless steel components for corrosive and harsh environment.
2. Eductor body: Shall be constructed of ASTM A351 CF8M stainless steel, with stainless steel suction, and stainless steel strainer mesh. Provide stainless steel mounting bracket to support the pump from the concrete sump. Discharge connection shall be 1-1/2” Male Nominal Pipe Thread (MNPT) and shall be arranged for vertical discharge.
3. Float Actuating Mechanism (Ball Float, Springs, and Steam Valve): Shall be all stainless steel with actuating springs constructed of Inconel X-750 springs. Ball float shall be ASTM 440-C stainless steel. Ball float shall be connected to a snap action steam valve mechanism through a stainless steel remote linkage. Steam valve shall be ASTM 316 stainless steel.
4. Provide inlet strainer.
5. Provide a non-slam, stainless steel check valve and isolation (ball) valve in the discharge piping of the sump ejector.

F. Basin: Provide sump basin with a minimum size of 14” x 14” x 24” in accordance with Section 03 30 00 – CAST IN PLACE CONCRETE and as indicated on the Contract Drawings.

G. Submittal and Testing: Manufacturer shall provide complete installation, and operation instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, concrete sump and conditions for compliance with requirements for installation and other conditions affecting performance of sump ejector. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine rough-in for drainage piping system to verify actual locations of piping connections prior to installation.

3.2 INSTALLATION

A. General: Comply with the manufacturer's written installation and alignment instructions.

B. Provide pump in location and arrange to provide access for periodic maintenance, including removal of entire ejector assembly from pit.

C. Support ejector and piping separately so that the weight of the piping system does not rest on the ejector.

D. Basin / sump pit: Provide sump ejector in indicated location on the Contract Documents and connect to drainage discharge line. Refer to Section 03 30 00 – CAST IN PLACE CONCRETE for the sump pit.

E. Provide the inlet screen at least 6" above the bottom of the sump pit.

3.3 INSTALLATION OF STRAINERS

A. Install strainers where indicated and at places not indicated but where required by a manufacturer's instruction to protect his equipment.

B. Install steam strainers horizontally on their side with screen chamber at the 3 or 9 o'clock position. Install all other strainers horizontally with the screen chamber at the 6 o'clock position. Provide blowdown drain with valve and cap. Install strainers vertically only when required and when the direction of flow is down.

3.4 CONNECTIONS

A. General: Provide valves that are same size as the piping connecting the ejector.

B. Provide discharge pipe size equal to or greater than the diameter of the ejector nozzle.

C. Provide a non-slam check valve and isolation (ball) valve on the discharge side of ejector.

END OF SECTION 22 22 29

Armstrong® Stainless Steel Sump Ejector

Armstrong Condensate Management Group offers a stainless steel sump ejector for use in draining unwanted water from steam pits, steam tunnels or enclosed spaces. The stainless steel sump ejector uses a snap-acting Inconel X-750 spring-assisted mechanism, which engages a steam motive valve, turning the pump on or off as the float rises and falls. The all stainless steel design will ensure long life in the rather harsh environment of a steam pit.

The stainless steel sump ejector is designed to eliminate maintenance headaches and safety issues surrounding steam pits, tunnels and enclosed spaces.

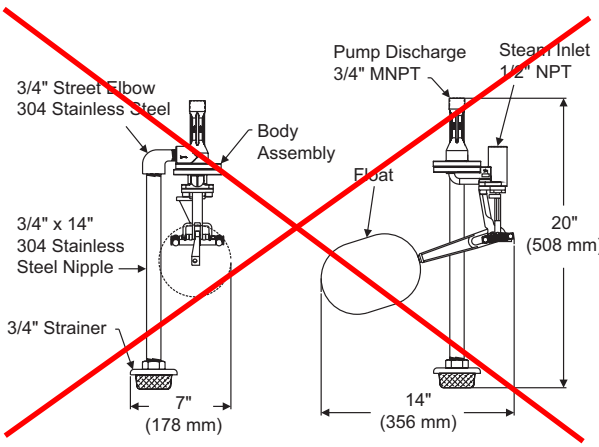
Features

- All stainless steel construction and design guard against corrosion
- True steam-on, steam-off operation
- Heavy duty Inconel X-750 springs provide a long, trouble-free service life
- The small, compact and unique cast stainless steel design is unlike anything on the market today

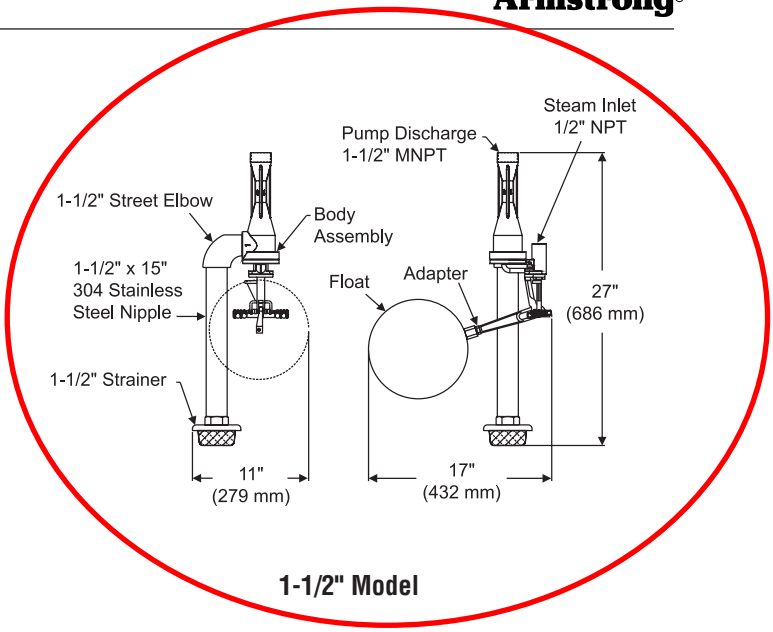
For a fully detailed certified drawing, refer to list below.
3/4" CDF #1052
1-1/2" CDF #1065

Stainless Steel Sump Ejector Materials	
Name of Part	**Material**
Mechanism	ASTM A351 CF8M
Springs	Inconel X-750
Spring Ends	304 Stainless Steel
Clevis Pins	304 Stainless Steel
Body	ASTM A351 CF8M
Nozzle	308 Stainless Steel
Seal Retainer	308 Stainless Steel
Motive Ball	440-C Stainless Steel
Motive Valve	316 Stainless Steel
Rod Seal	PTFE
Seal Spring	Hastelloy C-276
Rod Wiper	Nitrile
O-Ring	EPDM
Bolts	18-8 Stainless Steel
Strainer Body	Glass Filled Nylon
Strainer Mesh	Stainless Steel
Fittings	304 Stainless Steel
Pipe	304 Stainless Steel

Stainless Steel Sump Ejector



3/4" Model



1-1/2" Model

3/4" Stainless Steel Sump Ejector Capacities in gallons per minute (gpm)

Discharge Head (ft)	Water Temperature 60°F						Water Temperature 100°F						Water Temperature 140°F				
	Motive Steam Pressure (psig)						Motive Steam Pressure (psig)						Motive Steam Pressure (psig)				
	40	60	80	100	120	150	40	60	80	100	120	150	60	80	100	120	150
0	6.0	9.3	11.6	12.2	12.8	12.9	6.0	9.0	9.2	8.6	8.0	8.0	5.5	5.3	5.4	5.5	5.5
5	4.0	7.3	9.9	11.1	11.9	12.4	3.0	7.1	8.2	8.1	7.8	7.8	4.5	4.5	5.3	5.4	5.4
10	2.0	5.2	8.3	10.0	11.0	11.9	—	5.2	7.2	7.7	7.6	7.6	3.5	3.5	5.2	5.2	5.2
15	—	3.2	6.6	8.9	10.0	11.5	—	3.3	6.2	7.2	7.3	7.4	—	—	5.1	5.1	5.1
20	—	—	5.0	7.8	9.2	11.0	—	—	5.2	6.7	7.1	7.3	—	—	5.0	4.9	4.9
25	—	—	—	6.7	8.3	10.5	—	—	—	6.2	6.8	7.1	—	—	4.9	4.8	4.8
30	—	—	—	5.6	7.4	10.0	—	—	—	5.7	6.6	6.9	—	—	4.8	4.6	4.6
35	—	—	—	—	6.5	9.5	—	—	—	—	6.4	6.7	—	—	—	4.5	4.5
40	—	—	—	—	5.6	9.1	—	—	—	—	6.1	6.6	—	—	—	4.3	4.3
45	—	—	—	—	—	8.6	—	—	—	—	—	6.4	—	—	—	—	4.2
50	—	—	—	—	—	8.1	—	—	—	—	—	6.2	—	—	—	—	4.0

Note: Maximum operating pressure is 175 psig (12 bar). No increase in capacity with motive pressure over 150 psig (10 bar).

1-1/2" Stainless Steel Sump Ejector Capacities in gallons per minute (gpm)

Discharge Head (ft)	Water Temperature 60°F						Water Temperature 100°F						Water Temperature 140°F					
	Motive Steam Pressure (psig)						Motive Steam Pressure (psig)						Motive Steam Pressure (psig)					
	60	80	100	120	150	175	60	80	100	120	150	175	60	80	100	120	150	175
5	23.0	34.0	42.2	48.4	56.8	55.8	23.2	34.1	42.2	49.9	55.3	56.0	26.3	36.1	46.3	46.2	41.1	41.0
10	—	28.4	38.0	43.2	51.0	51.2	—	28.9	37.2	44.5	52.1	54.8	—	28.9	38.2	43.5	41.1	40.9
15	—	—	35.0	37.9	46.5	50.4	—	—	31.3	39.3	48.9	53.1	—	—	30.7	38.1	41.1	40.9
20	—	—	26.1	33.5	44.4	49.5	—	—	—	35.0	44.7	51.4	—	—	23.6	33.4	41.2	40.8
25	—	—	—	29.0	39.5	48.0	—	—	—	30.9	40.3	47.2	—	—	—	—	41.4	40.5
30	—	—	—	—	35.2	43.5	—	—	—	—	36.5	43.9	—	—	—	—	—	—
35	—	—	—	—	31.1	38.8	—	—	—	—	32.3	39.1	—	—	—	—	—	—
40	—	—	—	—	—	34.3	—	—	—	—	—	35.7	—	—	—	—	—	—

SECTION 26 05 13 - MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cables and related cable splices, terminations, and accessories for medium-voltage (2001 to 35,000 V) electrical distribution systems.

1.3 DEFINITIONS

A. Jacket: A continuous nonmetallic outer covering for conductors or cables.

B. NETA ATS: Acceptance Testing Specification.

C. Sheath: A continuous metallic covering for conductors or cables.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Indicate location of each cable, splice, and termination.

B. Qualification Data: For Cable Splicer.

C. Source quality-control reports.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than fourteen days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2 and NFPA 70.

C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Cable; Prysmian Group North America
2. Okonite Company (The)
3. Prysmian Cables and System; Prysmian Group North America
4. Southwire Company

B. Cable Type: Type MV 105.

C. Conductor Insulation: Ethylene-propylene rubber.

1. Voltage Rating: 525kV.
2. Insulation Thickness: 133 percent insulation level.

D. Conductor: Copper.

E. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74, and ICEA S-97-682.

F. Conductor Stranding: Compact round, concentric lay, Class B.

G. Shielding: Copper tape, helically applied over semiconducting insulation shield.

H. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.

I. Cable Jacket: Sunlight-resistant PVC.

2.3 SOLID TERMINATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M
2. G&W Electric Company
3. nVent (RAYCHEM)
4. TE Connectivity Ltd.

B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.

1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.
2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.

2.4 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M
2. G&W Electric Company
3. nVent (RAYCHEM)
4. TE Connectivity Ltd.

C. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

D. Load-Break Cable Terminators: Elbow-type units with 200-A-load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

E. Dead-Break Cable Terminators: Elbow-type unit with 600-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

2.5 SPLICE KITS

A. Description: For connecting medium voltage cables; type as recommended by cable or splicing kit manufacturer for the application.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M
2. G&W Electric Company
3. nVent (RAYCHEM)
4. TE Connectivity Ltd.

C. Standard: Comply with IEEE 404.

D. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

1. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.
2. Premolded, EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.

3. Separable multiway splice system with all components for the required splice configuration.

2.6 MEDIUM-VOLTAGE TAPES

A. Description: Electrical grade, insulating tape rated for medium voltage application.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M
2. nVent (RAYCHEM)

C. Ethylene/propylene rubber-based, 30-mil (0.76-mm) splicing tape, rated for 130 deg C operation. Minimum 3/4 inch (20 mm) wide.

2.7 ARC-PROOFING MATERIALS

A. Description: Fire retardant, providing arc flash protection.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M
2. ABB, Electrification Products Division
3. Adalet
4. DSG-Casuna
5. Eaton
6. Engineered Products Company
7. G&W Electric Company
8. MP Husky USA Cable Tray & Cable Bus
9. nVent (RAYCHEM)
10. Scott Fetzer Co. (The)
11. TE Connectivity Ltd.

C. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, and compatible with cable jacket.

2.8 SOURCE QUALITY CONTROL

A. Test and inspect cables according to ICEA S-97-682 before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches (1200 to 1800 mm) on the pull rope.

1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.

G. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.

H. Install cable splices at pull points and elsewhere as indicated; use standard kits. Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.

I. Install terminations at ends of conductors.

J. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
3. Standoff Insulator: At each terminal junction, with one on each terminal.

K. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.
2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
3. Smooth surface contours with electrical insulation putty.
4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
5. Band arc-proofing tape with two layers of 1-inch- (25-mm-) wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.

L. Seal around cables passing through fire-rated elements according to Section 078413 "Penetration Firestopping."

M. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

N. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.

3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.

C. Medium-voltage cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 26 05 13

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

B. Related Requirements:

1. Section 26 05 13 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 601 to 35,000 V.

1.3 DEFINITIONS

A. PV: Photovoltaic.

B. RoHS: Restriction of Hazardous Substances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company
2. American Bare Conductor
3. Belden Inc
4. Cerro Wire LLC
5. Encore Wire Corporation
6. General Cable; Prysmian Group North America
7. Okonite Company (The)
8. Services Wire Co.
9. Southwire Company
10. WESCO

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M Electrical Products
2. ABB, Electrification Products Division
3. AFC Cable Systems; Atkore International
4. Gardner Bender
5. Hubbell Incorporated, Power Systems
6. ILSCO
7. NSi Industries LLC
8. O-Z Gedney; Emerson Electric Co., Automation Solutions, Appleton Group
9. Service Wire Co.
10. Shawcor
11. TE Connectivity Ltd.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits:

1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

B. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly

3.8 FIELD QUALITY CONTROL

A. Administrant for Tests and Inspections:

1. Administer and perform tests and inspections.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each of the following visual and electrical tests stated in NETA Acceptance Testing Specification. Certify compliance with test parameters:

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements described in this Section, provide products by one of the listed manufacturers in the Sub-Sections below.

1. ABB, Electrification Products Division
2. Advanced Lighting Technology, Ltd.
3. Burndy; Hubbell Incorporated, Construction and Energy
4. Dossert; AFL Telecommunication LLC
5. ERICO, nVent
6. Fushi Copperweld Inc.
7. Galvan Industries, Inc.; Electrical Products Division, LLC
8. Hargar Lightning & Grounding
9. ILSCO
10. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group
11. Robbins Lightning, Inc.
12. Siemens Industry, Inc., Energy Management Division

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Bonding Cable: 4/0 solid conductor, 4/0 medium stranded (7 conductor), 4/0 high stranded (19 conductor) as required for each application.
4. Bonding Conductor: No. 2, No. 4 or No. 6 AWG, stranded conductor.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

B. Ground Ring: 4.0 AWG Class A stranded copper conductor (7 strand) or solid conductor. 19 strand ground wire is not acceptable in contact with earth.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install stranded conductors unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.

1. Bury at least 30 inches (750 mm) below grade.

C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.

E. Conductor Terminations and Connections:

1. Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Handholes: Install a driven ground rod through handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Hadhole Components: Bond exposed-metal parts within each handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Use exothermic welds for all below-grade connections.
3. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Ground Ring: Install a grounding conductor, electrically connected to each ground rod and to each indicated item, extending around the perimeter of area or item indicated.

G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Pad-Mounted Equipment: 5 ohms.
5. Handhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks.
2. Manholes

B. Related Requirements:

1. Section 03 30 00 “Cast-In-Place Concrete”
2. Section 03 41 00 “Precast Structural Concrete”
3. Section 07 17 50 “Sheet Membrane Waterproofing (Exterior Utilities)”
4. Section 26 05 13 “Medium Voltage Cables”
5. Section 26 05 29 “Hangers and Supports for Electrical Systems”
6. Section 26 05 26 “Grounding and Bonding for Electrical Systems”
7. Section 26 05 53 “Identification for Electrical Systems”
8. Section 31 00 00 “Earth Moving”
9. Section 31 50 00 “Excavation Support and Protection”

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

B. GRC: Galvanized rigid (steel) conduit.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, boxes.

4. Warning tape.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.
3. Frame and cover design.
4. Grounding details.
5. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
6. Joint details.

C. Product Certificates: For concrete and steel used in precast concrete vaults, as required by ASTM C 858.

D. Source quality-control test reports.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

D. Comply with IEEE C2 (NESC).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Submit request to the Owner for any Utility Interruptions a minimum of two weeks in advance for review, approval and scheduling.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 COORDINATION

A. Coordinate layout and installation of ducts, manholes, equipment pads and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Propose revision to locations and elevations from those indicated as required to suit field conditions through the RFI process for approval by the Engineer and by the Owner.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to vaults and as approved by Engineer.

C. Protection

1. Provide electrical insulating blankets, sleeves, gloves, etc., to protect workmen from electrical hazards as required.

D. In case of conflict between the as found conditions and contract drawings and specifications, the Contractor shall promptly notify the Engineer through the RFI Process.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cantex, Inc.
2. CertainTeed Corp.

3. IPEX Inc.
4. JM Manufacturing Co., Inc.
5. Lamson & Sessions; Carlon Electrical Products.
6. Underground Devices.

B. METAL CONDUIT AND FITTINGS

1. GRC: Comply with ANSI C80.1 and UL 6.
2. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
3. Manufactured Bends: Not less than a 4-foot radius

C. RIGID NONMETALLIC CONDUIT

1. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
2. PVC conduit fittings: solvent-weld, NEMA TC 3, match to conduit type and material, UL 514B. Provide end bells at manholes, building penetrations, and cable vaults unless otherwise indicated on the Drawings.
3. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
4. Solvents and Adhesives: As recommended by conduit manufacturer.
5. Manufactured Bends: Not less than a 4-foot radius

2.2 DUCT ACCESSORIES

A. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.

B. Concrete: Concrete for primary duct banks shall have a red color additive mixed in the concrete for identification. Specifically Solomon 417; mix approximately three and a half pounds (3-1/2 lbs.) per 80 pounds of cement to provide identifiable red color as warning to any one digging into the medium voltage cable run. The concrete supplier shall premix concrete. Color additive shall not be hand-troweled in and shall not be sprinkled.

2.3 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.

1. Color: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC"
6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Pullboxes located in roadways shall be HS-20 rated.
9. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Carson Industries LLC.
b. Christy Concrete Products.
c. Nordic Fiberglass, Inc.

2.4 PRECAST MANHOLES

A. Comply with ASTM C 858, and with interlocking mating sections, complete with accessories, hardware, and features.

1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of vaults, but close enough to corners to facilitate racking of cables on walls.
b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

a. Type and size shall match fittings to duct or conduit to be terminated.

b. Fittings shall align with elevations of approaching ducts and be located near interior corners of vaults to facilitate racking of cable.

B. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.

C. Minimum interior dimensions of manhole shall be 10 feet wide by 10 feet long by 8 feet high.

D. Structural Design Loading: Underground utility structures shall be designed by an engineer registered in the State of Florida based on ASTM C857 Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures with A-16 (AASHTO HS20) wheel loads. An additional load case consisting of A-12 (AASHTO HS15) wheel loads with 1/3 of the ASTM C857 impact and with Live Load Spacing of 32 inches rather than 4 feet shown in ASTM C857 Figure 1 shall also be considered.

E. Joint Sealant: "Ram-Nek" sealant or approved equal.

2.5 UTILITY STRUCTURE ACCESSORIES

A. Manhole Frames and Hatch Components: Comply with structural design loading specified for vault.

1. Hatches: Provide square or rectangular, checker plate, hinged, spring assisted for ease of opening hatches with frames of aluminum or steel galvanized in accordance with ASTM A123. All hatches shall be secured with stainless steel penta-head bolts.

a. Hatches shall be welded or brass marked "ELECTRIC," with permanent marking of vault identification with ID number.
b. Hatches for vaults shall be sized to accommodate replacement of switch and the function of the structure.

2. Circular Openings: Provide US Foundry (USF) 690 Ring & AG/M Cover or approved equal. Load Classification AASHTO M306, Gray Cast Iron, ASTM-A48 Class 35B

B. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- diameter eye, and 1-by-4-inch bolt.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

C. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

D. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

E. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

F. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer. Provide product by Unistrut or Underground Devices.

1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment. UD model number CR36-B or approved equal.
2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties. UD model number RA20 or approved equal.

G. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

H. Inflatable bladder-type, lubricated duct seal, capable of sealing both empty and occupied ducts from hydrostatic pressure of up to 15 feet. For ducts occupied by more than two cables, provide sealing clip compatible with inflatable duct seal. Inflatable seal and sealing clips shall be of the same manufacturer.

I. Duct Label Requirements: Engraved plastic tag with ¼" high black letters on yellow background. Tag shall have all edges beveled and smooth. Secure tag with non-metallic, fungus resistant, heat stabilized, self-extinguishing nylon cable ties. 1.5"x4" approximate dimension. Tag shall be larger as required to fit appropriate text. Provide label that identifies the following:

1. Destination of Duct.

SAMPLE LABEL

TO MH-17

2.6 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Owner and Engineer if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into vaults and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to vaults, manholes and handholes, and as approved by Engineer.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 31 10 00 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 31 10 00 "Site Clearing."

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

3.3 HANDHOLES

A. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Fiberglass-reinforced polyester resin, SCTE 77, Tier 15 structural load rating.

B. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with fiberglass frame and cover, SCTE 77, Tier 8 structural load rating.

C. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses."

D. Cut and patch existing pavement in the path of underground ducts and utility structures.

3.5 DUCT INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the ductbank configuration shown. Duct installation requirements in this Section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward vaults and handholes and away from buildings and equipment. Slope duct from a high point between two vaults, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated. Alignment modifications to the Bid Document ductbank drawings shall be analyzed for pulling stresses on the cable by the contractor. Ensure that 5kV MV-105 EPR shielded cable (consisting of 3-500kcmil phase conductors and a 4/0, 600V XHHW ground cable) can be pulled with a safety factor of 20%. Pulling stress calculations shall be submitted to the Engineer, for review and approval as part of the as-built submittals.

1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

F. Installation Adjacent to Underground Heating Utilities: Where duct is installed parallel to underground steam, condensate, high- or low-temperature hot water heating lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground heating utility, install insulation blankets listed for direct burial to isolate the duct bank from the heating utility.

G. End Bell Entrances to Manholes, Vaults and Building Foundation Walls: Use end bells, spaced approximately 12 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.
2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to the vault or manhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.
3. Grout end bells into structure walls from both sides to provide watertight entrances.

H. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs and/or an inflatable sealing system designed to withstand at least 15-psig hydrostatic pressure.

I. Pulling Cord: Install 200-lbf-test nylon cord in ducts, including spares.

J. Concrete-Encased Ducts: Support ducts on duct separators.

1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 31 20 00 "Earth Moving."
2. Depth: Install so top of duct envelope is at least 30 inches below finished grade.
3. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
4. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, a maximum of 5-feet of conduit run, on either side of conduit joints. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
5. Minimum Space between Duct: 3 inches between edge of duct and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.
6. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.

    a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.

        1) Stub-ups shall be flush with finished floor and minimum 3 inches from conduit side to edge of slab.

7. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
9. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between duct of like services, and 4 inches between power and communications ducts.
10. Concreting Sequence: Pour each run of envelope between structures or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a diagonal plane.

11. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application. Concrete shall be compacted so as to avoid inclusion of air pockets or areas where concrete doesn't completely cover ducts and reinforcements.
12. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks but in no case less than 6" below grade. A single tape is suitable for ductbanks less than two feet wide. Install tape above the edges of ductbanks wider than two feet, and above the edges and center of ductbanks wider than four feet. Tape shall consist of a minimum 3.5 mil solid foil core encased in a protective plastic jacket (total thickness 5.5 mils) and be 6" wide with black lettering imprinted on a color coded background that conforms to APWA color code specifications.
13. Copper Tracer Wire: Install a No. 12 gauge solid copper tracer wire with 45 mils polyethylene with each ductbank to facilitate location. Wire shall be installed directly above each ductbank and terminate at manholes.

3.6 INSTALLATION OF CONCRETE MANHOLES AND BOXES

A. Precast Concrete Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Frame: In paved areas and trafficways, set frames 1” above surrounding grade with continuous gradual slope down from opening with maximum slope of 1/3” per foot. Set other vault frames 3 inches above finished grade, and slope grade away from frame with maximum slope of 1” per foot.

C. Dampproofing: Apply dampproofing to exterior surfaces of manholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars.

D. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Conduit end bells shall have their wide end positioned flush with the interior of the vault wall.

E. Field-Installed Bolting Anchors in Manholes: Do not drill deeper than 3-7/8 inches for vaults and 2 inches for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.7 INSTALLATION OF HANDHOLES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, 30” below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Install ground rods in accordance with Division 26 "Grounding and Bonding for Electrical Systems."

C. Install bus bar and ground metallic components in accordance with Division 26 Section "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. A properly sized steel mandrel shall be pulled through all new or repaired ducts. Mandrel shall be 1/4 inch to 1/2 inch smaller in diameter than the duct. Follow with round bristle brush with a diameter ½ inch greater than the internal diameter of the duct for final cleaning and to assist in spreading lubricant throughout ducts, where required. Each duct shall be proved clear and usable, cleaned, have a pull string left in place, and spare ducts shall have duct plugs installed.
3. Test vault grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

A. Clean internal surfaces of manholes. Remove foreign material.

B. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 26 05 43

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Labels.
2. Tags.
3. Signs.
4. Cable ties.
5. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and feeder.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.

1. Colors for 480/277-V Circuits:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.

2. Color for Neutral: White.
3. Color for Equipment Grounds: Green.

C. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Label Requirements: Engraved plastic tag with ¼" high black letters on yellow background. Tag shall have all edges beveled and smooth. Secure tag with non-metallic, fungus resistant, heat stabilized, self-extinguishing nylon cable ties. 1.5"x4" approximate dimension. Tag shall be larger as required to fit appropriate text.
2. Medium Voltage Cables: Provide label that identifies the following:

   a. Cable size, material, insulation KV.
   b. Feeder Identification, voltage. NOTE: Feeder labels on this project will either be 1-6, 1-8, or 4-1.
   c. Month and Year of Installation.
   d. Circuit origin (example MH 45 or MH 59 SW 1)

SAMPLE LABEL

CABLE: 500 CU EPR 5KV
CKT: 4-1 4,160V
DATE: 08/2020
FROM: MH59 SW 1

3. Medium Voltage Cable Splices: Provide label that identifies the following:

    a. Cable size, material, insulation KV.
    b. Month and Year of Installation.
    c. Splicer's Name
    d. Splicer's company name

SAMPLE LABEL

CABLE: 500 CU EPR 5KV
DATE: 08/2020
NAME: JOHN SMITH
FROM: ABC ELECTRIC

4. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

D. Equipment Identification Labels:

1. Black letters on a white field.

2.3 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation
2. Carlton Industries, LP
3. Emedco
4. Marking Services, Inc.
5. Seton Identification Products; a Brady Corporation company

C. Nonmetallic Preprinted Tags: Polyethylene tags, [**0.015 inch (0.38 mm)**] [**0.023 inch (0.58 mm)**] thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation
2. Carlton Industries, LP
3. Emedco
4. Grafoplast Wire Markers
5. LEM Products, Inc.
6. Marking Services, Inc.
7. Panduit Corp
8. Seton Identification Products; a Brady Corporation company

2.4 SIGNS

A. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation
b. Champion America
c. emedco
d. Marking Services, Inc.

2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches (250 by 360 mm).

2.5 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. HellermannTyton
2. Ideal Industries, Inc.
3. Marking Services, Inc.
4. Panduit Corp

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

J. Metal Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

K. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

L. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

M. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

N. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

A. Color-Coding for Phase Identification, greater than 600 V: Use the colors listed below for ungrounded feeder and branch-circuit conductors.

1. Primary Cables: Cables running in cable tray shall be marked with the circuit name for identification using plastic (lamacoid) tags with engraved ½" high by 1/16" thick lettering (black on white).
2. Power-Circuit Conductor Identification, 5kV: For conductors in pull and junction boxes, and cable trays use color-coding conductor tape to identify the phase.

a. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
b. Color-Coding for Phase and Voltage Level Identification, 5kV: Use colors listed below for ungrounded service conductors.

1) Colors for 5kV Circuits:

a) Phase A: Brown.

b) Phase B: Orange.

c) Phase C: Yellow.

d) Neutral: White or Gray

e) Equipment Ground: Green/Black

B. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded feeder and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG, field applied.
2. Colors for 480/277-V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.

c. Phase C: Yellow.
d. Neutral: White or Grey.
e. Equipment Ground: Green w/ Yellow Strip

C. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings. Each cable shall have an identifiable colored stripe.

D. Warning Labels for Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on a white background.
1. Labeling Instructions:

a. Equipment: Engraved, laminated acrylic or melamine label.
b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Electrical cabinets, and enclosures.
b. Electrical switchgear.

END OF SECTION 26 05 53

SECTION 26 13 29 - MEDIUM-VOLTAGE, PAD-MOUNTED SWITCHGEAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Switchgear components and related requirements are also specified in the following Sections:

1. Section 033000 “Cast-in-Place Concrete”
2. Section 260513 “Medium-Voltage Cables”
3. Section 260519 “Low Voltage Electrical Power Conductors and Cables”
4. Section 260526 “Ground and Bonding for Electrical Systems”
5. Section 260553 “Identification for Electrical Systems”

1.2 SUMMARY

A. Section includes dead-front, remotely controlled insulated vacuum load and fault interrupting switchgear.

1.3 DEFINITIONS

A. BIL: Basic Impulse Insulation Level.

B. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

C. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted switchgear and to provide a fully insulated connection. Also called an "elbow connector."

D. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or non-load break, separable insulated connector (bushing).

E. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).

F. Fault Interrupter: A self-controlled mechanical switching device capable of making, carrying, and automatically interrupting an alternating current. It includes an assembly of control elements to detect overcurrents and control the fault interrupter. A fault interrupter always consists of a switching device, a control unit, and sensors for current and/or voltage sensing.

G. Hotstick: An insulated stick, usually made of fiberglass, that is used to work energized overhead conductors and operate electrical equipment that is overhead, underground, and compartmentalized.

H. NETA ATS: InterNational Electrical Testing Association, Acceptance Testing Specification.

I. SCADA: Supervisory control and data acquisition.

J. Way: A three-phase or single-phase circuit connection to the bus that may contain combinations of switches and protective devices or may be a solid bus.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. Time-current characteristic curves for overcurrent protective devices.

B. Shop Drawings: For pad-mounted switchgear.

1. Include a tabulation of installed devices with features and ratings.
2. Include dimensioned plans and elevations, showing dimensions, shipping sections, and weights of each assembled section. Elevations shall show major components and features, and they will mimic bus diagram.
3. Include a plan view and cross section of equipment base showing clearances, manufacturer's recommended work space, and locations of penetrations for grounding and conduits. Show location of anchor bolts.
4. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, and location and size of each field connection.
5. Include list of materials.
6. Locate accessory and spare equipment storage.
7. Include single-line diagram.
8. Include control power wiring diagrams.
9. Include copy of nameplate.

10. Switchgear Ratings:

    a. Voltage.
    b. Continuous current.
    c. Short-circuit rating.
    d. BIL.

11. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting seismic restraints.
12. Relay settings.
13. Interface data with monitoring or control network.
14. Wiring Diagrams: For each switchgear assembly, include the following:

    a. Power, signal, and control wiring.
    b. Three-line diagrams of current and future secondary circuits, showing device terminal numbers and internal diagrams.
    c. Schematic control diagrams.
    d. Diagrams showing connections of component devices and equipment.

C. Field quality-control reports.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Certificates: For pad-mounted switchgear.

1. Switch ratings as listed in IEEE C37.74.
2. Interrupter ratings as listed in IEEE C37.60.
3. Coating system compliance with the IEEE standard listed in "Enclosure" Article.

C. Source quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchgear and switchgear components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
    b. Record as-left set points of adjustable devices.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in "Field Quality Control" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. S&C Electric Company

2.2 SYSTEM DESCRIPTION

A. Manufactured Unit: Pad-mounted switchgear, designed for application in solidly grounded neutral underground distribution systems.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with IEEE C2.

D. Comply with IEEE C37.74.

2.3 RATINGS

A. Switchgear is applied to a nominal 23 kV (L-L) medium-voltage electrical power system. Minimum ratings of the switchgear shall be as follows:

1. Rated Maximum Voltage and Rated BIL: 27 kV and 125 kV BIL.
2. Continuous and Load Interrupting Current: 600 A.
3. Short-Time and Short-Circuit Interrupting Current: 25 kA rms Sym.

2.4 SWITCHGEAR ENCLOSURE

A. Weatherproof enclosure with an integral skid mounting frame, designed for mounting on a concrete pad, suitable to allow skidding or rolling of the switchgear in any direction, and with provision for anchoring the frame to the pad.

B. Enclosure Integrity: Comply with IEEE C57.12.28 for compartmentalized enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to the public.

1. Each vertical section shall have the following features:

a. Structural design and anchorage adequate to resist loads imposed by 125-mph (200-km/h) wind.
b. Skid Mounted: Mount each shipping group on an integral base frame as a complete weatherproof unit.

C. Corrosion Protection: Enclosure coating system shall be factory applied, meeting the requirements of IEEE C57.12.28, in manufacturer's standard color green.

2.5 SWITCHGEAR CONSTRUCTION

A. Dead-front, front and rear access switchgear.

B. Each disconnect switch in switched ways shall be in a sealed, dielectric filled stainless steel tank, factory-filled with SF6 gas.

1. SF6 Gas: Comply with ASTM D2472. Provide enclosure with pressure gauge and self-sealing fill valve.

C. Construct switchgear assembly with switched ways that have front-accessible terminations for cables entering from below and with manual operating provisions with a lineman's hotstick.

D. Viewing Windows: For each switch, located adjacent to manual operating devices, and positioned to show switch contact position.

E. Grounding: Provision to make grounding cable and wire connections at each way.

2.6 SWITCHED WAYS

A. Source Switch Ways: Non-fused, hotstick operated, ganged vacuum load interrupter switches, in series with a visible-break disconnect switch.

1. Rated Continuous Current and Load Switching Current: 600 A.
2. Vacuum Load Interrupter:

a. With 24 V dc motor operators to open or close the load interrupter.
b. Trip-free switch mechanism. Closing the switch shall be independent of the speed of the operating handle.

3. Visible-Break Disconnect Switch: Three positions, with open, closed, and ground positions. The switch shall be mechanically interlocked so that the vacuum interrupter opens and closes first.

a. Switch position indicator, clearly labeled.
b. Padlocking and tagging provisions.

B. Fault Interrupting Switched Ways: Non-fused, hotstick-operated, ganged vacuum fault interrupter switches, in series with a visible-break disconnect. With internally mounted current transformers and electronic overcurrent sensing for three-phase ganged tripping of the interrupter. Comply with IEEE C37.60.

1. Rated Continuous Current and Load Switching Current: 600 A.
2. Vacuum Fault Interrupter:

a. Operated by a motor-charged stored energy mechanism, with provision to manually charge the mechanism. Charging motors shall operate at 24 V ac.
b. Auxiliary Switches: Provide two auxiliary switches, each with field-selectable NC or NO switch position, for connection of remote indication of the position of the switched way. The switches shall be rated at 15 A, 120 V ac, and 1 A, 120 V dc.
c. Trip-free switch mechanism when manually operated. Closing the switch shall be independent of the speed of the operating handle.
d. Single operating handle and a clearly labeled switch position indicator; open, closed, tripped.
e. Operations Counters: Mechanical type, linked to the operating handle of each switched way.
f. Padlocking and tagging provisions.

3. Visible-Break Disconnect Switch: Three positions, with open, closed, and ground positions. The switch shall be mechanically interlocked so that the switch cannot be operated unless the vacuum fault interrupter is open.

a. Switch position indicator, clearly labeled.
b. Padlocking and tagging provisions.

C. Controls:

1. Motor Actuators: "Open," "close," and "stop" push buttons.
2. Switch Status LEDs: "Open" and "closed" lights. Show status of disconnect switch using its auxiliary contact.

3. Motor Actuator Process LEDs: "Opening" and "closing" lights indicating that the selected motor is operating the switch.
4. Power Switch: "On" and "off" toggle switch and circuit protector, to disconnect the dc supply to its motor and provide overload and short-circuit protection.
5. 120 V ac LED to display battery system power level.
6. Battery voltage meter to show battery condition.
7. Local and Remote Selector: In the "local" position remote operation of the switches is disabled and is possible only under the control of switchgear-mounted push buttons.

D. Overcurrent Relays: Field-adjustable microprocessor electronic relays in each phase at indicated locations. Provide for current adjustment from 0 to 600 A.

1. Device Functions: 51/50, 51N/50N, or 51G/50G according to IEEE C37.2.

2.7 POWER SUPPLY

A. The power supply for instrumentation, communications, and switch operations shall be from a potential transformer installed as part of the switchgear.

2.8 AUTOMATIC SOURCE TRANSFER CONTROLS

A. An automatic switch control system shall execute manual, automatic source-transfer, and SCADA operation of the source and fault interrupting switch ways. The source-transfer controls shall open an incoming switch way where voltage is lost and close the other incoming switch way if voltage is present. The controls shall include an overcurrent lockout that prevents the closing of a switch way into a system fault.

B. The automatic switch control system shall execute remote commands received from a SCADA master station and transmit switchgear operation information to a SCADA master station using DNP3 communications protocol. Execution of remote commands shall include enabling of the source-transfer controls and transfer of switch ways to "close," "open," and "ground" positions. Transmission of switchgear information shall include switch way positions and DC supply system status. Additional switchgear information that shall be transmitted follows:

1. Auxiliary Switches: Indication of Feeder and Loadway position. Dry contacts to be terminated in a low-voltage enclosure with terminal blocks.
2. Remote Low Pressure Alarm: Provisions only (plugged pressure gage) for future low pressure warning device.
3. Motor Operator Package: Provisions only to allow retrofit of motor operator to achieve remote control without replacement of the switch or the switch enclosure.
4. External Trip: Provisions to allow an external signal to open fault interrupter.

C. The control shall have communication port provisions for connection to a multi-mode serial fiber link.

2.9 CONTROL NETWORK

A. Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications and shall be able to communicate directly via RS-485 serial networks and Ethernet 10Base-T networks as a native device.

B. Support DNP3 protocol remote control commands received from the SCADA master stations that control switch operations. Comply with the requirements of IEEE 1815.

2.10 BUSHINGS

A. Separable insulated connectors shall be used to connect primary cable. Comply with requirements in Section 260513 "Medium-Voltage Cables."

1. Bushings: One-piece, 600 A, BIL ratings the same as the connectors. Comply with IEEE 386.
2. Supply a standoff bracket or parking stand for each bushing, mounted horizontally adjacent to each bushing.

2.11 SURGE ARRESTERS

A. Distribution class; metal-oxide-varistor type, fully shielded, separable elbow type, suitable for plugging into the inserts. Comply with IEEE C62.11 and IEEE 386.

1. Nominal System Line-to-Line Voltage: 27 kV rms.
2. Maximum Continuous Operating Voltage: 29 kV rms.

2.12 WARNING LABELS AND SIGNS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for labels and signs.

1. High-Voltage Warning Label: Self-adhesive labels on the outside of the high-voltage compartment door(s). Legend shall be "DANGER HIGH VOLTAGE" printed in two lines of minimum 2-inch (50 mm) high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background.
2. Arc-Flash Warning Label: Self-adhesive labels on the outside of the high-voltage compartment door(s), warning of potential electrical arc-flash hazards and appropriate personal protective equipment required.

2.13 SOURCE QUALITY CONTROL

A. Factory Tests: Comply with requirements in IEEE C37.60 and IEEE C37.74 for testing procedures.

1. Circuit Resistance Test: Verify that switchgear contacts have been properly aligned and current transfer points have been properly assembled.
2. Power-frequency dry withstand voltage test.
3. Dielectric withstand test; one-minute dry power-frequency.
4. Calibrate overcurrent devices for conformance to published time-current characteristic curves.
5. Sealed Tank Leak Test:

    a. Comply with IEC 62271-1 for test procedure for switchgear using SF6.

6. Operating tests shall verify the following:

    a. Switch position indicators and contacts are in the correct position for both the open and closed positions.
    b. Insulating medium quantity indicator (if provided) is functioning properly.
    c. Circuit configuration is shown correctly.
    d. Mechanical interlocks are in place and operative.
    e. Position and polarity of current transformers meets requirements.
    f. Control, secondary wiring, and accessory devices are connected correctly.
    g. Devices and relays actually operate as intended. Circuits for which operation is not feasible shall be checked for continuity.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Upon delivery of switchgear and prior to unloading, inspect equipment for damage.

1. Examine tie rods and chains to verify they are undamaged and tight and that blocking and bracing are tight.
2. Verify that there is no evidence of load shifting in transit and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
3. Examine switchgear for external damage, including dents or scratches in doors and sill, and termination provisions.
4. Compare switchgear and accessories received with the bill of materials to verify that the shipment is complete. Verify that switchgear and accessories conform to the

manufacturer's quotation and Shop Drawings. If the shipment is not complete or does not comply with project requirements, notify the manufacturer in writing immediately.

5. Unload switchgear, observing packing label warnings and handling instructions.
6. Open compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Handling:

1. Handle switchgear, according to manufacturer's recommendations; avoid damage to the enclosure, termination compartments, base, frame, and internal components. Do not subject switchgear to impact, jolting, jarring, or rough handling.
2. Transport switchgear upright to avoid internal stresses on equipment mounting assemblies. Do not tilt or tip switchgear.
3. Use spreaders or a lifting beam to obtain a vertical lift and to protect switchgear from straps bearing against the enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
4. Do not damage structure when handling switchgear.

C. Storage:

1. Switchgear may be stored outdoors. If possible, store switchgear at final installation locations on concrete pads. If dry concrete surfaces are not available, use pallets of adequate strength to protect switchgear from direct contact with the ground. Ensure switchgear is level.
2. Protect switchgear from physical damage. Do not store switchgear in the presence of corrosive or explosive gases.
3. Store switchgear with compartment doors closed.

D. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders have to cross section barriers to reach load or line lugs.

E. Pre-Installation Checks:

1. Verify removal of any shipping bracing after placement.

F. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at switchgear location.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SWITCHGEAR INSTALLATION

A. Comply with NECA 1.

B. Equipment Mounting:

1. Install switchgear on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

C. Install level and plumb, tilting less than 1.5 degrees when energized.

D. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

E. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and IEEE C2.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. For counterpoise, use tinned bare copper cable not smaller than No. 4/0 AWG, buried not less than 30 inches (765 mm) below grade interconnecting the grounding electrodes. Bond surge arrester and neutrals directly to the switchgear enclosure and then to the grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable with no kinks or sharp bends.
2. Fence and equipment connections shall not be smaller than No. 4 AWG. Ground fence at each gate post and corner post and at intervals not exceeding 10 ft. (3050 mm). Bond each gate section to the fence post using 1/8 by 1 inch (3 by 25 mm) tinned flexible braided copper strap and clamps.
3. Make joints in grounding conductors and loops by exothermic weld or compression connector.
4. Terminate all grounding and bonding conductors on a common equipment grounding terminal on the switchgear enclosure.
5. Complete the switchgear grounding and surge protector connections prior to making any other electrical connections.

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
2. Bundle associated phase, neutral, and equipment grounding conductors together within the switchgear enclosure. Arrange conductors such that there is not excessive

strain on the connections that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.

C. Terminate medium-voltage cables in incoming section of switchgear according to Section 260513 "Medium-Voltage Cables."

3.4 SIGNS AND LABELS

A. Comply with the installation requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."

B. Install warning signs as required to comply with OSHA 29 CFR 1910.269.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. General Field Testing Requirements:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" chapter.
2. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
3. After installing switchgear but before primary is energized, verify that grounding system at the switchgear is tested at the specified value or less.
4. After installing switchgear and after electrical circuitry has been energized, test for compliance with requirements.

C. Medium-Voltage Switchgear Field Tests:

1. Visual and Mechanical Inspection:

a. Verify that current and voltage transformer ratios correspond to Drawings.
b. Inspect bolted electrical connections using calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
c. Confirm correct operation and sequencing of electrical and mechanical interlock systems.

1) Attempt closure on locked-open devices. Attempt to open locked-closed devices.
2) Make key exchange with devices operated in off-normal positions.

d. Inspect control power transformers.

1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify that primary and secondary fuse or circuit breaker ratings match Drawings.

2. Electrical Tests:

a. Inspect bolted electrical connections using a low-resistance ohmmeter to compare bolted resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value. Provide resistance or torque values on Field Quality Control Report.

D. Medium-Voltage Vacuum Interrupter Field Tests:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and required clearances.
c. Verify the unit is clean.
d. Perform mechanical operation tests on operating mechanism according to manufacturer's published data.
e. Record as-found and as-left operation counter reading. Operation counter shall advance one digit per close-open cycle.

2. Electrical Tests:

a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to ground with switch closed, and across each open pole. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Insulation-resistance values shall be according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Investigate and correct values of insulation resistance less than this table or manufacturer's recommendations. Dielectric-withstand-voltage tests shall not proceed until insulation-resistance levels are raised above minimum values.
b. Perform a contact/pole-resistance test. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value. Microhm or dc millivolt drop values shall not exceed the high levels of the normal range according to manufacturer's published data. If manufacturer's published data is not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

c. Verify correct operation of any auxiliary features, such as electrical close and trip operation, and trip-free operation. Auxiliary features shall operate according to manufacturer's published data.
d. Trip circuit breaker by operation of each protective device. Reset trip logs and indicators.

E. Microprocessor-Based Protective Relay Field Tests:

1. Visual and Mechanical Inspection:

a. Record model number, style number, serial number, firmware revision, software revision, and rated control voltage.
b. Verify operation of light-emitting diodes, display, and targets.
c. Record passwords for each access level.
d. Clean the front panel and remove foreign material from the case.
e. Check tightness of connections.
f. Verify that the frame is grounded according to manufacturer's instructions.
g. Download settings from the relay. Print a copy of the settings for the report and compare the settings to those specified in the coordination study.

2. Electrical Tests:

a. Functional Operation: Check functional operation of each element used in the protection scheme.
b. Control Verification:

1) Functional Tests:

a) Check operation of all active digital inputs.
b) Check output contacts or silicone-controlled rectifiers, preferably by operating the controlled device, such as circuit breaker, auxiliary relay, or alarm.
c) Check internal logic functions used in protection scheme.
d) Upon completion of testing, reset min/max recorders, communications statistics, fault counters, sequence-of-events recorder, and event records.

F. Ground Resistance Test:

1. Visual and Mechanical Inspection:

a. Verify ground system complies with the Contract Documents and NFPA 70 "Grounding and Bonding" Article.
b. Inspect physical and mechanical condition. Grounding system electrical and mechanical connections shall be free of corrosion.

c. Inspect bolted electrical connections using a calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value. Provide resistance values on Field Quality Control Report.
d. Inspect anchorage.

2. Electrical Tests:

a. Perform fall-of-potential or alternative test according to IEEE 81 on the main grounding electrode or system. The resistance between the main grounding electrode and ground shall be no more than 5 ohms.
b. Inspect bolted electrical connections for high resistance using a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value. Provide resistance values on Field Quality Control Report.
c. Inspect physical and mechanical condition.
d. Inspect anchorage.

G. Switchgear will be considered defective if it does not pass tests and inspections.

H. Prepare test and inspection reports.

1. Provide a test report that indicates each visual and mechanical test was completed, and the test values for each electrical test.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 26 13 29

SECTION 26 56 13 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Poles and accessories for support of luminaires.

1.3 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete luminaire.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

1.4 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.

1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
2. Anchor bolts.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of poles.

4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations.
5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

1.5 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

B. Qualification Data: For Installer and testing agency.

C. Material Test Reports:

1. For each foundation component, by a qualified testing agency.
2. For each pole, by a qualified testing agency.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: Manufacturer's standard warranty.

G. Soil test reports

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For poles to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include pole inspection and repair procedures.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Pole repair materials.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for foundation testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

1. Warranty Period: Five years from date of Substantial Completion.
2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 ALUMINUM POLES

A. Provide product specified on drawings.

2.3 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

2.4 MOUNTING HARDWARE

A. Anchor Bolts: Provided by pole supplier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Direct-Buried Foundations: Install to depth indicated on Drawings, but not less than as indicated. Add backfill in 6-inch (150-mm) to 9-inch (230-mm) layers, tamping each layer before adding the next. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

C. Anchor Bolts: Install plumb using manufacturer-supplied steel or plywood template, uniformly spaced.

3.3 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.

1. Fire Hydrants and Water Piping: 60 inches (1520 mm).

2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet (3 m).
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.

1. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
2. Install base covers unless otherwise indicated.
3. Use a short piece of 1/2 -inch (13-mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

B. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.5 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Inspect poles for nicks, mars, dents, scratches, and other damage.
2. System function tests.

END OF SECTION 26 56 13

SECTION 26 56 19 – LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

6. Wiring diagrams for power, control, and signal wiring.
7. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of the following:

1. Luminaire.
2. Photoelectric relay.

C. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Source quality-control reports.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 2 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Owner prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Provide product specified on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Install lamps in each luminaire.

C. Fasten luminaire to structural support.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires at height and aiming angle as indicated on Drawings.

H. Coordinate layout and installation of luminaires with other construction.

I. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top at distance indicated on drawings above finished grade. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

a. IES LM-5.
b. IES LM-50.
c. IES LM-64.
d. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit

occupied conditions. Make up to one visit to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 56 19

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and disposing of topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing abandoned site utilities.
7. Temporary erosion- and sedimentation-control measures.

B. Related Requirements:

1. Section 01 01 60 “Utility Outages and Dig Permits” for permits required prior to start of excavation.
2. Section 02 41 19 "Selective Demolition" for partial demolition of structures.
3. Section 31 20 00 “Earth Moving” for excavating and backfilling.
4. Section 31 23 19 “Dewatering” for dewatering excavations.
5. Section 31 50 00 “Excavation Support and Protection” for shoring, bracing, and sheet piling of excavations.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, as indicated on Drawings.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for suitable native backfill and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.

C. Utility Locator Service: Notify Sunshine State One-Call before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."

1. **Obtain approved borrow soil material off-site. Satisfactory soil material is not available on-site.**

B. Tree Pruning Compound: Waterproof, antiseptic, elastic and free of kerosene, coal tar, creosote, and other substances harmful to plants.

C. Herbicides: A chemical or a combination of chemicals which, according to the manufacturer's label, will kill stumps and roots. Deliver herbicides to the site in original manufacturers containers indicating type and percentage of chemical, and application instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to Owner's requirements.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap abandoned utilities indicated to be removed.

1. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others.

B. Excavate for and remove abandoned underground utilities indicated to be removed.

C. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 02 41 19 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of no less than 6 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 12 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove topsoil and legally dispose off of Owner's property.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

C. Remove and dispose of all logs, tree trimmings, and debris from Owner’s property. Leave Work area in a neat uncluttered condition.

END OF SECTION 31 10 00

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the project sites.
2. Preparing subgrades for walks, pavements, and turf and grasses.
3. Excavating and backfilling for structures.
4. Excavating and backfilling pits for buried utility structures.

B. Related Requirements:

1. Section 01 01 60 “Utility Outages and Dig Permits” for permits required prior to start of excavation.
2. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping, topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 31 23 19 "Dewatering" for lowering and disposing of ground water during construction.
4. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
5. Section 32 13 13 “Concrete Paving” for preparation of sidewalk and pavement subgrade and base courses.
6. Section 32 93 20 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock:

1. Rock is defined as limestone, sandstone, granite or similar rocks in solid beds or masses in original or stratified position which can be removed only by continuous drilling, blasting or the use of pneumatic tools, and all boulders of 1 cubic yard in volume or larger.
2. The ability to rip or excavate rock is determined by the type of excavator capable of removing it without blasting (i.e. hydraulic excavator; equipped with a short-tip-radius rock bucket; rated at not less than 120-flywheel hp with bucket curling force of not less than 25,000 Ibf and stick-crowd force of not less than 18,700 Ibf ; measured according to International Organization for Standardization (ISO) 6165).
3. Material which can be loosened with a pick, frozen materials, soft laminated shale and hardpan, which for convenience or economy is loosened by drilling, blasting, wedging or the use of pneumatic tools, removal of concrete pavement and retaining walls shall not be classified as rock excavation.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Controlled low-strength material, including design mixture.
2. Warning tapes.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

A. Blasting: Blasting is not permitted.

B. Pre-excavation Conference: Conduct conference at project site.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify the “Sunshine State One Call of Florida” (811) and in addition provide utility locator services for areas where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures are in place.

D. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

E. Do not direct vehicle or equipment exhaust towards protection zones.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. **GENERAL: PROVIDE APPROVED BORROW SOIL MATERIALS FROM OFF-SITE. SATISFACTORY SOIL MATERIALS ARE NOT AVAILABLE FROM EXCAVATIONS.**

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

F. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.

G. Sand: ASTM C 33/C 33M; fine aggregate.

H. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:

    a. Grab Tensile Strength: 157 lbf; ASTM D 4632.
    b. Sewn Seam Strength: 142 lbf; ASTM D 4632.
    c. Tear Strength: 56 lbf; ASTM D 4533.
    d. Puncture Strength: 56 lbf; ASTM D 4833.

3. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
4. Permittivity: 0.5 per second, minimum; ASTM D 4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Potable water systems.
5. Green: Sewer systems.
6. Purple: Reclaimed water systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.

B. Classified Excavation: Excavate to subgrade elevations.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling, ram hammering; or ripping of material not classified as rock excavation is earth excavation.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.8 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavement with a pneumatic-tired to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted backfill layer, at least one test for every 150 feet or less of trench length but not fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 31 23 19 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes construction dewatering.

B. Related Requirements:

1. Section 31 20 00 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.3 SUBMITTALS

A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and professional engineer that is licensed in the state of Florida.

B. Field quality-control reports.

C. Existing Conditions: Using photographs show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in dewatering work.

1.6 FIELD CONDITIONS

A. Make test borings and conduct other exploratory operations necessary for dewatering according to performance requirements.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 31 10 00 "Site Clearing," during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Survey-Work Benchmarks: Resurvey benchmarks daily during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify

Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

D. Prepare reports of observations.

3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 31 23 19

SECTION 31 25 00 - EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The extent of erosion, sediment and pollution control is shown on the Contract Drawings.

B. Erosion and sediment control includes, but is not limited to the following:

1. Standard control measures such as storm structure protection, gravel construction entrance/exit, silt fence, block and gravel protection.
2. Seeding

C. Provide all materials, labor, equipment and services required to accomplish all related work in accordance with the Contract Drawings and specifications.

1.2 RELATED WORK

A. Review Contract documents for requirements that affect work of this section. Specification Sections that directly relate to work of this section included, but are not limited to:

1. Site Clearing
2. Earth Moving

1.3 QUALITY ASSURANCE

A. Perform erosion and sediment control in compliance with applicable requirements of Local and State governing authorities having jurisdiction.

1.4 PRODUCT DELIVERY AND STORAGE

A. Take all required measures to ensure that all materials are protected from damage.

B. Special care shall be exercised during delivery and storage, to avoid damage to the products.

C. All materials shall be delivered and stored within the Contractor’s work limits are in an area approved by the Owner.

PART 2 - PRODUCTS

2.1 INLET PROTECTION FILTER FABRIC

A. Inlet protection filter shall be a polypropylene filter fabric. Standard of Quality shall be Mirafi 100X, Exxon GTF-103S, Geotex 914SC, or other approved equal.

2.2 SILT FENCE

A. Siltation fence shall be a polyproylene filter fabric backed with industrial netting and wood post. Standard of Quality shall be Mirafi 100X, Exxon GTF-103S, or Geotex 914SC, or an approved equal.

PART 3 - EXECUTION

3.1 GENERAL EROSION CONTROL

A. Install construction erosion control features, as indicated on drawings and specifications prior to topsoil stripping, earthwork, and removal of existing vegetation. Keep the disturbance to a minimum. Install other features as described in the sequence of erosion, sediment and pollution control on the Contract Drawings.

B. Until a disturbed area is stabilized, trap runoff sediment by the use of methods acceptable to governing authorities.

C. Provide erosion controls on slopes and swales traversing, bordering, or leaving the site. Limit the water flow to a non-erosive velocity.

D. Inspect all erosion and sediment control measures immediately after each rainfall and at least daily during prolonged rainfall. Make required repairs immediately.

E. Remove sediment deposits when they reach approximately one half of the height of the barrier. Dispose sediment in a manner that does not result in additional erosion or pollution.

F. The Contractor is responsible for prompt removal and disposal of all rubbish and debris in accordance with the governing authorities.

3.2 SILTATION FENCE

A. Excavate a 6-inch x 6-inch trench along the lower perimeter of slopes along the contract limit line, or as indicated on the site plan. Place excavated material on uphill side of trench for backfilling.

B. Drive 36’ minimum length posts into the downhill side of the trench so that minimum 16” of post height is in the ground. If prefabricated silt fence with fabric attached to posts is used, drive stakes so that 8” of fabric will be buried in the ground.

C. Backfill trench with excavated material so that at least 8” of fabric is securely tied into the ground to prevent undermining.

D. Join sections by overlapping fabric between two posts and setting posts simultaneously. Overlap by minimum 18”.

E. Attach siltation fence securely to 2”x2” metal posts spaced no more than eight (8’ o.c.) on center. Secure fence fabric to post with three one (1”)-inch staples.

3.3 CLEAN UP

A. During the Contract and at intervals as directed by the Engineer or Owner’s Representative as erosion, sediment and pollution control procedures are completed; clear the site of all extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining condition.

END OF SECTION 31 25 00

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Installation of temporary shoring and bracing required for construction of structures and utilities, and to support existing structures.
2. Inspection and acceptance of existing shoring and bracing.
3. Maintenance of shoring and bracing.
4. Removal of shoring and bracing, as required to a minimum of four feet below the surface.
5. Support of existing utilities, manholes, valves, and piping.
6. Monitoring existing structures.

B. Types of shoring and bracing system include, but are not limited to the following:

1. Steel soldier piles.
2. Timber lagging.
3. Steel sheet piles.

C. Driving or jetting of sheeting or piles by the use of vibratory equipment impact hammer, or water is prohibited.

D. Related Requirements:

1. Section 01 01 60 "Utility Outages and Dig Permits" for permits required prior to start of excavation.
2. Section 31 20 00 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.
3. Section 31 23 19 "Dewatering" for dewatering excavations.

1.3 SUBMITTALS

A. Prior to starting work, submit for review and approval, calculations, and shop drawings showing each proposed method of supporting adjacent earth and structures; i.e. retention system and other methods of bracing. Include the following:

1. Lists of material to be used, including design mixes.
2. Sequence of operations.
3. Detailed sections clearly illustrating the scope of work.
4. Relationship of piles, lagging, walls, and bracing to new and existing structures.
5. Location of utilities and details of support when required.
6. Procedures and details of testing.

B. Shop drawings and calculations: Prepared by qualified Licensed Professional Engineer registered in the State of Florida and bearing their seals and signatures.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of complete projects with project names and addresses, names and addresses of engineers and owners, and other information specified.

D. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by excavation support and protection systems.

1.4 QUALITY ASSURANCE

A. Comply with the Publications of the following agencies to the extent referenced and applicable:

1. ASTM - American Society for Testing and Materials.
2. AISC - American Institute of Steel Construction.
3. OSHA - Occupational Safety and Health Act.

B. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing excavation support and protection systems similar to those required for this Project and with a record of successful in-service performance.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Florida and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.

1. Engineering Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of data for the excavation support and protection system

including drawings and comprehensive engineering analysis that shows the system's compliance with specified requirements.

D. Do not install excavation support and protection system until successfully reviewed by the Engineer.

1.5 JOB CONDITIONS

A. Before starting work, check and verify governing dimensions and elevations. Survey condition of adjoining surfaces. Photograph existing conditions to record any prior settlement or cracking of structures, pavements, and other deficiencies. Prepare a list of existing damages, verified by dated photographs and signed by the Owner.

B. Survey adjacent building, structures and improvements, establishing exact elevations at fixed points to act as bench marks. Clearly identify benchmarks and record existing elevations. Locate datum level used to establish benchmark elevations.

1.6 EXISTING UTILITIES

A. The contract drawings indicate the general location of underground utilities. All utility locations and elevations in the vicinity of work shall be verified by the contractor prior to the start of project work. Test pits shall be conducted in areas where conflicts may occur prior to any excavation, heavy equipment loading, drilling and setting the H-piles is performed so as to avoid damaging or interfering with these existing utilities.

B. Call “Sunshine State One Call of Florida” (811) 7 days prior to starting excavation operations.

C. Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted in writing by the respective representative and then only after arranging to provide temporary utility service according to requirements indicated.

PART 2 - PRODUCTS

A. Design sheeting and bracing using the following criteria:

1. Design shoring and bracing systems using a safety factor of 2.0 minimum.
2. Select structural steel members on the basis of AISC specifications.
3. Select structural wood members on the basis of Timber Construction Standards of the American Institute of Timber Construction.
4. Existing building, valve vaults, manholes or foundations shall not be used for support of sheeting and shoring load. Sheeting and shoring shall be independent of the adjacent structure.

5. All shoring and bracing work shall comply with the applicable publications, codes standards and regulation of OSHA.

2.2 MATERIALS

A. General: Provide adequate shoring and bracing materials, which will support loads imposed. Materials need not be new, but should be in serviceable condition.

B. Structural Steel - ASTM designation A 36 or ASTM A 572 Grade 50.

C. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal 3 inches thick, unless otherwise indicated. Maximum 0.5 inch space between individual pieces.

PART 3 - EXECUTION

3.1 SHORING

A. The Contractor shall design the sheeting and shoring to minimize disruption to existing utilities. The Contractor will be fully responsible for planning his work and designing the sheeting and shoring to avoid disrupting all utilities not indicated on the plans for relocation.

B. Cut and remove the top of shoring to 48 inches below existing ground prior to restoration of the area.

3.2 BRACING

A. Provide engineered bracing to support construction activities at the top of the excavation. Bracing shall be designed by an engineer registered in the State of Florida in accordance with OSHA and included in the shop drawing.

B. Locate bracing to clear existing and proposed work. If necessary to move a brace, install new bracing prior to removal of original brace.

C. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

D. Maintain bracing until structural elements are retraced by other bracing or until permanent construction is in place. Bracing shall be inspected for its ability to withstand lateral earth and hydrostatic pressure.

E. Remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.

F. Repair or replace, as acceptable to the Owner, adjacent work damaged or displaced through the installation or removal of shoring and bracing work.

3.3 PROTECTION OF ADJOINING STRUCTURES

A. Do not begin any work until drawings and test procedures are approved by the Owner and Engineer.

B. Prior to shoring and bracing operations, take and record initial elevation readings of adjacent utilities, footings, pavements, buildings, and other structures.

C. Upon completion of shoring and bracing operations take and record elevation readings in identical location of initial readings. Settlement greater than 0.4 inch will require the Contractor to take remedial action.

D. Submit one electronic copy of all elevation records for review by the Owner and Engineer.

E. If any of the following conditions occur during shoring and bracing operations, stop the work immediately and revise procedures to prevent further damage. Revised procedures will be subject to approval.

1. New cracking of existing footings, walls, floors, or pavements.
2. Settlement of 0.1 inch relative to adjoining areas.
3. Total settlement of 0.4 inch.
4. Signs of shifting in adjoining facilities or utilities.

3.4 INSTALLATION

A. Provide all piling, bracing, shoring, or other applicable form of temporary supports required to stabilize and protect from movement all existing facilities and utilities that are to remain undisturbed during the course of excavation and demolition operations. Comply with the requirements of OSHA for all work.

B. Perform the work in such a manner to prevent settlement or shifting of adjoining structure or pavement.

C. Install piles by means of drilling or boring to eliminate vibration and disturbance to adjacent structure. Jetting, vibratory, or impact hammers, or any other method causing vibration shall not be used. Voids between sheeting and earth shall be filled with lean concrete.

D. Where tiebacks are used, test each tieback with loads greater than design loads.

E. The Contractor shall be responsible for the installation of all shoring and bracing, and shall make good at his expense any damage caused by or due to failure of sheet piling, shoring, and bracing or other protection methods used.

F. Maintain sheet piling, shoring, and bracing in place until fill has been placed or permanent construction is in position. Remove shoring, and bracing as required in such a manner to avoid disturbance to underlying soils and structures, pavements, facilities and utilities. As a minimum, remove piling, and lagging to 48 inches below existing, and remove whalers, which interfere with wall placement, prior to final construction.

3.5 DEWATERING

A. Provide equipment to remove excess water as required to permit installation of new work in accordance with Section 31 23 19, "Dewatering".

END OF SECTION 31 50 00

SECTION 32 10 00 - PAVING AND SURFACING

PART 1 - GENERAL

1.1 REFERENCE SPECIFICATION

A. Except as may be otherwise specified on the plans or herein, the applicable sections of the Florida Department of Transportation (FDOT), Standard Specifications for Road and Bridge Construction, July 2022 Edition, referred to hereinafter as the Standard Specifications, shall apply. All references in the Standard Specifications to the Department or Department's State Materials and Research Engineer at Gainesville shall be deleted and The Contract Administrator inserted. Online versions of the Standard Specifications are available at the following website: https://www.fdot.gov/programmanagement/Implemented/SpecBooks.

B. Except as may be otherwise shown in the plans or specified herein, the applicable details of the State of Florida Department of Transportation, Design Standards, FY 2022-2023, shall apply. On line versions of the Design Standards eBook (DSeB) and applicable Design Standards Revisions (DSRs) are available at the following website: https://www.fdot.gov/design/standardplans/SPRBC.shtm.

C. Contractor shall pay for the services of an independent testing laboratory to perform all tests required by the contract documents. Related Requirements:

1. No additional payment will be made for Superpave Asphalt Concrete installed thicker than what is shown on the plans, nor will any increased pay factors be accepted. Tonnage will be calculated by plan area multiplied by a density of 110 pounds per square yard per inch thickness.

END OF SECTION 31 10 00

SECTION 32 13 13 – CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide concrete curbs, walks, and paving as shown and specified. The work includes

1. Final subgrade preparation and paving base.
2. Curbs, walks, and paving.

1.3 SUBMITTALS

A. Submit concrete mix designs. Obtain approval before placing concrete.

B. Product Data:

1. Submit complete materials list of items proposed for the work. Identify materials source.
2. Submit admixture, curing compound, retarder, and accessory item product data.
3. Submit material certificates for aggregates, reinforcing, and joint fillers.

C. Submit concrete delivery tickets. Show the following:

1. Batch number
2. Mix by class or sack content with maximum size aggregate.
3. Air content.
4. Slump test results.

5. Time of loading.

D. Submit concrete cylinder strength test reports.

1.4 QUALITY ASSURANCE

A. Testing and inspection: Performed by a qualified independent testing laboratory.

B. Construction Manager shall engage a testing agency to perform materials evaluation tests. Related testing costs are the responsibility of the Contractor.

C. Materials and methods of construction shall comply with the following standards:

1. American Society for Testing and Materials, (ASTM).
2. American Concrete Institute, (ACI).

D. Maintain field records of time, date of placing, curing, and removal of forms of concrete in each portion of work.

E. Do not change source or brands of cement and aggregate materials during the course of the work.

1.5 PROJECT CONDITIONS

A. Work notification: Notify Landscape Architect at least 24 hours prior to installation of concrete.

B. Establish and maintain required lines and grade elevations.

C. Do not install concrete work over wet, saturated or muddy subgrade.

D. Do not install concrete when air temperature is below 40 degrees F. Use of calcium chloride, salt, or any other admixture to prevent concrete from freezing is prohibited.

E. Protect adjacent work.

F. Provide temporary barricades and warning lights as required for protection of project work and public safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete for Curbs: Concrete shall be Class I that conforms to the requirements of FDOT Standards for Road and Bridge Construction, 1991, Section 345Grade Rings: Provide continuous precast concrete riser to grade and match frame and cover diameter. (No grade rings.)

B. Concrete at Sidewalks: Concrete shall be Class I that conforms to the requirements of FDOT Standards for Road and Bridge Construction, 1991, Section 345.

C. Preformed Joint Filler: ASTM D1751, pre-molded, non-extruding asphalt impregnated fiberboard, thickness indicated.

D. Curing Compound: ASTM C309, non-yellowing, non-staining liquid membrane forming type containing a fugitive dye. Chlorinated rubber compounds are not acceptable.

E. Forms: Wood or metal of sufficient strength to resist concrete placement pressure and to maintain horizontal and vertical alignment during concrete placement. Provide forms straight, free of defects and distortion, and height equal to full depth of concrete work.

1. Provide 2" nominal thickness, surfaced plank wood forms for straight sections. Use flexible metal, 1" lumber or plywood forms to form radius bends.

F. Reinforcing: Reinforcing for concrete driveways and walks shall be 6 x 6 # 10/10 welded wire mesh or fiber reinforced concrete. Refer to drawings.

G. Form release agent: Non-staining chemical form release agent free of oils, waxes, and other materials harmful to concrete.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine subgrades and installation conditions. Do not start concrete work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Proof roll the subgrade and do all necessary rolling and compacting to obtain firm, even subgrade surface. Fill and consolidate depressed areas. Remove uncompactable materials, replace with clean fill and compact to Proctor specified within Contract Documents.

B. Remove loose material and debris from base surface before placing concrete.

C. Install, align, and level forms. Stake and brace forms in place. Maintain following grade and alignment tolerances:

1. Top of form: Maximum 1/8" in 10'-0".
2. Vertical face: Maximum 1/8" in 10'-0".

D. Coat form surfaces in contact with concrete with form release agent. Clean forms after each use and coat with form release agent as necessary to assure separation from concrete without damage.

E. Locate, place, and support reinforcement as indicated.

F. Install, set, and build-in work furnished under other specification sections. Provide adequate notification for installation of necessary items.

3.3 INSTALLATION

A. Concrete Placement:

1. Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as specified.
2. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing. In cold weather comply with ACI 306, "Recommended Practice for Cold Weather Concreting". In hot weather comply with ACI 305, "Recommended Practice for Hot Weather Concreting".
3. Moisten base to provide a uniform dampened condition at the time concrete is placed.
4. Place and spread concrete to the full depth of the forms. Use only square-end shovels or concrete rakes for hand-spreading and consolidating operations to prevent segregation of aggregate and dislocation of reinforcement.
5. Place concrete in a continuous operation between expansion joints. Provide construction joints when sections cannot be placed continuously.
6. Place concrete in one course, monolithic construction, for the full width and depth of concrete work.
7. Strike-off and bull-float concrete after consolidating. Level ridges and fill voids. Check surface with a 10'-0" straightedge. Fill depressions and refloat repaired areas. Darby the concrete surface to provide a smooth level surface ready for finishing.
8. Provide curb profiles indicated.
9. Provide handicapped ramps where indicated.
10. Provide concrete base for interlocking bricks where indicated.

B. Joints:

1. Construct control, expansion, and construction joints properly aligned with face perpendicular to concrete surface.
2. Provide sawcut control joints at sidewalks, sectioning concrete into segments as shown on the construction details and plans. Joints to depth of 1 1/2" (minimum).
3. Provide expansion joints using pre-molded joint filler at concrete work abutting curbs, walls, structures, walks, and other fixed objects.

    a. Locate expansion joints as indicated. When not indicated, provide joints at maximum 32'-0" on center for curbs, walks and concrete slabs below. Align expansion joints in abutting curbs and walks.

C. Concrete Finishing:

1. Perform concrete finishing using mechanical or hand methods as required.

2. Upon completion of floating, and after bleed water has disappeared and concrete can sustain foot pressure with nominal indentation, cut concrete away from forms. Work edges with an edging tool.
3. Install control joints at indicated locations during edging operations.
4. Complete surface finish as follows:

    a. Provide sidewalk surfaces with finish specified within Contract Documents before the surface sets to produce a surface uniform in texture and appearance.
    b. Provide ramps with non-slip textured finish as indicated on the plans.

5. Curbs: Provide a wood float finish. After floating surface, hand trowel curb surfaces. Hand troweling shall produce a surface which is free from trowel marks and uniform in texture and appearance.

3.4 FIELD QUALITY CONTROL

A. Provide field quality control testing and inspection during concrete operations.

B. Contractor shall provide adequate notice, cooperate with, provide access to the work, obtain samples, and assist test agent and their representatives in execution of their function.

C. Testing:

1. Provide slump test on first load of concrete delivered each day and whenever requested by the Landscape Architect due to changes in consistency or appearance of concrete.
2. Provide air indicator tests and air meter tests for all air-entrained concrete.

    a. Perform air indicator test with a "Chase" AE 35 or equal air indicator, and air meter test in accordance with ASTM C231 or C173. Test first load of concrete delivered each day.
    b. Furnish copies of field records and tests reports as listed for strength tests.

3. Strength testing:

a. Provide 1 set of 3 test specimens for each 50-cu. yd. placed in any one day. Secure samples in accordance with ASTM C172 and mold specimens in accordance with ASTM C31.
b. Test 1 specimen at 7 days and 2 specimens at 28 days in accordance with ASTM C39.
c. Furnish copies of field records and test reports as follows:

2 copies to Landscape Architect
1 copy to Contractor
1 copy to Ready Mix Supplier
1 copy to Owner

4. Record the exact location of the concrete in the work represented by each set of cylinders and show on test reports.
5. Provide an insulated moist box for protection of the test cylinders until shipped to the laboratory.

3.5 PROTECTION

A. Protect concrete work from damage due to construction, vandalism and vehicular traffic until final acceptance. Exclude construction and vehicular traffic from concrete pavement for at least 14 days.

3.6 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from concrete operations.

B. Sweep concrete sidewalks and pavement, wash free of stains, discoloration, dirt, and other foreign material immediately prior to final acceptance.

END OF SECTION 32 13 13

SECTION 32 14 00 – UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provide unit paving as shown and specified. The work includes:

1. Clay brick unit paving.
2. Concrete base.

1.2 QUALITY ASSURANCE

A. Materials and methods of construction shall comply with the following standards:

1. American Society for Testing and Materials, (ASTM).
2. American Association of State and Highway Transportation Officials, (AASHTO).

B. Installation: Performed only by skilled workmen with satisfactory record of performance on completed projects of comparable size and quality.

C. Do not change source of unit pavers during the course of the work.

D. Installer Qualifications: Engage an Installer who has successfully completed within the last three (3) years at least three (3) unit paver applications similar in type and size to that of this project and who will assign tradesmen from these earlier applications to this project, of which one will serve as lead tradesman.

E. Do not change source of brands for paver units or setting materials during process of work.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections. manufacturer's product data and installation instructions for concrete paver units.

B. Submit a minimum of 5 full size samples of each color paver unit required. Include the full range of style, size, exposed finish, color, and texture proposed for the work.

C. Submit manufacturer's certification that paver units comply with specified material and physical requirements.

D. Submit material certificates for bedding materials.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect paving units from damage, chipping, and soiling during delivery and storage. Store off the ground on pallets or wood platforms.

B. Store loose granular materials in a well-drained area on a solid surface to prevent mixing with foreign materials.

1.5 PROJECT CONDITIONS

A. Review installation procedures and coordinate paving work with other work affected by the concrete unit paving work.

B. Protect partially completed paving against weather damage when work is not in progress.

C. Provide temporary barricades and warning lights as required for protection of project work and public safety.

D. Protect adjacent work from damage, soiling, or staining during paving operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Pavers shall be manufactured by Pine Hall Brick, wire cut "English Edge", full range, heavy vehicular paver, 2 3/4" x 4" x 8" equal.

1. Compressive strength: Average compressive strength shall be 12,000 psi at time of delivery.
2. Absorption: Maximum 5%.
3. Freeze-thaw test: Passes CSA-A231.2 freeze-thaw test in saline solution and maximum 1% loss in dry weight after 150 cycles.
4. Dimension tolerances: Length maximum 1/6" (1.5 mm), height maximum 1/8" (3mm) from standard dimension.
5. Provide only sound units free of defects that would interfere with proper placing of units or impair strength or permanence of construction. Minor cracks and minor chipping incidental to methods of manufacture, handling in shipment, and delivery will be acceptable subject to Landscape Architect's review and acceptance. Excessive cracks and chipping, as determined by the Landscape Architect, will be rejected as not complying with specification requirements.
6. Provide test reports certifying materials and physical requirement compliance. Tests shall have been conducted not more than 12 months prior to manufacture.

B. Base Material:

1. Provide 8" concrete base to 4000 psi at vehicular locations.

C. Bedding and leveling material: ASTM C33 or AASHTO M43, #10 graded clean coarse concrete sand. The setting bed shall be carefully screened, leveled, and compacted prior to receiving the brick. The sand used in the bedding course should be washed, angular san. Use only Bedding Sand conforming to ASTM C 33 Specifications for Concrete Aggregate. Limestone screenings should not be used as they do not compact uniformly, are normally too soft, are moisture sensitive, and some may cause staining to the brick pavers. See plans for details.

D. Sand Cement Dry Jointing: A dry mix of sand and cement must be installed when is completely dry and there is no chance of rain. A 3:1 mortar mixture (Blend one part Portland cement with three parts jointing sand) is mixed dry then spread over the finished paving. Using a soft brush you sweep the mix into the joints. Each joint is then packed down

with the edge of a trowel or similar implement to pack the dry mix into the joints. This process may need repeating several times to ensure a good solid joint. Any residue on the surface needs to be swept clean to avoid any cement staining the stones.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrates and installation conditions. Do not start concrete unit paving work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Do not use paving units with chips, cracks, voids, discolorations, or other visible defects.

B. Cut paving units with motor-driven saw equipment designed to cut masonry with clean, sharp unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible. Avoid the use of small pieces of pavers or large joint spaces.

C. Set clay brick unit pavers in patterns indicated with level surface and uniform joints of widths indicated.

3.3 INSTALLATION: BASE MATERIALS

A. Subgrade:

1. Obtain Engineer's inspection and acceptance of subgrade surface before placing of concrete base.
2. Compact subgrade materials with suitable compaction equipment to 98% modified proctor T-180.

B. Concrete Base:

1. Construct concrete base with reinforcing as indicated on the plans.

C. Bedding and Leveling Course:

1. Obtain Engineer's inspection and acceptance of finished concrete base course before placing bedding and leveling course materials.
2. Spread bedding and leveling course materials evenly over the entire area to be paved, screed to a minimum level that will provide a minimum 3/4" to 1" thickness for pavers over a concrete base when the pavers have been placed and vibrated.
3. Protect screeded and leveled bedding and leveling course from damage until covered with paver units. Do not pre-compact bedding and leveling course.

3.4 INSTALLATION

A. Lay paver units in pattern indicated on the drawings. Paver layout indicated on plans has been designed to minimize cutting of individual paver units. Paver units must be installed in such a manner as to assure minimized paver cuts. Maintain desired pattern. Place clay brick pavers hand tight. Paver "nibs" will assure adequate spacing for sweeping sand/cement mix into joints.

B. Fill gaps at the edge of the paved surface with standard edge pieces or with paver units cut to fit. Provide cut units with straight even cut surfaces, free from cracks or chips.

C. Vibrate paver units to their final level with 3 or more passes of a vibrating plate compactor.

D. After first vibration, brush sand/cement over the surface and vibrate into the joints with additional passes of the plate vibrator. Completely fill joints.

E. After final vibrating the surface shall be true to grade and shall not vary by more than 1/4" when tested with a 10'-0" straightedge at any location on the surface.

3.5 PROTECTION

A. Protect concrete unit paving from damage until final acceptance.

3.6 CLEANING

A. Remove and replace concrete paving units which are broken, chipped, stained or otherwise damaged.

B. Perform cleaning during installation of work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from concrete unit paving operations.

END OF SECTION 32 14 00

SECTION 32 17 26 – TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Detectable warning unit brick pavers.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.
2. Section 321400 "Unit Paving" for unit paving installations incorporating detectable warning unit pavers specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes, showing truncated-dome pattern, color.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering and wear.
b. Cracking or chipping of units.

2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the Florida Building Code, Accessibility, 6th Edition for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING UNIT PAVERS

A. Detectable Warning Unit Pavers: Solid paving units manufactured by Pine Hall Brick (or equal), with a compressive strength of not less than 5000 psi, water absorption of not more than 5 percent according to ASTM C 140, and no breakage and not more than 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67, with accessible detectable warning truncated domes on exposed surface of units.

1. Shapes and Sizes:

    a. Thickness: 2 ¾"
    b. Face Size: 4"x8"

2. Dome Spacing and Configuration: Manufacturer's standard ADA compliant spacing pattern.
3. Color: Full Range

B. Setting Bed: Comply with requirements in Section 321400 "Unit Paving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING UNIT PAVERS

A. Unit Paver Installation, General:

1. Setting-Bed and Unit Paver Installation: Comply with installation requirements in Section 321400 "Unit Paving."
2. Mix unit pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
3. Cut unit pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.

B. Aggregate Setting-Bed Applications:

1. Place aggregate base compact by tamping with plate vibrator, and screed to depth indicated.
2. Place leveling course and screed to a thickness of 1 inch taking care that moisture content remains constant and density is loose and uniform until unit pavers are set and compacted.
3. Treat leveling course with herbicide to inhibit growth of grass and weeds.
4. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz.
5. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

3.4 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Landscape Architect. Replace using tactile warning surfacing installation methods acceptable to Landscape Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 32 17 26

SECTION 32 33 00 – SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide all labor, materials, equipment and incidentals to supply and install site furnishings, shown on the drawings and as specified. Items of work are pre-manufactured furnishings, including:

1. Benches
2. Trash Receptacles
3. Bollards

1.3 QUALITY ASSURANCE

A. All furnishings described herein shall be installed by qualified tradesmen.

B. All installation work and materials to be per manufacturer's specifications, or as directed by the Landscape Architect.

1.4 SUBMITTALS

A. Submit product data/specifications and shop drawings to Landscape Architect for review and approval for all items of work.

B. All submittals to be approved by the Landscape Architect prior to Contractor delivering materials to site.

1.5 PRODUCT HANDLING

A. Delivery of all furnishings shall be the responsibility of the contractor.

B. Store all site furnishings in a secure and weather-protected area.

C. Return any damaged furnishings to manufacturer.

D. All products shall be inspected by the Landscape Architect for damage and chipped or marred finish. Contractor shall spot paint any chipped paint or scratched surfaces. Paint to be supplied by the manufacturer.

1.6 PROJECT CONDITIONS

A. Verify all work to field locations and dimensions and coordinate work being done by others.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Trash Receptacle:

1. Manufacturer: Max-R (www.max-r.com / 877-646-0663)
Model: Terra (Custom - refer to the UF Landscape Master Plan Landscape Design Standards, Section 2.5, page 165)
Color: Black
Quantity: 8

B. Bench:

1. Manufacturer: Keystone Ridge (www.keystoneridgedesigns.com / 800-284-8208)
   Style: Pullman P28C
   Color: Black
   Quantity: 5

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install furnishings in locations as indicated on the plans and details. Assure that all furnishings are installed plumb and level and in accordance with the plans and details.

B. Install as per manufacturer's specifications.

3.2 ACCEPTANCE

A. The Landscape Architect will review each installation to determine compliance with plans and specifications prior to final acceptance of the work.

B. Any work not installed in accordance with the plans and specifications and rejected by the Landscape Architect shall be removed and replaced at the Contractor's expense.

3.3 GUARANTEES

A. The contractor shall furnish warranties in writing certifying that the quality and workmanship of all materials and installation furnished is in accordance with these specifications and in accordance with the original manufacturers' warranties. The Contractor shall warrant the installation workmanship for a period of one year from the date of final acceptance of the job, or any accepted portion of the job.

3.4 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from site furnishing installations.

END OF SECTION 32 33 00

SECTION 32 84 00 – PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide an underground irrigation system as shown and specified. The work includes:

1. Automatic irrigation system including piping, fittings, sprinkler heads, and accessories.
2. Valves, valve boxes, and fittings.
3. Testing.
4. Excavating and backfilling irrigation system work.
5. Pipe sleeves.

1.3 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each of the system components.

B. Upon irrigation system acceptance, submit written operating and maintenance instructions. Provide format and contents as directed by the Landscape Architect.

C. Provide irrigation system record drawings:

1. Legibly mark drawings to record actual construction.
2. Indicate horizontal and vertical locations referenced to permanent surface improvements.
3. Identify field changes of dimension and detail and changes made by Change Order.

1.4 QUALITY ASSURANCE

A. Installer's qualifications: Have satisfactorily installed irrigation systems on at least five (5) other projects of comparable complexity.

B. Materials, equipment, and methods of installation shall comply with the following codes and standards:

1. All applicable local codes or regulations.
2. American Society of Testing and Materials (ASTM).
3. The Irrigation Association (IA).
4. Florida Irrigation Society.

C. Excavating, backfilling and compacting operations: Comply with specification requirements and as specified.

D. Obtain UF Facilities Services acceptance of installed and tested irrigation system prior to installing backfill materials.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.

B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded or plain.

C. Store and handle materials to prevent damage and deterioration.

D. Provide secure storage for valves, sprinkler heads and similar components that cannot be immediately replaced to prevent installation delay.

1.6 PROJECT CONDITIONS

A. Coordinate with responsible departments as may be needed to locate underground and superficial utilities. Call Sunshine as required by law.

B. Promptly repair damage to adjacent facilities caused by irrigation system work operations. The cost of these repairs shall be at Contractor's expense.

C. Promptly notify UF Facilities Services of unexpected subsurface conditions.

D. Irrigation system layout is diagrammatic. Exact locations or piping, sprinkler heads, valves and other components shall be established by Contractor in the field at time of installation.

1. Space sprinkler components as indicated on plans.
2. Minor adjustments in system layout will be permitted to clear existing fixed obstructions. Final system layout shall be accepted by the Landscape Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Provide only new materials without flaws or defects and of the highest quality of their specified class and kind.
2. Comply with pipe sizes indicated. No substitution of smaller pipes will be permitted. Remove damaged and defective pipe.
3. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size schedule and type of pipe, working pressure at 73° F.

B. Plastic pipe, fittings and connections:

1. Polyvinyl chloride pipe: ASTM D2241, rigid, unplasticized PVC, extruded from virgin parent material. Provide pipe homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles and dents.

    a. Lateral lines: PVC Class 160 IPS plastic pipe
    b. Sleeves; PVC Schedule 40

2. PVC Lateral pipe fittings: ASTM D2241 schedule 40 PVC molded fittings suitable for solvent weld.
3. All pipe under paved areas will be sleeved with Schedule 40 P.V.C. The Contractor will provide a minimum of 2" Schedule 40 P.V.C. under all paved areas to produce access for electrical control wire.
4. All piping to be purple in color. This irrigation system will utilize reuse water.

C. Sprinkler heads, valves and associated equipment:

1. Refer to drawing's materials lists.

    a. Sprinklers: All Sprinkler heads shall be as indicated on the drawings. All sprinkler heads on risers of 12 inches or more shall be secure in plumb position using a 30

inch angle iron stake and stainless steel clamps. All risers shall be painted. Heads to be set clear of shrubbery.

b. All irrigation heads shall have purple caps or rings securely attached to spray or rotor head.

D. Controls:

1. Refer to drawing's materials list.

a. Controller: Irrigation controller(s) are existing.

E. Electrical control wire:

a. Electrical control and ground wire: Type UF 600 volt AWG control cable #14/2 or larger.

2.2 ACCESSORIES

A. Valve access boxes: Tapered enclosure of rigid plastic material comprised of fibrous components chemically inert and unaffected by moisture corrosion and temperature changes. All valve box covers to be purple.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Layout and stake the location of each pipe run and all sprinkler heads and sprinkler valves. Obtain acceptance of layout from UF Facilities Services prior to excavating.

B. Schedule 40 sleeves to be used under paved vehicular use areas or established walks or trails.

C. No open roadway cuts are allowed for any irrigation installation. Jack and bore or directional bore under all existing pavement areas.

D. Place sleeves as indicated for installation of piping and control wire.

3.3 INSTALLATION

A. Excavating and backfilling:

1. Excavate trenches of sufficient depth and width to permit proper handling of installation of pipe and fittings.
2. Excavate to depths required to provide 2" depth of earth fill or sand bedding for piping when rock or other unsuitable bearing materials in encountered.
3. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater than 8" depth.

    a. Provide approved earth fill or sand to a point 4" above the top of the pipe.
    b. Fill to within 6" of final grade with approved excavated fill materials free of lumps or rocks larger than 3" in any dimension.
    c. Provide clean topsoil fill free of rocks and debris for top 6" of fill.

4. Except as indicated, install irrigation mains with a minimum cover of 18" based on finished grades. Install irrigation laterals with a minimum cover of 12" based on finished grades.
5. Excavate trenches and install piping and fill during the same working day. Do not leave open trenches or partially filled trenches open overnight.

B. Plastic pipe:

1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
2. Saw cut plastic pipe. Use a square-in-sawing vice to ensure a square cut. Remove burrs and shavings at cut ends prior to installation.

3. Make plastic to plastic joints with solvent weld joints. Use only solvent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions.
4. Make plastic to metal joints with plastic male adapters.
5. Make solvent weld joints in accordance with manufacturer's recommendations.
6. Allow joints to set at last 24 hours before pressure is applied to the system.

C. Sprinklers, fittings, valves and accessories:

1. Install fittings, valves, sprinkler heads, risers and accessories in accordance with manufacturer's instructions, except as otherwise indicated.

    a. Provide concrete thrust blocks where required at fittings and valves.

2. Set sprinkler heads perpendicular to finished grades, except as otherwise indicated, and level with top of soil.
3. Obtain Owner's Representative's review and acceptance of height for proposed sprinkler heads and valves prior to installation.
4. Locate sprinkler heads to assure proper coverage of indicated areas. Do not exceed sprinkler head spacing distances indicated.
5. Install risers for spray heads in shrub or flower bed areas and planters of sufficient height to prevent interruption of the stream by the plan material.

    a. Provide risers of 1/2" PVC pipe, sched. 40, threaded each end.
    b. Paint exposed galvanized risers with 1 coat black paint.
    c. Set risers in a row with top level and in-line.

6. Install pop-up gear driven sprinklers with an adjustable double swing joint riser of at least 3 standard 90 elbows. Fabricate double swing risers of schedule 80 PVC nipples and schedule 40 PVC elbows. The horizontal nipple connected directly into the side of the lateral line shall be a minimum of 3" long. All other nipples of the swing joint riser shall be of length as required for proper installation of the sprinkler head.

    a. If the sprinkler heads have a side inlet, 2 street ells and a nipple may be used instead of a double swing joint assembly.

7. Install in-ground control valves in a valve access box as indicated.
8. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box.

9. Seal all threaded connections with Teflon tape or approved plastic joint type compound.

D. Control wiring:

1. Install electric control cable in PVC conduit from controller to Remote control valves. The conduit shall be installed in the same trench as the Mainline where possible. Where necessary to run conduit in a separate trench, provide a minimum cover of 12". Pull Boxes shall be installed as needed.
2. Provide sufficient slack at site connections at remote control valves in control boxes and at all wire splices to allow raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
3. Connect each remote control valve to one station of a controller except as otherwise indicated.
4. Make wire connections to remote control electric valves and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer's recommendations.
5. Provide tight joints to prevent leakage of water and corrosion build-up of the joint.

E. Sleeves:

1. Install new sleeves prior to paving installation wherever possible. Coordinate with general contractor.
2. Install pipe sleeves under existing concrete or asphalt surface by directional drilling of the sleeve. Obtain UF Facilities Services permission before cutting existing concrete surfaces. Cutting of asphalt surfaces is prohibited. Where piping is shown under paved areas that are adjacent to turf areas, install the piping in the turf areas.

F. Flushing, testing and adjustment:

1. After sprinkler piping and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
2. Perform system testing upon completion of each section. Make necessary repairs and retest repaired sections as required.
3. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
4. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw on lateral line or circuit as required for proper radius. Interchange nozzles' patterns as directed by UF Facilities Services to give best arc of coverage.

5. Adjust all electric remote control valve flow control stems for system balance.
6. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles to accommodate plant requirements.

3.4 DISPOSAL OF WASTE MATERIALS

A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris on a weekly basis.

3.5 ACCEPTANCE

A. Test and demonstrate to UF Facilities Services the satisfactory operation of the system free of leaks. All main lines shall be hydrostatically tested at a pressure of 100 psi for a period of time not less than 3 hours. Should any leaks be found, they shall be repaired. The line shall then be retested until satisfactory.

B. Instruct University designated personnel in the operation of the system, including adjustment of sprinklers, controller(s) and valves.

C. Upon acceptance, the University will assume operation of the system.

3.6 GUARANTEES

A. The irrigation contractor shall furnish warranties in writing certifying that the quality and workmanship of all materials and installation furnished is in accordance with these specifications and in accordance with the original manufacturers' warranties. Irrigation contractor shall further see to the fulfillment of all manufacturers' warranties. Irrigation contractor shall warrant the installation workmanship for a period of one (1) year from date of completion of acceptance of the job or any accepted portion of the job.

3.7 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.

END OF SECTION 32 84 00

SECTION 32 93 00 – LANDSCAPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 32 93 20 – Turf and Grasses

C. Section 32 84 00 – Irrigation Systems

1.2 SUMMARY

A. This Section includes the following:

1. Soil Preparation
2. Trees, plants, and ground covers.
3. Planting mixes.
4. Mulch and planting accessories.
5. Maintenance.

1.3 DEFINITIONS

A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than sizes indicated; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

B. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and

protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Planting Soil: Native soil backfill.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.4 SUBMITTALS

A. Submit the following material samples:

1. Mulch
2. Planting accessories.

B. Submit certifications for the following materials:

1. Fertilizer

C. Material Test Reports: Ph of existing surface soil and within general planting areas.

D. Record Drawings: Contractor responsible for providing the Owner with as-built landscape plan drawings. Legibly mark drawings to record actual construction. Indicate actual planting locations and identify any field changes to size or quantity of material.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when landscape installation is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed. Related testing costs are the responsibility of the Contractor.

C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

D. Plant names indicated comply with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed conform generally with names accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.

E. Plant material shall be graded Florida No. 1 or better as outlined under Grades and Standards for Nursery Plants, State Plant Board of Florida.

F. All plants shall be nursery grown under climatic conditions similar to those in the locality of the project for a minimum of two years.

G. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 4 ½ ft. above grade for all trees. Measure main body of tree or shrub for height and spread; do not measure branches tip-to-tip. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost, and providing that the large plans will not be cut back to size indicated.

H. Observation: Landscape Architect may observe trees either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. The Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from project site.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver fertilizer materials in original, unopened, and undamaged containers showing weight, analysis, and name of manufacturer. Store in manner to prevent wetting and deterioration.

B. Take all precautions customary in good trade practice in preparing plants for moving. Workmanship that fails to meet the highest standards will be rejected. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during delivery. Do not drop plants during delivery. Handle planting stock by root ball.

1. Inspection certificates required by law shall accompany each shipment invoice or order to stock and on arrival, the certificate shall be filed with the Owner's Representative.

C. Cover plants transported on an open vehicle with a protective covering to prevent windburn.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition. Water heeled-in plants daily.

1.7 COORDINATION

A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

B. Work notification: Notify Landscape Architect at least 7 working days prior to installation of plant material.

C. Protect existing utilities, paving, and other facilities from damage caused by landscaping operations.

D. The irrigation system will be installed, tested, and functioning prior to planting. Locate, protect, and maintain the irrigation system during the planting operations. Repair irrigation system components damaged during planting operations at Landscape Contractor's expense.

E. Coordination with Sodding: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Landscape Architect.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

F. A complete list of plants, including a schedule of sizes, quantities, and other requirements is shown on the drawings. In the event that quantity discrepancies or material omissions occur in the plant materials list, the planting plans shall govern.

1.8 WARRANTY

A. Special Warranty: Warrant the trees, shrubs and ground covers for the warranty period indicated, against defects including death and unsatisfactory growth, or defects resulting from lack of adequate maintenance. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, freezing rains, lightning storms, or winds over 50 miles per hour, winter kill caused by extreme cold and sever winter conditions not typical of planting area, acts of vandalism, or negligence on the part of the Owner.

1. Warranty Period for Landscape Material: One year from date of Substantial Completion. Inspection of plants will be made by Landscape Architect at completion of planting.
2. Replace, in accordance with the drawings and specifications, all plants that are dead or, as determined by the Landscape Architect, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes due to the Contractor’s negligence. The cost of such replacement(s) is at Contractor’s expense. Warrant all replacement plants for one year after installation.
3. Replace landscape material that is more than 25 percent dead or in an unhealthy condition at end of warranty period.

1.9 MAINTENANCE

A. Trees, Shrubs and Ground Covers: Maintain landscaping through final acceptance by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown trees, shrubs and ground cover complying with Florida “Grades and Standards for Nursery Plants”, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees, shrubs and ground covers of sizes and grades complying with Florida “Grades and Standards for Nursery Plants” Florida No.1 for type of trees, shrubs and ground cover required. Trees, shrubs and ground cover of a larger size may be used if acceptable to Owner’s Representative, with a proportionate increase in size of roots or balls.

C. Dig balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standards for Nursery Stock." Cracked or mushroomed balls are not acceptable. Synthetic burlap is not acceptable.

D. Container-grown stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.

1. No plants shall be loose in the container.
2. Container stock shall not be pot bound

E. Provide tree species that at heights (when mature) over 25'-0" with a single main trunk. Trees that have the main trunk forming a "Y" shape are not acceptable

F. Plants planted in rows shall be matched in form.

G. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the plant list.

H. No pruning wounds shall be present with a diameter of more than 1" and such wounds must show vigorous bark an all edges.

I. Shrubs and ground covers shall meet the requirements for spread and height indicated in the plant list.

1. The measurements for height shall be taken from the ground level to the average height of the top of the plant and not the longest branch.
2. Single stemmed or thin plants will not be accepted.
3. Side branches shall be generous, well twigged, and the plant as a whole well bushed to the ground.
4. Plants shall be in a moist, vigorous condition, free from dead wood, bruises or other root or branch injuries.

2.2 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 12 percent nitrogen, 10 percent phosphorous, and 12 percent pot ash, by weight. ¼ of nitrogen in the form of nitrates, ¼ in the form of ammonia salt and ½ in the form of organic nitrogen.

2.3 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:

1. Type: Pine straw

2.4 STAKES AND GUYS

A. Stakes for Staking: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects. See construction drawings for sizes.

B. Stakes for Guying: Hardwood. See construction drawings for sizes.

C. Guy/Staking Wire: No. 10 or 12 gauge galvanized wire.

D. Turnbuckles: Galvanized steel of size and gauge required to provide tensile strength equal to that of the wire. Turnbuckle openings shall be at least 3".

E. Staking and Guying Hose: Two-ply, reinforced garden hose not less than 1/2" inside diameter.

F. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Planting shall be performed only by experienced workmen familiar with planting procedures under the supervision of a qualified supervisor.

D. Locate plants as indicted or as approved in the filed by Owner's Representative after staking by the Contractor. If obstructions are encountered that are not shown on the drawings, do not proceed with planting operations until alternate plant locations have been selected. Make minor adjustments as required.

3.3 INSTALLATION

A. Transplanting Sabal Palms: Dig palm with limited size root ball, as close as 8” from trunk. Crop several of the lower leaves and tie up the remaining leaves. Immediately transplant to new planting hole. Provide water through irrigation or supplemental watering as may be needed.

B. Planting Pits: Excavate circular plant pits with vertical sides, except for plants specifically indicated to be planted in beds. Depth of pit shall accommodate the root system. Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation. Scarify the bottom of the pit to a depth of 4".

C. Backfill all planting pits with excavated material.

D. Obstructions: Notify Owner's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material if hardpan layer is detected.

E. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

F. Set plant material in the planting pit to proper grade and alignment. Set plants upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure. Set plant material 1" above the finish grade. No filling will be permitted around trunks or stems. Backfill the pit with planting mixture. Do not use frozen or muddy mixtures for backfilling.

1. Space ground cover plants in accordance with indicated dimensions. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants. Plant to within 18" of the trunks of trees and shrubs within planting bed and to within 12" of edge of bed.
2. Do not use stock if root ball is cracked or broken before or during planting operation.
3. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. After plants are set, muddle planting soil mixture around bases of balls and fill all voids.
4. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

G. Mulching: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Mulch shrub and groundcover areas immediately after planting. Do not place mulch within 3 inches of trunks or stems. Thoroughly water mulched areas.

3.4 GUYING AND STAKING

A. Stake/guy all trees immediately after sodding operations and prior to acceptance. Stake deciduous trees under 3" caliper. Stake evergreen trees under 8'-0" tall.

B. Guy deciduous trees over 3" caliper. Guy evergreen trees over 8'-0" tall.

C. All work shall be acceptable to the Owner’s Representative.

3.5 MAINTENANCE

A. During exterior planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

C. Maintain plantings until completion and acceptance of the entire project.

D. Maintenance shall include pruning, cultivating, weeding, watering, mowing sod, and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease.

1. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.
2. Tighten and repair guy wires and stakes as required.
3. Correct defective work as soon as possible after deficiencies become apparent and weather and season permit

3.6 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment, and legally dispose of them off Owner's property. Repair damage resulting from planting operations.

3.7 ACCEPTANCE

A. Inspection to determine acceptance of planted areas will be made by the Owner’s Representative, upon Contractor’s request. Provide notification at least 10 working days before requested inspection date.

1. Planted areas will be accepted provided all requirements, including maintenance, have been compiled with and plant materials are alive in a healthy and vigorous condition.

B. Upon acceptance, the Owner will assume responsibility for plant maintenance

END OF SECTION 32 93 00

SECTION 32 93 20 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide sodded lawns as shown and specified. The work includes:

1. Soil preparation.
2. Sodding common areas, pavement edges, and other indicated areas.
3. Maintenance.

B. Requirements of the following specification sections apply to this section.

1. Section 32 93 00 – Landscaping.

1.3 SUBMITTALS

A. Submit sod grower’s certification of grass species. Identify source location.

1.4 QUALITY ASSURANCE

A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.

B. Provide the following data on existing topsoil:

1. Topsoil:

    a. Recommendations on type and quantity of additives required to establish satisfactory Ph factor and supply of nutrients to bring nutrients to satisfactory level for planting.

1.5 DELIVERY, STORAGE AND HANDLING

A. Cut, deliver and install sod within a 24-hour period.

1. Do not harvest or transport sod when moisture content may adversely affect sod survival.
2. Protect sod from sun, wind, and dehydration prior to installation.
3. Do not tear, stretch, or drop sod during handling and installation.

1.6 PROJECT CONDITIONS

A. Work notification: Notify Landscape Architect at least 7 working days prior to start of sodding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by sodding operations.

C. Perform sodding work only after irrigation and other work affecting ground surface has been completed. The irrigation system will be modified, installed, tested, and functional prior to sodding. Locate, protect, and maintain the irrigation system during sodding operations. Repair irrigation system components damaged during sodding operations at the Contractor's expense.

D. Provide hose and lawn watering equipment as required.

1.7 WARRANTY

A. Provide a uniform stand of grass by watering, mowing and maintaining lawn areas until final acceptance. Re-sod areas which fail to provide a uniform stand of grass with specified materials, until all affected areas are accepted by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sod:

1. Emerald Zoysia

B. Provide healthy, well-rooted, material, free of diseases, chinch bugs, sod webworms, armyworms and other insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch, and extraneous material; viable and capable of growth and development when planted.

1. Furnish sod machine stripped and of Supplier's standard width, length, and thickness: Uniformly 1-1/2" thick with clean cut edges. Mow sod before stripping.

C. Water: Free of substance harmful to sod growth. Hoses or other methods of transportation furnished by Contractor.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine finish surfaces, grades, topsoil quality and depth. Do not start sodding work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Limit preparation to areas that will be immediately sodded.

B. Loosen topsoil of lawn areas to minimum depth of 2". Remove stones over 1" in any dimension and sticks, roots, rubbish, and extraneous matter.

C. Grade lawn areas to smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and fill depressions as required to drain. Grade immediately before sodding. Verify grading follows engineering plans. Contractor will be responsible for regarding if sod is not placed in a timely manner and wash out or other erosion causes grades to deviate from engineering plans.

D. Dampen dry soil prior to sodding.

E. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

3.3 INSTALLATION

A. Sodding:

1. Lay sod to form a solid mass with tightly-fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, and drains.
2. Do not lay dormant sod or install sod on saturated soil.
3. Water sod thoroughly with a fine spray immediately after laying.
4. Roll a minimum of four (4) times with a medium weight roller to ensure contact with sub-grade.

B. Sod indicated areas within contract limits and areas adjoining contract limits disturbed as a result of construction operations.

3.4 MAINTENANCE

A. Maintain sodded lawn areas, including watering, spot weeding, mowing, application of herbicides, fungicides, insecticides and resodding until a full, uniform stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Owner’s Representative.

1. Water sod thoroughly every day, as required to establish proper rooting.
2. Repair, rework, and resod all areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.
3. Mow lawn areas as soon as lawn top growth reaches a 3" height. Cut back to 2" height. Not more than 40% of grass leaf shall be removed at any single mowing.

3.5 ACCEPTANCE

A. Inspection to determine acceptance of sodded lawns will be made by Owner’s Representative, upon Contractor's request. Provide notification at least 7 working days before required inspection date.

1. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even-colored viable lawn is established, free of weeds, undesirable grass species, disease and insects.

B. Upon acceptance, the Owner will assume responsibility for lawn maintenance.

C. If not accepted at the time of the inspection, the Contractor will be required to prepare a maintenance schedule for all grassed areas for the County. The County may require this maintenance schedule if construction is delayed or for any reason the County deems necessary to ensure that the grass is well maintained.

3.6 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris and equipment. Repair damage resulting from sodding operations.

END OF SECTION 32 93 20

SECTION 33 11 13 – DOMESTIC AND RECLAIMED WATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of Contract, including General Conditions, Supplemental General Conditions, General Conditions, and other Division 1 through 33 Specification Sections, apply to this Section.

B. All products and installation shall be in accordance with NFPA 13-1994 and NFPA 24 as well as local jurisdictions.

1.2 SUMMARY

A. This Section includes water service piping and appurtenances for the installation water piping.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 312000 "Earth Moving" for excavation and backfill required for water service piping and structures.
2. Section 033000 "Cast-In-Place Concrete" for supports and structures.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for valves, pipe, fittings, and identification devices.

C. Field quality-control tests.

1.4 QUALITY ASSURANCE

A. Comply with requirements of utility supplying water to the project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves for shipping as follows:

1. Ensure valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends, flange faces, and weld ends.
3. Set valves in best position for handling. Set gate valves closed to prevent rattling.

B. Storage: Use the following precautions for valves during storage:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

C. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.6 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that water service piping may be installed in compliance with the original design and referenced standards.

B. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate connection to any public water main with Owner.

B. Coordinate with interior water distribution piping.

C. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS, GENERAL

A. Ductile Iron Pipe, Type 2 or Type 5 double thickness, NSF-61 cement lined and with NSF-61 sealcoat, ANSI/AWWA C150, C151, AWWA C104, ANSI A21.4, Special Thickness Class 53 or greater, asphalt or fusion bonded epoxy exterior coating. AWWA C105 8-mil polyethylene encasement. Use Type 5 cement for applications with elevated sulfates. Manufacturer to be ISO 9001 (or equivalent) and ISO 14001 or equivalent certified.

B. Polyvinyl Chloride (PVC) pipe conforming to AWWA C900. The pipe shall be a minimum DR18.

1. PVC pipe shall be provided in standard 20 foot lengths, unless otherwise specified, detailed or required on the approved plans. Shorter lengths, up to 10 feet, will be permitted when authorized by the Engineer. Field cut lengths of pipe used as closures may not be shorter than 2 feet in length, and must be approved by the Engineer.
2. All PVC pipe entering or exiting a fitting shall be a minimum length of 5 feet.
3. Acceptable PVC pipe shall have common profiles for interchangeability between rough-barrel dimensions, couplings, ends, and elastomeric gaskets so as to facilitate future repairs. When assembled, the pipe shall have only one gasket per bell and spigot end, and/or two gaskets per coupling.
4. PVC pipe shall be purple or have a purple stripe on top of the pipe.

C. FITTINGS: Ductile Iron Type 2 or Type 5 double thickness NSF-61 cement lined and with NSF-61 sealcoat ANSI/AWWA C110/A21.10,; AWWA C104/ANSI A21.4 Minimum Pressure Class 350, all materials NSF-61 compliant, AWWA C105 8-mil polyethylene encasement. Use Type 5 cement for applications with elevated sulfates. NSF-61 Fusion bonded epoxy interior also acceptable. Manufacturer to be ISO 9001 (or equivalent) and ISO 14001 or equivalent certified.

D. JOINTS: AWWA/ANSI C111/A21.11 compression gasketed joints or AWWA/ANSI C110/A21.10 Type MJ mechanical joint. Where restraint is required, provide corrosion resistant epoxy coated ductile iron wedge-action gland restraint except that restraining gasket may be used in place of wedge action gland restraint where each piping joint is fully extended to engage the thrust restraint, and following manufacturer/DIPRA, and AWWA C600 requirements. Restraint gaskets shall not be used in lieu of wedge-restraints for lines subject to bi-directional flow unless thrust has otherwise been accommodated. Thrust blocks are required for ALL lines. All bolts, nuts, and accessories AWWA C111/ANSI A21.1 compliant grade and type, Cor-Blue fluorocarbon coated low alloy high strength steel bolts/nuts mildly cathodic to the pipe are required for underground applications.

E. Pipe and pipe fitting materials shall be compatible with each other. Where more than one type of material or product is indicated, selection is Installer's option. Provide adapters capable of transitioning to and from PVC.

2.2 VALVES

A. Resilient Wedge Gate Valves: Mueller A2361 series or approved equal. AWWA C509, resilient seated, ductile-iron body and bonnet, non-rising bronze stem, 300-psi working pressure, with a 2-inch square operating nut which shall turn counter clockwise to open, mechanical joint ends.

B. Tapping Valves and Sleeve: Same requirements as resilient seated gate valves. In addition, the body seat rings shall clear inside opening sufficient to pass a cutter of full diameter and equal to the nominal size of the tapping valve. Tapping tees shall be iron body mechanical joint type, or stainless steel type with full 360-degree gasket. Tapping valves for ductile iron pipes shall have flange by mechanical type ends unless otherwise shown on the Plans. All tapping tees shall be furnished with an outlet for testing.

C. Valve Boxes: Cast-iron box having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5-1/4 inches in diameter, and screw adjustable cast-iron extension of length required for depth of bury of valve.

1. Provide a steel tee-handle operating wrench with each valve box. Wrench shall have tee handle with one pointed end, stem of length to operate valve, and socket fitting valve operating nut.

D. Post Indicator Valves : A post indicator valve (P.I.V.) shall be provided on the private fire protection water service line, located as shown on drawing but not closer than 40’ to the building, top of post a minimum 36 inches above final grade line. Post Indicator Valve shall be installed with electric tamper switch.

2.3 COUPLINGS

A. Couplings shall be ductile iron class 250, 12 to 13 inches long, bituminous coated and double thickness cement lined with bituminous seal coat in accordance with AWWA C104. Coupling shall be mechanical joint with integrally cast standard mechanical joint rotatable glands on each end that has a lock against joint separation.

2.4 IDENTIFICATION

A. Underground Warning Tapes: Detectable Marking Tape, Conductive/Magnetic, 6 inches wide by 4 mils thick, with continuously printed caption in black letters "CAUTION: BURIED INSTALLATION BELOW" in the following colors:

1. Potable Water – Blue
2. Reclaimed Water - Purple

PART 3 - EXECUTION

3.1 PREPARATION OF BURIED PIPE FOUNDATION

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the piping.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of piping. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 INSTALLATION OF PIPE AND PIPE FITTINGS

A. Ductile-Iron Mechanical Joint Pipe: Install with cement-mortar-lined, ductile-iron, flexible restrained mechanical joint fittings, and rubber gaskets in accordance with AWWA C600.

B. Water Service Termination: Terminate water service piping inside building. Provide sleeve cast into building wall and watertight sleeve seal. Provide a factory flange for transition from DI pipe to steel pipe

C. Minimum bury depth four feet.

3.3 INSTALLATION OF VALVES

A. General Application: Use mechanical joint end valves for 3-inch and larger buried installation.

B. AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem pointing up, 2-inch operating nut, and with cast-iron valve box.

3.4 INSTALLATION OF ANCHORAGES

A. Anchorages: Provide anchorages for valves, and hydrant branches.

B. Provide flexible restrained joints for anchoring tees, plugs and caps, bends, valves, and pipe.

3.5 APPLICATION OF PROTECTIVE COATINGS

A. Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.

3.6 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 12 to 18 inches below finished grade, directly over piping.

3.7 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have sufficiently hardened. Fill pipeline 24 hours prior to testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 200 psi pressure for 2 hours.

1. Increase pressure in 50-psi increments and inspect each joint between increments. Hold at test pressure for two hours; decrease to 0 psi. Slowly increase again to test pressure and hold for two more hours. Remake leaking joints with new materials and repeat test until leakage is zero.

3.8 CLEANING/FLUSHING

A. Clean and disinfect water distribution piping as follows:

1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired, prior to use.
2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction or, in case a method is not prescribed, use the procedure described in AWWA C651, or as described below:

    a. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.
    b. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
    c. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system. Lines shall be filled slowly with potable water at a minimum velocity of 1 ft/s while venting all air. Precautions shall be taken to prevent entrapping air in lines. After filling, lines shall be flushed to blowoffs and dead ends at a minimum velocity of 3fts/s. A minimum of three changes of treated water shall be used for flushing

operations. Valves shall be closed slowly to prevent excessive surges while maintaining positive pressure at all times throughout the new line. Flushing water shall be discharged without causing erosion damage, nuisance, or interruption of traffic. Disposal of flushing water shall be in accordance with authorities having jurisdiction.

d. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Prepare reports for all purging and disinfecting activities.

C. Flush all new piping prior to connection to existing system to remove any foreign materials.

D. Pipes shall be flushed at a flow rate of not less than 1000 gallons per minute (gpm) for 8" pipe, 750 gpm for 6" pipe, or 400 gpm for 4" pipe. Flow rate must produce a flow velocity of at least 10 feet per second.

END OF SECTION 33 11 13

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes storm drainage piping and appurtenances.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for drainage piping specialties.

C. Shop drawings for precast concrete storm drainage manholes, precast catch basins, including frames, covers, grates, and steps.

D. Coordination drawings and profiles showing pipe sizes, manholes and catch basins locations and elevations in locations where conflicts occur which are not indicated on the plans. Include details of underground structures and connections. Show other piping in the same trench and clearances from all interferences. Indicate interface and spatial relationship between piping and proximate structures.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm sewerage systems.

B. Utility Compliance: Comply with State Highway Administration standards for installation of storm drainage systems.

1.5 PROJECT CONDITIONS

A. Site Information: Perform site survey and verify existing utility locations. Verify that system piping may be installed in compliance with original design and referenced standards.

B. Locate existing system piping and structures that are to be abandoned and closed and provide bulkheading.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General: Provide pipe and pipe fitting materials compatible with each other. Where more than one type of materials or products is indicated, selection is Installer's option.

B. PVC (Polyvinyl Chloride) Gravity Sewer Pipe and Fittings: ASTM D 3034, SDR 35, for solvent cement or elastomeric gasket joints.

1. Solvent Cement: ASTM D 2564.
2. Gaskets: ASTM F 477, elastomeric seal.

2.2 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast reinforced concrete, of depth indicated with provision for rubber gasket joints.

1. Base Section: 6 inch minimum thickness for floor slab and 5 inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
2. Riser Sections: 5 inch minimum thickness, diameter and lengths to provide dimensions as indicated.
3. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone to match grade rings.
4. Grade Rings: Provide 2 or 3 reinforced concrete rings, of 6-8 inch total thickness and match 24 inch diameter frame and cover.
5. Gaskets: ASTM C 443, rubber.
6. Steps: Cast into base, riser, and top sections sidewall at 12-16 inch intervals.
7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
8. Channel and Bench: Sewer brick, ASTM C32, Grade SM.

B. Manhole Steps: Steel - reinforced plastics, wide enough for an adult to place both feet on one step and designed to prevent lateral slippage off the step.

1. Steel Reinforcing Bar: ASTM A615, Grade 60, 0.5 inch diameter.
2. Plastic: ASTM D4101, copolymer polypropylene, 3.18 mm minimum thickness.

C. Cast In Place Manholes: Refer to Specification 03 30 00.

D. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, heavy-duty, traffic bearing, ductile iron, 24 inch inside diameter by 8 – 10 inch riser with 5 inch minimum width flange, and 14 inch diameter cover, indented top design, with lettering "STORM SEWER" cast into cover.

2.3 CONCRETE AND REINFORCEMENT

A. Concrete: Portland cement mix, 4000 PSI.

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.
5. Reinforcement: Steel conforming to the following:

a. Fabric: ASTM A 185, welded wire fabric, plain.
b. Reinforcement Bars: ASTM A 615, Grade 60, deformed.

2.4 IDENTIFICATION

A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inch wide by 4 mils thick, solid green in color with continuously printed caption in black letters "CAUTION - STORM DRAIN BURIED BELOW."

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED STORM SEWERAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 PIPE APPLICATIONS FOR UNDERGROUND STORM SEWERS

A. Storm Drain Pipe Sizes 15 inch and Larger: Reinforced concrete sewer pipe and fittings, unless otherwise indicated.

B. Storm Drain Pipe Sizes 15 inch and Smaller: PVC gasket joint sewer pipe and fittings.

C. Storm Drain Pipe DIP : Cement lined, Class 150, ductile-Iron Pipe, standard pattern ductile-iron fittings and push-on joints. Backfill up to the pipe springline with washed sand.

3.3 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of the underground storm sewerage system piping. Location and arrangement of piping layout takes into account many design considerations. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes or catch basins for changes in direction, except where a fitting is indicated.

D. Use proper size increasers, reducers, and couplings, where different material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope of 1 percent, except where indicated otherwise.

F. Extend storm sewerage system piping to connect to storm drains, of sizes and in locations indicated.

G. Tunneling: Install pipe under streets, existing tunnels or other obstructions that cannot be disturbed where shown on the plans, by tunneling, jacking, or a combination of both.

3.4 PIPE AND TUBE JOINT CONSTRUCTION AND INSTALLATION

A. Join and install DIP pipe as follows:

1. Ductile-Iron Push-on Joint Pipe: Install with cement-mortar-lined, ductile-iron and rubber gaskets in accordance with AWWA C600
2. Backfill up to the pipe springline with washed sand.

3.5 MANHOLES

A. General: Install manholes complete with accessories as indicated. Construct brick channels and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 1 inch above finish surface, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated, and install in accordance with ASTM C 891.

C. Construct brick manholes as indicated.

D. Construct cast-in-place manholes as indicated.

E. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

F. Apply bituminous mastic coating at joints of sections.

3.6 CATCH BASINS

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 CLOSING ABANDONED SYSTEM

A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure that may result after ends of abandoned utilities have been closed.

1. Close open ends of concrete or masonry utilities with not less than 300 mm thick brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.

B. Abandoned Structures: Remove structure and close open ends of the remaining piping.

3.8 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground piping. Locate 6-8 inch below finished grade, directly over piping.

3.9 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed sanitary piping in accordance with WSSC requirements.

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
3. Flush piping between manholes and sand filters, if required by local authority, to remove collected debris.

C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 24 inch of backfill is in place, and again at completion of project.
2. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects and reinspect.

END OF SECTION 33 41 00

SECTION 33 63 13 – DIRECT BURIED UNDERGROUND STEAM AND CONDENSATE PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work of this section.

B. This Section identifies all work and materials required for a fully functional system and it will be included in the Contract Documents for Steam and Condensate Line and Vault Replacement Contract.

1.2 DESCRIPTION OF WORK

A. All underground steam and condensate lines, as indicated on contract drawings, shall be Class A testable, drainable and dryable. The system supplier shall have fabricated systems of the composition herein for at least three years. All straight sections, fittings, anchors, and other accessories shall be factory prefabricated to job dimensions and designed to minimize the number of field welds. Each system layout shall be computer analyzed by the piping system manufacturer to determine the stresses on the carrier pipe and anticipated thermal movement of the service pipe. The system design shall be in strict conformance with ASME B31.1, latest edition. Factory trained field technical assistance shall be provided for the critical periods of installation, i.e., unloading, field joint instruction and testing. The preapproved conduit system shall include all piping and components to a point twelve inches inside the building, or manhole wall. Manufacturer shall be Perma-Pipe (Multi-Therm 750), Thermacor (Duo-Therm 505), or Rovanco (Insul 800 Elite).

1. In addition, supply the following:

a. 20 LF of straight, factory-fabricated, pre-insulated pipe in all sizes indicated on contract drawings for field modifications.
b. 4 spare factory supplied field closure kits in all pipe sizes indicated on contract drawings.
c. 4 Canusa CSC-X heat shrink sleeves in pipe sizes indicated on the contract drawings.

B. The system supplier's representative shall be responsible for directing the installation and testing of the conduit system, including training the installing contractor, overseeing the installation process, and reviewing manufacturer’s installation instructions with the Contractor and Facilities Services inspectors. Where the manufacturer’s warranty requires the factory representative to be on site during all phases of construction, the factory representative shall be assigned for the duration of the project. The manufacturer’s warranty dictates the level of

factory representation required on-site and shall be adhered to strictly. The Contractor is responsible for compliance with manufacturer's instructions. Facilities Services and the Engineer may inspect the installation as clarified below, but neither party has responsibility for the installation or quality control measures for the warranty. Submit the factory representative's resume for approval by the Owner. It shall be certified in writing by the supplier that the representative is technically qualified and has a minimum of 5 years' experience in the design and/or inspection of the systems. Irrespective of warranty requirements which may be less stringent than below, inspections will be performed as follows:

1. Inspection and unloading: At a minimum, the factory representative shall witness the first unloading procedure. At this first trip, the factory representative shall review the manufacturer's instructions with Facilities Services Utility and Energy Services (FS-UES), Facilities Services Operations (FS-OPS), Contractor, and Engineer.
2. Inspection of trench prior to laying of conduit: At a minimum, the factory representative shall inspect the first set up. At this first trip, the factory representative shall review the manufacturer's instructions with FS-UES, Contractor, and Engineer. Facilities Services will perform inspections with spot inspections by Engineer after initial inspection and meeting with the factory representative.
3. Inspection of expansion loops: If 100% on-site factory representative is not required by warranty, FS-UES and the Engineer may perform inspections.
4. Inspection of field closures: At a minimum, the factory representative shall witness the first joint closure procedure. If 100% on-site is not required for warranty, FS-UES may witness all subsequent pipe joint work.
5. Hydrostatic Testing (piping): Regardless of manufacturer's warranty requirements, FS-UES and FS-OPS will witness.
6. Air test (conduit): Regardless of manufacturer's warranty requirements, FS-UES and FS-OPS will witness.
7. Air test (jacket): Regardless of manufacturer's warranty requirements, FS-UES and FS-OPS will witness.
8. Repair of any patchwork: At a minimum, the factory representative shall inspect the first repair. If 100% on-site factory representative is not required by warranty, FS-UES may perform inspections with spot inspections by Engineer.
9. Back filling of conduit sections: If 100% on-site factory representative is not required by warranty, FS-UES and Engineer may perform inspections.

C. The Piping Installation Contractor shall not perform any of the above stated work in the absence of the Piping Supplier's representative.

D. The Piping System Supplier's representative shall prepare and daily submit field reports for each of the inspections and tests witnessed above. Field reports shall be submitted daily to the Owner and Engineer.

E. The Piping Installation Contractor performing the work shall be responsible for the installation of the preapproved system and all other components of the underground steam and condensate conduit systems, including the piping and equipment in the manholes and

buildings. This responsibility shall include all site work and purchase of the preapproved system from the system supplier.

1.3 SUBMITTALS

A. Refer to Division 1 and Basic Mechanical Requirements for administrative and procedural requirements for submittals.

B. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for the type of manufactured piping specialty.

C. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support. A complete engineering stress analysis indicating all anchors, fittings, dimensions in three axes, maximum anticipated stresses and maximum allowable stresses must be submitted.

D. Piping Supplier shall submit factory prepared and certified Underground Piping System layout drawings at same scale as Contract Drawings.

E. Piping Supplier shall submit factory prepared and certified Underground Piping System stress and thermal movement calculations for carrier pipe.

F. Piping Supplier shall submit anchor details and calculations.

G. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

H. Quality Control Submittals:

1. Submit certified factory test results for insulation testing prior to shipment.
2. Submit certified factory test results for outer jacket air testing prior to shipment.
3. Technical qualification certification of the supplier’s on-site representative.
4. Submit welders' certificates specified in Quality Assurance below.
5. Welding procedures.

I. Excavation Support and Protection:

1. Prior to starting work, submit for review and approval, calculations and shop drawings showing each proposed method of supporting adjacent earth and structures; i.e. retention system and other methods of bracing. Include the following:

    a. Lists of material to be used, including design mixes.
    b. Sequence of operations.
    c. Detailed sections clearly illustrating the scope of work.
    d. Relationship of piles, lagging, walls, and bracing to new and existing structures.

e. Location of utilities and details of support when required.
f. Procedures and details of testing.

2. Shop drawings and calculations: Prepared by qualified Licensed Professional Engineers registered in the State of Florida and bearing their seals and signatures.
3. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of complete projects with project names and addresses, names and addresses of architects and owners, and other information specified.

J. All piping, fittings, and accessories shall be provided by a single manufacturer.

K. Country of Fabrication:

1. All piping, fittings, and accessories not manufactured, fabricated, and assembled in the USA or Canada must be manufactured, fabricated, and assembled by an ISO 9001 registered corporation.
2. For all piping, fittings, and accessories not fabricated in the USA or Canada, submit ISO 9001 certificates and an independent test report for all materials to be provided.
3. No piping, fittings, or accessories manufactured, fabricated, or assembled in China (including Taiwan) are permitted.

L. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by excavation support and protection systems.

1.4 QUALITY ASSURANCE

A. Welder's Qualifications: All welders shall be certified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing qualifications.

B. Welding procedures and testing shall comply with ASME B31.1-Code Power Piping Code and The American Welding Society, Welding Handbook.

C. Provide certified factory test results for insulation testing and outer jacket air testing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-applied plastic end-caps on each length of pipe conduit. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and conduit. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS AND FITTINGS

A. Systems Designs

1. Medium Pressure Steam: Normal operating conditions are 70 PSIG at 335 degrees F. Design conditions for the system shall be 90 PSIG at 474 degrees F.
2. Pumped Condensate: Normal operating conditions are 30 PSIG at 160 degrees F. Design conditions for the system shall be 75 PSIG at 250 degrees F.

B. Service Pipe: Steam and condensate piping shall be A106, Grade B seamless. Steam piping 2 inches NPS and below shall be Schedule 80. Steam piping 2 1/2 inches NPS and above shall be hard Schedule 40. All condensate piping shall be Schedule 80. All joints shall be butt-welded for sizes 2 1/2 inches and greater, and socket welded for 2 inches and below. Where possible, straight sections shall be supplied in 40 foot random lengths with 6 inches of piping exposed at each end for field joint fabrication. Refer to Section 40 05 01 – COMMON WORK RESULTS FOR PIPING for weld requirements of pipe.

C. Fittings: Fittings 2 inches and smaller shall be 3000 pound socket-weld in accordance with ANSI B16.11. Material shall conform to ASTM A105. Fittings 2 1/2 inches and larger shall be steel butt-welding type in accordance with ANSI B16.9 and with the same wall thickness as the attached pipe. Material shall conform to ASTM A234, Grade WPB.

D. Sub-Assemblies: Gland seals, end seals, and anchors shall be designed and factory prefabricated to prevent the ingress of moisture into the system. All sub-assemblies shall be designed to allow for complete draining and drying of the conduit system. Anchors shall be prefabricated steel plates, factory furnished and installed where shown on plans. A 4,000 psi concrete block shall be cast over the plate and conduit and shall be large enough for firm anchorage into undisturbed trench sidewalls and/or bottom. Size of anchor and concrete encasement shall be per piping manufacturer’s recommendation.

E. Insulation: Service pipe insulation shall be Pyrogel XTE, as manufactured by Aspen Aerogel, 30 mm minimum; outer conduit insulation shall be polyurethane, 1 inch minimum. Insulation shall be held in place by stainless steel bands installed on not less than 18 inch centers. The insulation shall have passed the most recent boiling test and other requirements specified in the Federal Agency Guidelines. The insulation shall be applied to a total thickness which limits the maximum sustained temperature of the outer jacket to 100 degrees F.

F. Outer Conduit: The steel conduit casing shall be 10 gauge, galvanized, airtight, pressure testable, smooth wall welded steel conduit. The steel conduit shall withstand H-20 loading with a minimum of 24 inches of cover. Cold galvanizing paint shall be applied to field welds of the galvanized outer conduit.

G. Outer Conduit Insulation and Jacket: Conduit insulation shall be a minimum of 1 inch thick factory applied polyurethane foam, meeting ASTM C591. The outer jacket shall be either:

1. Fiberglass (FRP), filament wound directly onto the urethane foam insulation with thickness of 0.160 inches for 6 inch and above service pipes and 0.120 inches for service pipes below 6 inches. Fiberglass field enclosures matching the thickness of the outer jacket shall be used to complete the installation closures. **No shrink wrap type will be allowed for closure joints.**
2. High Density Polyethylene (HDPE) jackets with a minimum wall thickness of 0.1750 inches. A pressure testable electric-fusion process or heat shrinkable (recommended by the manufacturer) HDPE field joint closures equal to or greater in thickness to the outer jacket shall be used to complete the installation closure. **No shrink wrap type will be allowed for closure joints.** Apply two additional heat shrinkable HDPE field joint closures overlapping the ends of the first field joint closure to provide a layering joint.

H. Pipe Supports: All pipes within the inner casing shall be supported at not more than 10 foot intervals. These supports shall be designed to allow for continuous airflow and drainage of the conduit in place. The straight supports shall be designed to occupy not more than 10% of the annular air space. Supports shall be of the type where insulation thermally isolates the carrier pipe from the outer conduit. Supports which directly contact both the carrier pipe and the outer casing shall not be allowed. The surface of the insulation shall be protected at the support by a sleeve not less than 12 inches long, fitted with traverse and where required, rotational arresters.

I. Expansion Loops, Ells and Tees: Expansion loops and Ells shall be of proper design in accordance with stress limits indicated by the code for pressure piping ASME B31.1. Loop piping shall be installed in conduit suitable sized to handle anticipated pipe movement. **Cold springs will not be permitted**.

J. Backfill: A 6 inch layer of Archer sand shall be placed and tamped in the trench to provide a uniform bedding for the conduit. The entire trench shall be evenly backfilled with a similar material as the bedding in 6 inch compacted layers to a minimum height of 6 inches above the top of the insulated piping system. Bedding and backfill materials shall be in accordance with ASTM C33 or as recommended by the manufacturer.

K. Manufacturers: Perma-Pipe "Multi-Therm 750”, Rovanco “Insul 800 Elite”, or Thermacor “Duo-Therm 505”.

2.2 BURIED UTILITY WARNING AND IDENTIFICATION TAPE:

A. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 6 inches minimum width, color yellow, with warning and identification imprinted in big black letters continuously and repeatedly over entire tape length. Warning and identification shall read "CAUTION BURIED STEAM SYSTEM DISTRIBUTION PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

B. Copper Tracer Wire: Install a No. 12 gauge solid copper tracer wire with 45 mils polyethylene with each buried pipe to facilitate location. Wire shall be installed directly above each pipe and terminate at manholes or building penetrations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installing contractor shall handle the system in accordance with the directions furnished by the manufacturer and as approved by the engineer. Seal the ends of pipes with caps or tape to prevent debris from entering the pipe prior to welding. Follow the manufacturer's approved method for cleaning the piping prior to testing.

B. The contractor shall take all precautions necessary to prevent groundwater or stormwater from entering the uncompleted pipe (service pipe, insulation, outer conduit, or outer jacket), including storing the prefabricated piping outside the trench, installing pumps to artificially lower the groundwater table, providing temporary watertight end closures, or other acceptable method. The contractor shall submit his plans for maintaining the pipe dry. Pipe that becomes wet shall be replaced by the contractor at no additional cost to the owner.

3.2 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. Polyethylene plastic tape shall possess a detectable metal core and be manufactured specifically for warning of and identifying buried utility lines and shall be supplied and installed by Contractor. Tape shall be buried above the pipe during the trench backfilling operation and shall be buried approximately 12 inches below grade.

3.3 OUTER JACKET AIR TEST

A. In cases that a HDPE outer jacket is used, the Contractor shall furnish all necessary equipment and labor to perform the air test, including air compressor, gauges, conduit caps, temporary pipe connections, etc. and complete the test to the satisfaction of the engineer.

B. Conduct each outer jacket air test under the supervision of the supplier's representative. The supplier's representative shall provide documentation of every field closure outer jacket inspection and air test. The HDPE outer jacket shall be tested per the manufacturer's recommendation.

1. If the outer jacket does not pass the air test, a Canusa CSC-X heat shrink sleeve shall be used to repair the outer jacket.

C. Piping System Supplier shall conduct an outer jacket air test on factory jacketed piping prior to the piping leaving the factory. Piping System Supplier shall provide documentation that all outer jackets have been tested and no leaks were found.

3.4 CONDUIT AIR TEST

A. The Contractor shall furnish all necessary equipment and labor to perform the air test, including air compressor, gauges, conduit caps, temporary pipe and connections, etc. and complete the test to the satisfaction of the Engineer. The outer conduit shall be tested to 15 psi and held for 2 hours.

B. Conduct each conduit air test under the supervision of the supplier's representative. The supplier's representative shall provide documentation of each conduit inspection and air test.

3.5 TESTING SERVICE PIPE

A. Supplier's representative shall be present during testing.

B. Radiographic Examination

1. General: 100% Radiographic Examination of all manufacturer's prefabricated welds and 100% of field welds in accordance with Section 400501.

C. Hydrostatic Pressure Test

1. Coordinate pressure tests with Engineer and Owner at least 3 working days in advance of its occurrence and conduct tests in presence of Engineer or Owner's Representative.

2. Conduct hydrostatic (HYDRO) test for service piping with test medium of water unless specifically indicated. Minimum test pressure shall be 135 psig for medium pressure steam service lines, and 112.5 psig for pumped condensate service lines.
3. If leaks are found, repair with new materials and repeat test.
4. No systems shall be insulated until it has been successfully tested. If required for additional pressure load under test, provide temporary restraints at expansion joints or isolate them during test. Minimum test time to be 4 hours plus such additional time as may be necessary to conduct examination for leakage.
5. No pressure drop shall occur during test period. Any pressure drop during test period indicates leakage.
6. Provide pumps, appropriately scaled and calibrated, gauges, instruments, test equipment, temporary piping and personnel required for tests and provide removal of test equipment and draining of pipes after tests have been successfully completed.
7. For hydrostatic tests, remove air from piping being tested by means of air vents or loosening of flanges. Measure and record test pressure at high point in system. Where test pressure at high point in system causes excessive pressure at low point in system, due to static head, portions of piping system may be isolated and tested separately to avoid undue pressure. However, every portion of the piping system must be tested at the specified minimum test pressure.

3.6 FLUSHING AND CLEANING OF STEAM AND CONDENSATE SYSTEM

A. Contractor shall visually inspect internal portion of each length of pipe during installation. Remove all dirt and foreign matter prior to installing additional lengths.

B. Facilities Services Utility and Energy Services (FS-UES) will introduce steam to the new piping and let the condensate drain for 4 hours or longer until needed to clear condensate to below 30 micromhos conductivity. During this time, the drip legs in the system will be blown down. Condensate will also be drained until conductivity is 50 micromhos or less.

3.7 VERIFICATION OF FINAL ELEVATIONS

A. Prior to covering the top of the casing with backfill material, but after all temporary supports have been removed and initial backfilling of the conduit systems have been accomplished, the contractor shall measure and record the elevation of the top of the casings in the trench. This measurement shall be checked against the contract drawings. These measurements shall confirm that the conduit system has been installed to the elevations shown on the contract drawings. These measurements shall be certified correct by the Contractor and provided to the Owner for review prior to covering the casing with backfill material. The preinsulated conduit system shall be installed, inspected, and tested in accordance with the contract drawings and specifications, the system supplier's Approved Brochure and any directions given by the system supplier's representative. All work pertaining to the preinsulated system shall be performed in the presence of the system supplier's representative.

END OF SECTION 33 63 13

SECTION 33 63 43 – STEAM MANHOLE RIMS AND OPENINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steam manhole rims and openings.

B. Requirements of the following specification sections apply to this section.

1. Section 03 30 00 – CAST-IN-PLACE CONCRETE

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.

1. Product data in form of manufacturer's technical data and installation instructions for each type of rim and locking device assembly, including setting drawings, templates, instructions, and directions for installation of anchorage, devices.

a. Include complete schedule, including types, general locations, sizes, construction details, finishes, latching and locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

A. Coordination: Furnish inserts and anchoring devices that must be built into other work for installation of rims and/or locking devices. Coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

A. Opening: Furnish each meeting H-25 traffic loading requirements.

1. Grade Rings: Provide continuous precast concrete riser to grade and match frame and cover diameter. (No grade rings.)
2. Patch joints inside and outside with non-shrink grout.

B. Manhole Frames and Covers: Fiber-reinforced composite, heavy-duty, traffic bearing, openings. Manhole frames and covers shall be Fibrelite F95, no equals.

1. Manhole identification shall be cast into name plate: “STEAM”. No rivet-on identification plates shall be accepted.
2. Manhole cover color shall match adjacent pavement: black in asphalt pavement, tan in concrete or pavers.
3. Cover shall have a textured surface finish to prevent pedestrian slip hazards in wet conditions.
4. Provide Fibrelite lifting tool for removal of covers.
5. Provide cast-in-place concrete reinforcement and expansion joint around frame and cover in accordance with drawing detail.

PART 3 - EXECUTION

3.1 MANHOLE FRAMES AND COVERS

A. Comply with manufacturer’s instructions for installation.

B. Coordinate installation with work of other trades.

C. Set frames accurately in position and securely attach to supports with face panels flush with adjacent finish surface. Set frames at the elevations indicated on drawings.

D. Pitch adjacent finish grade away from rim at 1/2” per foot.

END OF SECTION 33 63 43

SECTION 33 64 13 - UNDERGROUND HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SCOPE OF WORK

A. Provide hydronic piping and valves as shown on the Drawings and specified herein.

1.3 DESCRIPTION

A. This Section includes underground hydronic piping, fittings, and valves provided outside of buildings for hydronic cooling.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 02 – Existing Conditions
2. Division 03 – Concrete

1.4 DEFINITIONS

A. HDPE: High Density polyethylene plastic.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Quality Assurance: Provide documentation indicating the Contractor has 5 years' experience installing underground HDPE piping with fusion joints. Provide documentation indicating the Contractor has successfully completed five projects of similar scope and size and provide contact information.

C. Chilled water pipe hydrostatic Pressure test plan

D. Chilled water pipe cleaning and flushing plan

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, specialty locations, and elevations.

B. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For chilled and hot water valves and specialties to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Comply with AWWA C901/C906, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F2619, ASTM F714, ASTM D2774 and ASTM D 3350 for selection, design, and installation of thermoplastic water piping.

B. The qualifications of the fusion technician(s) shall be submitted and approved in advance. The technician(s) shall be qualified to DOT Title 192 standards.

C. Welder's Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing qualifications. SEE SECTION 400501.

D. Welding procedures and testing shall comply with ASME Standard B31.1 - Code for Power Piping, Power Piping and The American Welding Society, Welding Handbook. SEE SECTION 400501.

E. Provide certified factory test results for insulation testing.

F. Excavation Support and Protection:

1. Comply with the Publications of the following agencies to the extent referenced and applicable:

a. ASTM - American Society for Testing and Materials.
b. AISC - American Institute of Steel Construction.
c. OSHA - Occupational Safety and Health Act.

2. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has

specialized in installing excavation support and protection systems similar to those required for this Project and with a record of successful in-service performance.

3. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Virginia and who is experienced in providing engineering services for designing excavation support and protection systems that are similar to those indicated for this Project in material, design, and extent.
4. Engineering Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of data for the excavation support and protection system including drawings and comprehensive engineering analysis that shows the system's compliance with specified requirements.
5. Do not install excavation support and protection system until successfully reviewed by AE.

G. The system supplier's representative shall be responsible for directing the installation and testing of the conduit system, including training the installing contractor and overseeing the installation process. Submit the factory representative's resume for approval by the Owner. One factory representative shall be assigned for the duration of the project. It shall be certified in writing by the supplier that the representative is technically qualified and has a minimum of 5 years' experience in the design and/or inspection of the systems. The supplier's representative shall be present during the following work phases to approve the contractor's methods:

1. Inspection and unloading
2. Inspection of trench prior to laying of conduit
3. Inspection of butt-fusion of system, first full day of fusing
4. Inspection of field closures, first full day of closure installation
5. Hydrostatic Testing (piping)
6. Repair of any patchwork
7. Back filling of conduit sections

1.9 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling with the exception of butterfly valves. Butterfly valves shall be installed in the open position to ensure proper clearance with the adjoining pipe.

B. During Storage: Use precautions for valves, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Protect flanges, fittings, and specialties from moisture and dirt.

E. Pipe Handling, Storage and Delivery (HDPE)

1. Storage

a. The supplier shall provide recommended guidelines for the storage of HDPE pipe.

2. Handling

a. The polyethylene pipe sections shall be loaded, moved, and transported using a suitably sized backhoe, crane, or front end loader with forks and a pair of 8-inch wide nylon slings. In no case shall bare metal contact the polyethylene. No wire slings shall be used. The handling operations shall not cause any damage to the pipe. The supplier shall provide recommended guidelines for handling the pipe for use by the Contractor.

3. Inspection Upon Loading

a. All pipe and fittings shall be examined for damage such as scratches or gouges at the time of loading. Pipe or fittings found to damage according to the criteria set out below shall be subject to additional QA/QC as described below. A log of damage shall be accurately kept and submitted as described below.

1) Damage: Any breaks in the surface of the pipe greater than 10 percent of the wall thickness in depth shall be considered damage. All damage shall be sequentially numbered on the pipe using an easily visible paint and measured to determine the remaining wall thickness from the deepest part of the damage to the inside of the wall of the pipe.
2) Measuring: The measuring shall be non-destructive. The measurement of wall thickness shall be adjacent to the deepest part of the damage. If the damage is circumferential,

measurements shall be made every 30 degrees. The deepest part of the damage shall then be measured and subtracted from the measured wall thickness to determine the remaining wall thickness.

3) Rejection: The damaged portion of the pipe will be rejected and shall be cut out and removed when the remaining wall thickness is less than 90 percent of the specified minimum wall thickness for that pipe diameter and SDR.
4) Repair: Damaged pipe that is not rejected shall have all edges of the damage ground off to a smooth surface. The area that has been ground down shall then be re-measured and its wall thickness must still exceed the rejection criteria in paragraph 3, or this pipe section will be subject to removal as described below in paragraph 5.
5) Removal: The removal of pipe shall not change the total delivered pipeline length from that shown in the Bid Documents. An entirely new pipe length shall replace the removed piece or the portion of the damaged pipe shall be cut out and removed.
6) Costs: Furnish labor, material, instruments, and bear other costs in connection with all inspection, removal, and replacement of damaged pipe.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Steel:

1. Service Pipe: Carrier piping utilized shall be seamless carbon steel ASME A-53 Grade B standard weight for distribution systems. All joints shall be butt-welded for 2-1/2" diameter pipe and greater. All ferrous pipe field joints shall be welded by competent mechanics and hydrostatically tested under pressure of 165 psig or one and one-half times the design pressure, whichever is greater. Concealed pipe welds in prefabricated fittings shall be factory tested the same as specified for field welds prior to assembly.

B. High Density Polyethylene (HDPE)

1. Provide polyethylene pressure pipe manufactured from PE4710 high density polyethylene meeting AWWA C906 or ASTM F714 standards, ductile iron pipe standard (DIPS), Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter or ASTM D3035, Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter. Resin shall meet the cell classification of 445574C per ASTM 3350.

2. Pressure rating:

    a. 30-inch HDPE chilled water supply and return shall not be less than 200 psi (DR 11, ASTM F714).
    b. 6-inch HDPE chilled water supply and return shall not be less than 200 psi (DR 11, ASTM F714).
    c. 0.75-inch HDPE chilled water supply and return shall not be less than 200 psi (DR 11, ASTM F714).

3. Pipe shall be legibly marked, at intervals of no more than 5 feet, in accordance with the requirements of ASTM F714 and ASTM F2619.
4. Fabricated PE Fittings shall have the full rating of the HDPE pipe.
5. Fabricated PE Fittings shall be factory tested to 1.5x the design pressure prior to shipment.
6. High Density Polyethylene joints shall be butt-fusion welded and field insulated as indicated on Contract Drawings. All HDPE elbows shall be long radius sectionalized.

C. Ductile Iron

1. Ductile Iron Mechanical Joint Pipe, Flexible Restrained: AWWA C151, Class 52, with working pressure at 350-psi for pipe sizes 4 to 12-inches and with a working pressure of 250-psi for pipe sizes 14 to 30-inches.

    a. Lining: AWWA C104, cement mortar, sealed with a bituminous seal coat.
    b. Coating: Bituminous
    c. Gaskets: AWWA C111, rubber

2. Ductile Iron and Cast Iron Fittings: AWWA C110, ductile iron or cast iron, 250 psi pressure rating; or AWWA C153, ductile iron compact fittings, 350 psi pressure rating.

    a. Lining: AWWA C104, cement mortar.
    b. Gaskets: AWWA C111, rubber.

3. Ductile Iron Mechanical Joints:

    a. Flexible restrained joints and jointing materials shall meet requirements of ANSI/AWWA C111.

        1) Mechanical joint retainer glands shall be ductile iron and shall be manufactured by American Cast Iron Pipe Company, Clow Corporation, or EBBA Iron, Inc., or approved equivalent, and may be used at all pipe, valves and fitting joints with a minimum pressure rating of 200-psi.

b. Mechanical Couplings shall be Dresser "Style 38", Rockwell "441 or 411 Flexible Coupling", or Romac "Style 501"; without pipe stop, with oil resistant synthetic rubber gaskets.
c. Flanged Coupling Adapters shall be Rockwell "Type 912" or Romac "Style FCA501", with anchor studs, 12 inch and smaller; Rockwell "Type 913" or Romac Style FC400", 14 inch and larger.
d. Mechanical joint restraints shall be “MEGA-LUG” by EBBA Iron, Inc. or approved equal.
e. Temporary pipe shall use MEGA-LUG joints, or approved equal.

D. Field Applied Insulation and Jacket

1. Service pipe insulation shall be Foamglas One by Pittsburgh Corning, 2 inches minimum. Insulation shall be held in place by two wraps of strapping tape with 50% overlap per wrap. Apply insulation in two 1-inch thick layers; stagger joints 90 degrees.
2. Outer Jacket shall be Pittwrap HS by Pittsburgh Corning, 125 mil minimum thickness.
3. At termination points and pipe bends, a five-layer application of vapor retarder mastic reinforced with fabric shall be installed over the Pittwrap HS jacket.

    a. Karnak 19 Ultra Rubberized Wet/Dry Flashing Cement or equal shall be used.
    b. Reinforcing mesh for the vapor retarder mastic shall be one of the following:

        1) PC Fabric 79. A synthetic fabric, 6.5 x 6 mesh, as supplied by Pittsburgh Corning LLC, or approved equal.
        2) PC 150. A glass reinforcing mesh supplied by Pittsburgh Corning LLC, or approved equal.

    c. Flash off the Mylar film on the surface of the Pittwrap HS jacketing with a torch to facilitate bonding of the mastic to the asphalt membrane.
    d. Apply a layer of asphalt mastic to the fitting, overlapping the jacket at least 4-inches. Apply the mastic at a rate of 2-3 gal/100 sq. ft.
    e. Press a layer of reinforcing mesh into the mastic.
    f. Embed a second layer of fabric mesh into the freshly applied layer of asphalt mastic.
    g. Apply a final coat of mastic over the mesh at the rate specified, making certain to press the mastic through the mesh creating a monolithic coating.

E. Factory Applied Insulation (Deduct Alternate)

1. General: Provide factory pre-insulated straight lengths and fittings for the HDPE Chilled Water Supply (CHWS) and Chilled Water Return (CHWR).
2. Polyurethane foam, spray applied or injected into the annular space between the carrier pipe and outer jacket with a minimum thickness of 2 inches. Insulation shall be rigid, 90-95% closed cell polyurethane with a 2.0 to 3.0 pounds per cubic foot density and coefficient of thermal conductivity (K-factor) of 0.16 and shall conform to ASTM C-591.

F. Factory Applied Outer Jacket (Deduct Alternate)

1. Provide factory applied extruded high density polyethylene (HDPE) having a minimum wall thickness of 100 mils.

G. Field Joint Closure For Factory Insulated Pipe (Deduct Alternate)

1. Field insulate butt-fusion weld with rigid polyurethane half shells, thickness to match factory applied insulation. Secure shells with strapping tape.
2. Wrap the field installed joint insulation with heat shrink sleeve. Sleeve minimum thickness shall match the factory applied HDPE jacket.

2.2 STEEL TO HDPE TRANSITION

A. Transitions between steel and HDPE shall be performed using pre-fabricated transition couplings. The transition point at chilled water system manholes is outside of the manhole structure.

1. Transition coupling shall be Poly-Cam Series 863 ID Controlled Coupling. Couplings adjacent to chilled water system manholes shall have a bell-shaped steel extension attached to the outer compression ring, and epoxy coated. The bell-shaped extension provides an attachment for the outer containment of the steel chilled water pipe as it enters the chilled water manhole.
2. **Poly-Cam fitting shall be air tested to 5 psi for 10 minutes.**

2.3 COPPER TO HDPE TRANSITION

A. Transitions between copper and HDPE shall be performed using pre-fabricated transition couplings.

1. Transition coupling shall be Poly-Cam Series 911 “The Male Flare Nut Transition” or approved equal. The coupling shall be butt fused to a factory pre-fabricated 0.75-inch branch fused to 30-inch service pipe.

2.4 POLYETHYLENE CORROSION INHIBITOR WRAP

A. 8 mil minimum, virgin polyethylene film meeting the requirements of AWWA C105-10. Wrap shall bear the manufacturer's trademark, year of manufacture, type of resin, specification conformance and corrosion protection warning. Secure with manufacturer's recommended adhesive tape.

2.5 VALVES

A. Butterfly Valves:

1. AWWA C504, Class 150. Valves to be tight closing, rubber seated. Valves to be bubble-tight at rated pressure in either direction, and shall be suitable for throttling service and operation after long periods of inactivity. Valves to be designed for buried application.
2. Cast iron body ASTM-A 126, restrained joint ends in accordance with AWWA C-151. Disc to be cast iron ASTM A-126 with 316 stainless steel edge. Valve to be furnished complete with joint accessories (bolts, nuts, gaskets, and glands). Bolts, washers and nuts shall be Grade 2 or higher, hot dip galvanized.
3. Resilient seat shall be natural rubber bonded to Type 304 stainless steel retaining ring secured to disc by Type 304 stainless steel screws. Seat shall be capable of mechanical adjustment in the field and field replaceable. Valve body seat to be Type 304 stainless steel.
4. Valve shaft shall be Type 304 stainless steel.
5. Valve assembly shall be furnished with non-adjustable factory set thrust bearing design to center valve disc at all times.
6. Shaft bearings shall be contained in integral hubs of valve body and to be self-lubricated sleeve type.
7. Valves shall be hydrostatically and leak tested in accordance with AWWA C-504.
8. Valves shall be complete with buried service gear operator, shaft extensions, ground level position indicators, and valve boxes and to be coated with black asphaltic coating for buried service application per AWWA C-504.
9. Refer to drawings for length of shaft extensions.
10. Valve rotation shall be clockwise to open, counter-clockwise to open.
11. Valves shall be PRATT or Mueller (Lineseal III with MDT Buried Service Actuator), no equal. Valves to be furnished with flanged joint ends. Provide welded steel flanges matching the bolt pattern and pressure rating of the valve.
12. Wrap chilled water valve bodies, gearboxes, actuators and flanges (including HDPE backup ring, bolts, nuts and washers) with low density polyethylene encasement meeting the requirements of AWWA C105-10, ANSI A21.5-10, ASTM D4976 and NT4112-10.

    a. Thickness: 8-mil minimum.
    b. Tensile Strength: 3600 psi, minimum, per ASTM D882.

c. Elongation: 800%, minimum, per ASTM D882.
d. Dielectric Strength 800V/mil, minimum, per ASTM D149.
e. Impact Resistance: 600 g, minimum, per SATM D1709-B
f. Propagation Tear Resistance: 2550 gf, minimum, per ASTM D1922.
g. Wrap shall indicate trademark, year of manufacture, type of resin, specification conformance, applicable pipe sizes and corrosion protection warning.

B. Air Release Valves:

1. Air release valves shall be Watts series FV-4M1 or approved equal.

2.6 VALVE BOXES

A. Cast-iron box having top section and cover with lettering "CHILLED WATER" bottom section with base of size to fit over valve and barrel approximately 5-1/4 inches in diameter, and screw adjustable cast-iron extension of length required for depth of bury of valve. Covers shall be powder-coated blue with color RAL5024. Provide #6 Base Adaptor by Adaptor, Inc.

1. Provide one (1) steel tee-handle operating wrench coordinate with valve boxes for entire project. Wrench shall have tee handle with one pointed end, stem of length to operate valve, and socket fitting valve operating nut.
2. Provide a brass disk attached via metal imbed in valve box cover concrete collar embossed with chilled water valve name using nomenclature CHW-VLV-##, numbering shall be coordinated and provided by UF FS.

2.7 IDENTIFICATION

A. Detectable Plastic Underground Warning Tapes: As per Section 310000, "Earthwork", solid yellow in color with continuously printed caption in black letters "CAUTION – CHILLED WATER/HOT WATER DISTRIBUTION PIPING BELOW" or similar wording.

B. Copper Trace Wire: Install a No. 12 gage solid copper tracer wire with 45 mils polyethylene with buried pipe to facilitate location with an electronic detector. Wire shall be installed directly above pipeline and terminate at valve boxes or building penetrations. When applicable, connect new trace wire to existing tracer wire and terminate wire in valve boxes.

PART 3 - EXECUTION

3.1 PREPARATION OF BURIED PIPE FOUNDATION

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the piping.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or crushed angular rock per ASTM D2774 to indicated level.

3.2 INSTALLATION OF STEEL PIPE AND PIPE FITTINGS

A. The installing contractor shall handle the system in accordance with the directions furnished by the manufacturer and as approved by the engineer.

3.3 INSTALLATION OF HDPE PIPE AND PIPE FITTINGS

A. Install all chilled water pipe as specified on plans or a method approved by the A/E and manufactures requirements prior to construction, and in accordance with ASTM D2774.

B. Fusion Joining

1. Butt Fusion Joining - Make joints between plain end pipes and fittings by butt fusion using only procedures that are recommended by the pipe and fitting Manufacturer and ASTM F2620.

    a. Ensure that persons making butt fusion joints are certified according to the standards and have proven experience to make fusion welds following Manufacturer's recommended procedures.
    b. Maintain records of trained personnel, and certify that training was received not more than 12 months before commencing construction.
    c. External and internal beads resulting from butt fusion joining shall not be removed.
    d. All fusion joining shall be recorded, reviewed and downloaded to a central database via Datalogger. Datalog records shall be submitted for all pipe fusion joints daily (within 24 hours of fusion joining).

2. Use caution to protect the exposed butt ends of pipes from exposure to oils, greases, or hydrocarbons. Any pipe exposed to hydrocarbons of any type shall be cut-out and removed prior to butt fusion.

3.4 INSTALLATION OF DUCTILE IRON PIPE AND PIPE FITTINGS

1. Ductile Iron Restrained Joint Pipe: Install with cement mortar lined, ductile iron, flexible restrained mechanical joint fittings and rubber gaskets in accordance with AWWA C600.

3.5 INSTALLATION OF VALVES

A. General Application: Use flanged end valves for butterfly valves.

B. AWWA-Type Butterfly Valves: Comply with AWWA C600. Install buried valves with stem pointing up and with cast-iron valve box. Wrap valve with polyethylene encasement. Backfill and compact under and around valve box to ensure no vertical loads are transmitted to the valve operators or bonnets.

3.6 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground chilled water piping. Locate 6 inches above the underground piping and also 6 to 12 inches below finished grade, directly over piping.

3.7 TESTING SERVICE PIPE (HDPE)

A. Butt Fusion Testing: On the first day butt fusions are to be made for each pipe size, the first fusion shall be a trial fusion. After the trial fusion is allowed to cool completely, cut out fusion test straps and test per ASTM F3183. Do not commence butt fusion of pipe to be installed until a trial fusion has passed the test. Tests shall be witnessed and approved by the A/E and the technical assistant provided by the pipe manufacturer or fusion equipment provider.

B. During the initial trial fusion and all subsequent fusions, a Data Logger shall be used to monitor the fusion process to record the necessary critical parameters critical to the fusion process. Upon a successful trial fusion as tested by the bend back test strap, all subsequent butt fusions shall be recorded using the Data Logger and shall match the condition of the initial successful and approved trial fusion. Provided the conditions recorded on the Data Logger match the conditions of the trial fusion, no additional bent strap tests will be required.

C. The technical assistant provided by the pipe supplier shall be onsite for the first full day of fusing. Perform all fusion joints in the presence of the Owner or A/E as directed. Record the temperature and corresponding time for each fusion joint.

D. Hydrostatic Pressure Testing: Pressure test HDPE pipes in accordance with ASTM F2164, “Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure”. Due to the shrink/swell nature of the

HDPE piping, performing this test can take many hours (as long as a full day affair). Provide means for air to be removed from the piping during hydrostatic testing. The Contractor assumes all risk associated with backfilling the pipe prior to pressure testing. If the pressure test indicated a leak in the HPDE system, the Contractor is responsible for locating and repairing the leak with no additional cost or schedule impacts to the project.

3.8 TESTING SERVICE PIPE (STEEL)

A. Visual Examination (VT): Visually examine all pipe welds of the chilled water systems per ASME B31.1. Note that ASME B31.1 requires that all welds be examined by VT – this specification is simply enforcing this requirement. See Specification Section 400501 for additional information.

B. Ultrasonic Examination (UT): Ultrasonically examine all butt weld style pipe welds of the chilled water system per ASME B31.1. See Specification Section 400501 for additional information.

C. Provide documentation of each inspection of accepted or rejected welds. Provide report results within three working days for satisfactory results and one working day for unsatisfactory tests.

D. Remove weld defects by grinding or chipping and repair or replace weld joints in accordance with approved procedures. Retest all repaired joints.

E. Engineer and Owner may be present during testing.

F. Hydrostatic Pressure Test (Steel)

1. Coordinate pressure tests with Engineer and Owner at least 3 working days in advance of its occurrence and conduct tests in presence of Engineer or Owner’s Representative.
2. Conduct hydrostatic (HYDRO) test for service piping with test medium of water unless specifically indicated. Minimum test pressure shall be 165 psig for chilled water service lines.
3. If leaks are found, repair with new materials and repeat test.
4. Minimum test time to be 4 hours plus such additional time as may be necessary to conduct examination for leakage.
5. No pressure drop shall occur during test period. Any pressure drop during test period indicates leakage.
6. Provide pumps, appropriately scaled and calibrated, gauges, instruments, test equipment, temporary piping and personnel required for tests and provide removal of test equipment and draining of pipes after tests have been successfully completed.

7. For hydrostatic tests, remove air from piping being tested by means of air vents or loosening of flanges. Measure and record test pressure at high point in system. Where test pressure at high point in system causes excessive pressure at low point in system, due to static head, portions of piping system make be isolated and tested separately to avoid undue pressure. However, every portion of the piping system must be tested at the specified minimum test pressure.
8. Contractor may perform one or more hydrostatic tests on various segments of piping in accordance with the phasing plan. It is recommended that no field joints are insulated or jacketed prior to the hydrostatic test, however the contractor may proceed to insulate, jacket, and or backill field closures at their own risk. If a leak is discovered during the hydrostatic examination after the system has been completely insulated, jacketed, and/or backfilled, it is the contractor's responsibility to locate and repair the leak at no additional cost.
9. See Specification Section 400501 for additional information.

3.9 FLUSHING AND CLEANING OF CHILLED WATER SYSTEM

A. Contractor shall visually inspect internal portion of each length of pipe during installation. Remove all dirt and foreign matter prior to installing additional lengths.

B. Pull a pig through each pipe, max length of pull is 100 feet. This will require leaving the piping open at the ends for access for the pig. For steel pipe, TIG weld root passes on piping connections to prevent slag buildup in final connections.

C. Fill piping with water and conduct the specified hydrostatic pressure testing and completely drain system to system low point(s).

D. Submit a detailed cleaning and flushing plan for review and approval that is project specific. Identify locations where cleaning and flushing operations will occur and the segments of piping that will be cleaned and flushed. If multiple cleaning and flushing operations are proposed, submit multiple plans, and identify the delineation between phases. Phase the installation, cleaning, and flushing so that cleaning and flushing operations occur at low points in the new system. All cleaning and flushing shall be performed such that all debris will be pulled or flushed to accessible low points. Provide access at all low points through valves, tees, flanges, etc. to facilitate the cleaning and flushing process. If temporary fittings, piping, drains, or vents are required, they shall be provided by the contractor and removed by the contractor after successful cleaning and flushing. Contractor shall provide all water for flushing and cleaning Coordinate rental of fire hydrant meters with local authority or utility owner.

E. At selected cleaning and flushing locations, provide temporary pumps, generators, piping, connections, valves, unions, gauges, meters, hoses, tanks, strainers, test ports, injection ports, vents, drains, and water sources for cleaning and flushing

operation. Size components to achieve specified circulation velocity. Provide strainers upstream of pumps to prevent damage from foreign materials. Provide schematic detail of cleaning and flushing components in the cleaning and flushing plan for review and approval

F. After flushing and cleaning is completed, Contractor shall provide necessary pipe and fittings required to complete the piping system. Each cleaned section of piping shall be capped and protected to keep mud, debris, water, etc. from entering the piping. If a piping section is left open or unprotected, or is found to be contaminated, it shall be re-cleaned prior to being filed and activated at no cost to the Owner.

G. Contractor shall provide all temporary piping from water source to piping system and shall provide means for conducting cleaning water from underground piping system to the appropriate sewer; i.e. pumps, piping, hoses, tanks, etc. Contractor to remove all temporary piping, pumps, hoses, etc. from site immediately after flushing has been completed.

H. The following are flushing and cleaning procedure options:

1. Chemically Treated Water Flush

a. Contractor shall submit a plan that will comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction. Plan shall include all components necessary for a successful high-velocity flush, including:

1) Automatic fresh water makeup.

a) Obtain permission from owner for use a hydrant for water supply. All costs associated with the use of water supplied from hydrants shall be included and no additional costs to owner.

2) Chemical injection port.
3) Pumps with sufficient power to circulate the system volume at 6 feet per second (fps).
4) Automatic air release.
5) Strainer with removable baskets. Baskets shall have screens ranging from xx to xx.

b. Fill system and add sodium triphosphate cleaning solution at the rate of 0.5 to 1 gallon per 100 gallons of system volume. Circulate for not less than 8 hours at minimum 6 ft. per second velocity.

1) Contractor required to submit MSDS sheets for cleaning chemicals, and procedure for injection of cleaning solution into system, concentration within the piping, and concentration when being discharged.

c. Following circulation period, flush cleaning compound from system with automatic water make-up open and circulating pump on.
d. Flush until rinse water runs clear, and pH is within 0.5 units of the incoming water.
e. Test system to ensure no excess detergent remains, and conductivity approaches incoming water conductivity.
f. Replace strainers and reconnect all apparatus bypassed.
g. Provide temporary piping or hose to bypass any component, which may be damaged, unless acceptable means of protection are provided, and subsequent inspection of hide-out areas takes place.
h. All cleaning and flushing shall be performed such that all debris will be pulled or flushed downhill.
i. Do not let water stand in piping for more than 8-hours without treatment or circulation. Do not let treated water stand in piping for more than 24-hours.
j. Contractor is responsible for legally dispose of chemically treated water. Provide sampling and testing in accordance with/to conform to all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction's allowable concentration of contaminants.

2. Froth Flush High-Velocity, Low-Density Air and Water Slug)

a. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction.
b. Submit a plan for detailing the high-velocity froth flush process, safety precautions, cleaning procedure, all equipment to be used, sources for water and power, and frothing parameters for approval.

1) Obtain permission from owner for use a hydrant for water supply. All costs associated with the use of water supplied from hydrants shall be included and no additional costs to owner.

c. The plan shall include detailing safely performing the flush, including securing the area, ensuring use of PPE, restraint of loose piping, fittings and air lines, etc.
d. Review the design parameters of the flush to ensure no damage to installed chilled water piping will occur.
e. Install the slug former on the upstream end of the flush. Open the downstream end of the chilled water piping and provide containment vessel (tank) to capture the flush water and debris.

f. Blow low pressure air through the installed chilled water piping to ensure standing water is removed.
g. Build a slug of air and water using 135psi air. Release the slug through the piping to be cleaned. Continue flowing air through the piping for 30 seconds after the slug exits the piping.
h. Repeat until the emerging slug appears clean. Run additional slugs through the piping, capturing the exiting slug and sampling with a Millipore machine. Inspect for particulates. If no large particulates are observed and the patch maintains its color for 2-5 additional flushes, the process is complete.
i. Disassemble slug former and move equipment to the next line to be flushed, repeating the process.
j. Contractor is responsible for legally dispose of wastewater. Provide sampling and testing in accordance with/to conform to all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction's allowable concentration of contaminants.

3. High-Velocity Jet (Hydro Cleaning)

a. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction.
b. Submit a plan for detailing the high-velocity/pressure jetting process, safety precautions, cleaning procedure, all equipment to be used, sources for water and power, and jetting parameters for approval. The plan at the minimum shall detail/include/conform to the following:

1) Confirm with the chilled water piping manufacturer that the proposed jetting procedure will not damage or negatively impact the installed piping. This will require limits on the pressure used. Provide results of the jetting procedure on a sacrificial segment of pipe. The plan will need to demonstrate how the jet will be held centered within the pipe so that the highest velocity/pressure water emerging from the nozzle does not contact the pipe.
2) Obtaining permission from owner for use a hydrant for water supply. All costs associated with the use of water supplied from hydrants shall be included and no additional costs to owner.
3) During chilled water cleaning operations, necessary precautions shall be taken in the use of cleaning equipment to ensure that the water pressure created does not damage the chilled water pipe or cause flooding.
4) All high-velocity jet chilled water pipe cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. The equipment

shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

5) The designated chilled water pipe sections shall be cleaned using high-velocity jet equipment. The equipment shall be capable of removing HDPE shavings, dirt, rocks, sand, and other materials and obstructions from the chilled water lines. If cleaning of an entire section cannot be successfully performed from one end of the chilled water piping, the equipment shall be set up on the other end of the chilled water pipe and cleaning again attempted.

6) HDPE shavings, sludge, dirt, sand, rocks, and other material resulting from the cleaning operation shall be captured and removed of the section being cleaned, and disposed of in accordance with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction. Effluent water shall be collected and filtered before being discharged to municipal drain.

3.10 FINAL FILL

A. After cleaning and flushing, Contractor shall fill chilled water piping and add corrosion inhibitor in coordination with Owner.

3.11 VERIFICATION OF FINAL ELEVATIONS

A. Prior to covering the top of the casing with backfill material, but after all temporary supports have been removed and initial backfilling of the piping system has been accomplished, the contractor shall measure and record the elevation of the top of the casing in the trench. This measurement shall be checked against the contract drawings. These measurements shall confirm that the piping system has been installed to the elevations shown on the contract drawings. These measurements shall be recorded by the Contractor and given to the Owner prior to covering the casing with backfill material. The piping system shall be installed, inspected, and tested in accordance with the contract drawings and specifications, the system supplier's Approved Brochure and any directions given by the system supplier's representative.

END OF SECTION 33 64 13

SECTION 40 00 01 – GENERAL PIPING PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplemental Contract Requirements and Division 1 Specification Sections, apply to this Section.

B. Related Sections: All Division 40 Sections contain requirements that relate to this Section.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Code Conformance.
2. Coordination.
3. Submittals.
4. Record documents.
5. Maintenance manuals.
6. Rough-ins.
7. Mechanical installations.
8. Cutting and patching.
9. Maintenance Manuals.

1.3 RESPONSIBILITY AND QUALITY ASSURANCE

A. Certain portions of the mechanical specifications assign responsibility for specific work to manufacturers, suppliers, and subcontractors for quality assurance. However, the mechanical specifications are indivisible with respect to the Contract. The Contractor shall be responsible for compliance with the Contract Documents for all work.

B. The Contractor shall be responsible for obtaining all required permits, waivers, and releases for all Work from the Governing Authority. The Contractor shall schedule and adhere to all Requirements for Inspection of Work by the Governing Authority.

C. Equipment and appurtenances shall be designed in conformity with ANSI, ASME, IEEE, NEMA, OSHA, AGMA and other generally accepted applicable standards.

D. All machinery and equipment shall be safeguarded in accordance with the safety codes of the ANSI, OSHA, and local industrial codes, including but not limited to, shaft guards on all rotating shafts, cages around exposed fan blades, etc.

E. All mechanical work shall be performed by mechanics who are qualified to do such work and who are normally engaged in this type of work.

1.4 SUBMITTALS

A. General: Not required for this Section.

1.5 CODE CONFORMANCE

A. Install all systems of Division 40 sections in conformance with all applicable State of Florida and City of Gainesville codes as outlined in Section 01 06 00 – REGULATORY REQUIREMENTS, in addition to all the specific codes and standards listed in the various Division 40 sections.

B. Codes include but are not limited to:

1. ASME Power Piping Code B31.1.

1.6 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 when requested by individual specifications sections to a scale of 1/4” = 1'-0" or larger; detailing major elements and components of mechanical piping and materials in relationship with other systems, installations, and components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work.

B. Indicate the proposed locations of piping, supports, and accessories. Include the following:

1. Clearances for installing and maintaining insulation.
2. Clearances for servicing and maintaining valves and in-line accessories, etc., including removal and space for disassembly required for periodic maintenance.
3. System piping pitch, direction of flow, connections, and support and anchor details.
4. Exterior/interior wall and foundation penetrations.
5. Floor penetrations.
6. Sizes and location of required concrete pads and bases.
7. Valve stem movement and handwheel operation.

C. Indicate scheduling, sequencing, movement, and positioning of heavy materials during construction.

D. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and roofs and their relationship to other penetrations and installations.

1.7 RECORD DOCUMENTS

A. Prepare record documents in accordance with General Contract Requirements.

1.8 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Section 01 70 00 – PROJECT CLOSEOUT. In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, valve Cv, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include routine and normal operating instructions, including regulation, control, and emergency instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting, including disassembly, repair, and reassembly and aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification. Also furnish information for proper handling and storage of products under normal jobsite conditions.

B. If storage of equipment is necessary prior erection, the Contractor shall take appropriate precautions to prevent damage. Equipment shall be stored in a temperature controlled building to prevent deterioration prior to erection.

C. Outside storage of equipment shall not be permitted.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 STORAGE OF MATERIALS

A. Store all materials in a safe and orderly fashion. Protect all equipment and materials from damage during storage; refer to Paragraph 1.9.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other components.
2. Verify final locations for mechanical installations with field measurements and with the requirements of the actual equipment to be connected.
3. Arrange for chases, slots, and openings during progress of construction, to allow for mechanical installations.
4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.
5. Where mounting heights are not detailed or dimensioned, install materials, and equipment to provide the maximum headroom possible.
6. Coordinate connection of mechanical systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflicts to the Engineer.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other systems and components, regardless of exposure.
9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
10. Provide identification systems and painting for mechanical systems that adhere to Section 40 05 53 - IDENTIFICATION FOR PIPING AND EQUIPMENT.

B. It is the responsibility of the mechanical contractor to coordinate the work of his trade with all other trades prior to the commencement of construction. It is the responsibility of the contractors to provide, in their original bid, all necessary offsets, fittings, and transformations to provide a complete project. Any conflicts must be brought to the attention of the Engineer. Any work requiring removal and reinstallation due to the lack of coordination shall be the responsibility of the contractors with no additional cost to the Owner.

C. During coordination meetings discuss amongst the contractors scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3.3 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with 01 70 00 – PROJECT CLOSEOUT. Include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. One complete set of non-reproducible (white print or blue print) as-built drawings.
6. A copy of all of the satisfactory reviewed submittals.

3.4 TRAINING

A. Training for equipment and systems included in Division 40 specification sections shall be provided in accordance with the requirements contained in Section 01 78 23 - OPERATION AND MAINTENANCE DATA.

3.5 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.

B. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

D. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers.

3.6 INSTALLATION

A. Technical Erection Supervision:

1. Work performed without the assistance of the manufacturer's technical erection supervisor shall adhere to dimensional requirements, assembly methods, and installation procedures specified herein and in the manufacturer's instruction manuals and drawings.
2. The Contractor shall comply with erection and installation methods, techniques, sequence, and procedures requested by the manufacturer's representative, if the manufacturer's representative is present.
3. Where manufacturer's written instructions differ significantly from those proposed by the manufacturer's technical erection supervisor, the Engineer shall determine the method to be used.

B. Manufacturer's Drawings and Instruction Books: Manufacturer's drawings and instruction books for Owner-furnished equipment and materials to be installed will be made available to the Contractor. Upon completion of the Work, all instruction books shall be returned to the Owner.

C. Equipment Handling: Proper and adequate handling equipment and rigging shall be used at all times. Equipment and rigging shall be examined and checked at frequent intervals. The weights and dimensions of the equipment shall be obtained from the manufacturer's drawings, as required, to insure the use of adequate equipment.

D. Gaskets: Gaskets shall be installed in proper alignment, free of tears and wrinkles. Bolts shall be tightened evenly all around to insure uniform stress over the entire gasket area. Refer to Section 40 05 50 – GASKETS.

E. Guards: Guards shall be OSHA guards and shall be installed and adjusted over all exposed rotating mechanisms, such as shaft couplings, V-belt drives, and similar devices, following rotational checks.

3.7 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.

4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.

B. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

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D. Gaskets: Gaskets shall be installed in proper alignment, free of tears and wrinkles. Bolts shall be tightened evenly all around to insure uniform stress over the entire gasket area. Refer to Section 40 05 50 – GASKETS.

END OF SECTION 40 00 01

SECTION 40 00 05 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Mechanical sleeve seals.
2. Sleeves.
3. Painting and finishing.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. HDPE: High-density polyethylene

1.4 SUBMITTALS

A. Product Data: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit for the following:

1. Mechanical sleeve seals.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code-Steel."

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space and provide hydrostatic seal between pipe and wall penetration. Provide GPT Thunderline/Link-Seal or Metraflex Metraseal.

1. Sealing Elements:

a. For Steam, Pumped Condensate, and Trapped Condensate Piping Systems and PSAN Piping in Steam Manholes: Silicone interlocking links shaped to fit surface of pipe rated for 400 deg F continuous temperature. Include type and number required for pipe material and size of pipe. Note that GPT product appears not to carry the 400 deg F continuous rating.

b. For Chilled Water Piping Systems and PSAN Piping in Chilled Water Manholes: EPDM elastomer interlocking links. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.2 SLEEVES

A. Galvanized Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS – COMMON DEMOLITION REQUIREMENTS

A. Preparation:

1. Provide and erect such temporary supports as are required for the work and for pipe and equipment affected by the work.
2. Prevent damage to existing equipment, electrical conduit and wiring, foundations, piping and other services to remain intact and functional after demolition.
3. Do not disable or disrupt fire piping or fire alarms or other safety systems without written permission of the Owner.
4. Furnish, erect, and maintain approved barriers around dangerous areas of operation.
5. Furnish, erect, and maintain approved Danger, Warning and Keep Out signs at locations necessary for general safety.

B. Requirements:

1. Conduct demolition to minimize interference with adjacent areas.
2. Immediately cease demolition when dangerous conditions develop such as structure instability. Notify the Owner immediately.
3. Cease demolition work immediately when hazardous materials are discovered. Notify Owner for approval of an acceptable course of action.
4. Prior to cutting or disconnecting any electrical cables, de-energize and tag the circuit. Do not cut or remove any energized cable.
5. Remove demolished materials from the site unless otherwise directed by the Owner. Transport all demolished material to a disposal area acceptable to the Owner. Transport demolished materials and rubbish safely to avoid injury to personnel and spillage on roadways or adjacent area. Adhere to federal, state and local regulations.
6. Remove demolished materials from the site as work progresses. Upon completion of work, leave areas in clean condition.

7. All cutting and burning torch operations that produce sparks shall be controlled to prevent fire and damage in accordance with NFPA 51B. Existing facilities, such as electrical conduit, and equipment, shall be adequately protected from such operations. Hot work must be authorized by the Owner via hot work permit.

3.2 PIPING SYSTEMS – COMMON INSTALLATION REQUIREMENTS

A. Piping Installation:

1. Piping cuts for piping connections to be used in the final installation shall preferably be made by sawing or machining. If arc and torch cutting are used, the cut shall be smooth and true and shall be cleaned of all slag. Wherever piping cuts are made at the location of existing welds, the existing weld shall be removed completely as part of the new weld preparation. In the layout of modifications to existing piping, butt welds shall be spaced a minimum of 6 inches apart. Any deviation from this shall be approved by the Engineer.
2. Piping shall be erected in accordance with the plans and sections, as shown on the Drawings. Piping elevations and locations of existing lines may not reflect as-built conditions and shall be verified before erecting new piping. The Contractor shall take extra care to assure correctness of all cut lines when connecting to existing piping. The Contractor shall also verify dimensions of all shop-fabricated piping assemblies prior to fabrication.
3. Piping shall be installed straight without kinks or pockets and shall be parallel or perpendicular to building walls, beams, and girders. Vertical piping shall be installed straight and plumb. Full lengths of pipe shall be used, where possible; couplings and short lengths of pipe shall not be used where a single length can be used.
4. The Contractor shall endeavor to erect prefabricated pipe lines before the erection of field-fabricated piping in the same area.
5. Final piping system closure welds shall be made at the equipment nozzle connections and shall not be made until final equipment alignment has been completed.
6. Piping shall be installed so as to allow expansion and contraction without placing excessive stresses in piping, anchors, or equipment.
7. Authorization by the Engineer shall be obtained prior to welding or attaching temporary pipe supports, scaffolding, lugs, and structural shapes to the building steel or equipment in questionable locations. These items shall be removed when installation is complete. Temporary welds shall be removed by cutting. Breaking of welds is prohibited. Weld metal remaining on the steel surfaces shall be removed by grinding to produce a surface equal to the original surface in the immediate area. The ground surface shall be visually examined to insure that the area is free of cracks and undercuts. Undercutting of structural steel shall be repaired by welding and grinding smooth. Temporary welds shall not be permitted on the surface of previously erected adjacent piping, pipe supports, or vessels. The surface of adjacent piping shall be protected from strikes and weld spatter.
8. Except where the Drawings shown otherwise, minimum headroom clearance shall be 6’ – 8” under piping in buildings and under access platforms and walkways.

9. The use of pliers or pipe wrenches for tightening nuts or tubing connectors is prohibited. Proper cutting, forming, and assembling tools shall be used in the erection of all tubing. Tubing shall not be cut with a hacksaw.
10. Drains shall be piped to the nearest floor drain or contaminated water return; no drain shall spill on the floor.
11. Horizontal drainage lines shall be laid to a uniform pitch of 1/4 inch per foot, if practical, but in no case less than 1/8 inch per foot, except when the Drawings specifically show otherwise.
12. Bending of pipe shall not be permitted, unless specifically shown on the Drawings or permitted by the Piping Specifications.
13. The Contractor shall be responsible for the repair of all leaks detected during the pressure tests specified herein.
14. Insulation shall not be applied over piping prior to completion of testing. Welds or other type joints shall not be painted prior to completion of testing.
15. Cold pulling or jacking of pipe to bring weld ends into alignment or to obtain clearances for equipment removal shall be held to a minimum. Pulls resulting in pipe movements greater than 3/8 inch shall be approved by the Engineer before proceeding.
16. Throughout the entire system there shall be as few joints as possible.
17. Where interferences are found in the field, such as between piping, conduit, air and cable ducts, and electrical boxes, it shall be the responsibility of the Contractor to resolve the problem with the Engineer before proceeding with the work.
18. The Contractor shall be responsible for checking and confirming size, location, and flange drilling of all piping, valves, and material furnished to him by the Owner for installation in pipe lines herein specified.
19. All bolts in flanged construction shall be uniformly tightened with proper wrenches. Hammering and bumping shall be prohibited. Care shall be taken to obtain uniform pressure on the gasket and to avoid overstressing to the bolts, dishing of the flanges, and compression of the gasket beyond its proper limits. Hot torqueing may be required during start-up to cycling does not cause leaks.
20. Piping shall be checked inside and outside before installation to see that it is clean. Loose material, including rust, mill scale, and foreign matter, shall be removed.
21. Particular care shall be used in assembling the piping to prevent loose materials from getting into the piping system or equipment during erection of the piping. Every precaution shall be taken to keep the piping clean and free from internal dirt and debris.
22. All openings for pipe connections, all equipment access openings, and all open-ended pipes not being worked on during installation or in use otherwise shall be covered with temporary covers made of plywood, sheet metal, or plastic.
23. Proper cutting, forming, and assembling tools shall be used in the erection of tubing. Tubing shall not be cut with a hacksaw.
24. All valves shall be readily accessible. Provide chain wheel actuators with chains for all valves not accessible within 6 feet above floor or catwalk. Extend chains to 5 feet above accessible level.
25. Terminals:

a. Where the piping connects to equipment or piping furnished in place by Others, such connections shall be made by the Contractor, who shall properly complete the connections in each case.
b. All material, accessories, and fabrication for such piping shall conform to the requirements specified herein. Extreme care and judgment shall be used in routing small pipe, tubing, and conduit which is shown only diagrammatically on the Contract Drawings. Sufficient clearance shall be provided under and/or around hatchways, galleries, monorails, removable slabs, temporary end walls, and clearance required for access to equipment and valves, for maintenance, operation, inspection, and the like. Routing of small pipe and tubing shall be subject to review and acceptance by the Owner. The Contractor shall relocate, at his own expense and without cost to the Owner, any such small piping and tubing which does not conform to these requirements.

B. Field-Routed Piping:

1. Piping size 2” NPS and smaller shall be routed in the field according to this Specification and the Schematics or P & ID Contract Drawings. Connections to larger piping and equipment are shown on the Piping Drawings. Materials shall conform to the Piping Specifications.
2. Pipe shall be routed in the most direct manner without interfering with other piping, equipment, electrical cable trays, or the like. Piping should follow the general physical routing of larger piping to give a neat appearance, minimize interference with future piping.
3. Piping shall be located so as not to interfere with operation or maintenance of the equipment. All valves shall be readily accessible.
4. If vapor pockets are unavoidable, high point vents shall be installed equipped with a valve so that the line may be filled and tested. Low points shall have a valve drain. Vent and drain size shall be minimum 3/4 inch NPS.
5. Care shall be taken to locate lines so that there is clearance for any required insulation.
6. Pipe shall be adequately supported so that thermal growth is not restricted and deflection of the pipe due to the weight of the contents and insulation is minimized.

C. Planning and checking has been done to minimize as far as possible, interferences or conflicts between new piping and new or existing obstructions. However, prior to beginning the erection of each line, the Contractor shall ascertain that no interference will be encountered, thereby precluding the necessity of disassembling of partially or completely erected systems for rerouting to clear obstructions which may exist. Where any interference is encountered, the Contractor shall obtain the approval of the Engineer for a routing to clear the interference. After such approval has been obtained, the Contractor shall proceed with erection. In no case shall the Contractor be entitled to extra compensation for taking down or dismantling work which has been erected or pre-fabricated except such pre-fabrication that has been called for in the specification or on the drawings, or unless specifically authorized in writing by the Engineer.

D. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend galvanized sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

E. Manhole Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install galvanized steel pipe for sleeves smaller than 6 inches in diameter.
2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.4 PAINTING AND FINISHING

A. Painting of mechanical systems, equipment, and components is specified in Section 09 91 00 – PAINTING. Painting of piping systems is specified in Section 40 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT.

B. Do not paint piping specialties with factory-applied finish.

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

D. Work provided in manholes and concrete trenches shall be painted in accordance with the exterior paint schedule.

END OF SECTION 40 00 05

SECTION 40 01 10 - MECHANICAL ALTERATION AND DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplemental Contract Requirements and other Division 1 Specification Sections, apply to this Section.

1.2 WORK BY OWNER

A. No demolition work is designated to be by the Owner.

1.3 DESCRIPTION OF WORK

A. The Contract Drawings reflect the major elements of mechanical demolition. Demolition and removal of all small bore pipe, control wire and conduit, and pipe supports is not shown. The Contractor shall be aware of this and include the appropriate dollar amount in the Bid to account for demolition of components not specifically shown. The Contractor is responsible for all demolition work required to perform new work installations.

B. Demolition for work not specifically shown shall be brought to the attention of the Owner. The Owner will provide direction for this work.

C. Provide demolition, removal, relocation, rerouting, and reconnection for existing mechanical facilities, as required, shown and specified herein, to accomplish alteration and restoration and to accommodate new construction.

D. The Work shall include, but shall not be limited to, draining, disconnecting, relocating, removing, and dismantling, in a neat and workmanlike manner, which allows reuse by the Owner, the items and/or their appendages as indicated on the Contract Drawings.

E. Items to be re-used are indicated on the Contract Drawings.

F. Construction schedules shall indicate all mechanical demolition work.

1.4 QUALITY ASSURANCE

A. Reference Standards - Comply with the following:

1. ANSI A10.6: Safety Requirements for Demolition.

2. NFPA 51B: Fire Prevention in Use of Cutting and Welding Processes.
3. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.
4. "Demolition Safety Manual" published by the National Association of Demolition Contractors (NADC).

B. Special Precautions

1. Torch cutting of mechanical equipment will be permitted only with the specific written approval of the Owner.
2. Any cutting method, which may create sparks, must include "Fire Watch". Submit "Fire Watch" procedure for approval.
3. Any torch cutting, abrasive cutting, welding, or similar "hot work" that may result in a Fire hazard requires a permit from the University Fire Marshall. A permit must be obtained for each working day. An inspection of the site by the Fire Marshall is required before "hot work" can begin.
4. Draining operations must not damage building components or endanger human health.

PART 2 - PRODUCTS

2.1 GENERAL

A. For materials required for this work, comply with the applicable specification sections in Division 40.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide alteration and demolition of mechanical facilities as required by the Contract Documents. The drawings are diagrammatic and do not show the exact location of all existing mechanical work.

B. Do not begin the work until time schedules and manner of operations have been approved by the Owner. All interruptions of existing services shall be included in the schedules as approved by the Owner and so identified.

C. Verify the location of all existing mechanical equipment, piping, fittings, valves, ductwork, insulation, controls, and other mechanical facilities prior to demolition. Provide for the removal, relocation, rerouting, and reconnection of this work and any related work as required because of demolition methods or sequences employed. Obtain the permission of the Owner prior to commencing any work.

D. Planning and checking has been done by the Engineer to minimize as far as possible, interferences or conflicts between new piping and new or existing obstructions. However, prior to beginning the erection of each line the Contractor shall ascertain that no interference will be encountered, thereby precluding the necessity of disassembling of partially or completely erected systems for rerouting to clear obstructions which may exist. Where all interference is encountered, the Contractor shall obtain the approval of the Engineer for a routing to clear the interference. After such approval has been obtained, the Contractor shall proceed with erection. In no case shall the Contractor be entitled to extra compensation for taking down or dismantling work which has been erected or pre-fabricated except such pre-fabrication that has been called for in the specification or on the drawings, or unless specifically authorized in writing by the Engineer.

E. Comply with the installation procedures specified in the applicable Specification Sections in Division 40.

F. Where existing equipment must remain in service during construction, provide rerouting and reconnection of mechanical services as required to maintain continuous service.

G. Maintain system continuity and operation of piping, ductwork, or conduit, whether modified, spliced, extended, relocated, or newly constructed.

H. Remove, from the site, existing materials and equipment not intended for reuse in the work, and dispose of properly. Existing piping, conduit, and similar items to be abandoned that are not embedded in walls or floor slabs shall be completely removed. Cap open ends at all walls and floors.

I. No materials and equipment will be salvaged for future use by the Owner unless specified on the contract drawings.

J. Protect existing equipment (to be reused) from possible damage during demolition work.

K. If the Contractor is unsure as to the disposition of any portion of the demolition, he must request clarification from the Owner prior to removal. In the event that the Contractor removes materials and equipment not intended for removal, he shall replace those materials and equipment in a similar condition prior to removal at no cost to the Owner.

3.2 PIPING REMOVAL

A. All welded piping shall be cut off square at the locations indicated on the drawings. No cutting will be required where the demolition ends at a flanged valve or equipment. All openings of any remaining valves, piping, or fittings shall be closed off with weld caps or blind flanges to withstand full design pressure of the connected system.

B. All threaded piping shall be disconnected at the location indicated on the drawings. All openings of remaining valves, piping, fittings, and equipment shall be closed off with pipe plugs or pipe caps as required to withstand full design pressure of the connected system.

C. All pipe hangers, supports, supporting, and miscellaneous steel and/or anchors shall be removed with the piping.

3.3 PROTECTION FROM FREEZING

A. It is intended that all indoor areas remain protected from damage due to freezing temperatures. To that end, existing equipment used for heating shall remain in place and in operation.

B. When portions of an existing piping system are removed, and this removal causes loss of operation to another piece of equipment due to open (disconnected) piping, then the Contractor shall cap piping to retain operation of various systems.

C. Where the removal of equipment, etc. will leave an area unprotected from freezing, the Owner shall be notified by the Contractor prior to removal so appropriate steps can be taken to protect the area.

3.4 MECHANICAL EQUIPMENT REMOVAL

A. Remove all mechanical equipment shown, including (but not limited to) the equipment's supply and return piping, steam and condensate piping, drainage piping, other utility piping, valves, insulation, hangers, support steel, controls, and all line and low voltage wiring, unless indicated otherwise on the drawings.

B. Where equipment is supported by steel and/or structural supports, remove these supports unless otherwise stated in Contract Drawings.

C. Remove existing equipment indicated to be relocated in a manner that allows re-use. Make repairs to or replace relocated equipment for proper system operation.

3.5 INSULATION REMOVAL

A. All pipe and equipment insulation shall be removed, together with all piping, fittings, valves and equipment designated for demolition.

END OF SECTION 40 01 10

SECTION 40 05 01 - COMMON WORK RESULTS FOR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.

B. Requirements of the following Specification Sections apply to this Section:

1. Piping materials and installation methods for each pipe group are specified as subsections of this Section.
2. Section 40 05 29 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT
3. Section 40 05 50 – GASKETS
4. Section 40 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT
5. Section 40 07 00 – PIPING AND EQUIPMENT INSULATION

1.2 DESCRIPTION OF WORK

A. This Section specifies piping materials and installation methods common to more than one section of Division 40 and includes basic piping installation instructions. This Section covers piping that falls under the ASME B31.1 Power Piping Code.

B. Types of pipes and pipe fittings specified in this Section include the following:

1. Steel Pipes.
2. Miscellaneous Piping Materials/Products.

C. Pipes and pipe fittings furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division 40 Sections and in general shall comply with the requirements of this Section.

D. HDPE piping, HDPE-to-carbon steel transition fittings, and directed buried valves are specified in Division 33.

E. PSAN related piping is specified in Division 22.

1.3 SUBMITTALS

A. Product Data: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting.
2. Piping schedule showing manufacturer, ASTM number, ASTM type, ASTM grade, pipe or tube weight, fitting type, and joint type for each piping system.
3. The piping and accessories submittal shall clearly describe what components are going to be used for each piping group.
4. Records and reports required for certain pipe groups as specified in individual piping group specifications.
5. Provide ISO 9001 and Independent Test Reports if applicable per Quality Assurance paragraph below.
6. “Fire Watch” safety procedures.
7. Spool drawings of major systems are required as specified in Section 40 05 29 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT so that the thermal stress and pipe support analysis can be completed. Refer to that Section for a complete description.
8. Hot Tap and Plug Fittings and Components: Include sizes, materials, ratings, and installation requirements of all components including split tee, fitting, and valve. Include procedure description including requirements for installation and safety. Include fabricator’s qualifications for performing hot tap work.

B. Maintenance Data: In accordance with Section 01 77 00 – PROJECT CLOSEOUT PROCEDURES submit the following:

1. Maintenance data and parts lists for each type of mechanical fitting.

C. Quality Control Submittals: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Installers Qualification Data:

    a. Welder Qualification Data: Copies of certification; include names, home addresses and identification numbers of welders.
    b. Welding Procedures: Shall include QW-482 "Suggested Format for Welding Procedure Specification (WPS)" and QW-483 "Suggested Format for Procedure Qualification Record (PQR)" as specified in Welding Quality Assurance below for different weld types.
    c. Welders' Certificates: Shall include QW-484 "Suggested Format for Manufacturer's Record of Welder or Welding Operator Qualification Tests (WPQ)" for all welders for all weld types as specified in Welding Quality Assurance below.
    d. Welder Identification List

2. Manufacturer's Data: Copy of mill certificates, laboratory test and manufacturing reports relating to chemical and physical properties of pipe, fittings, and related materials.
3. Independent Testing Agency Qualifications: As specified in this Section.
4. ISO 9001 and Independent Test Reports: As specified in Quality Assurance below.
5. Hot Tap Qualifications: As specified in this Section.

D. Piping Tests: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Hydrostatic Testing Records: The Contractor shall maintain a constantly updated log (as described in this Section) available to the University and Engineer at all times. The Contractor shall submit a final log to the Engineer for his records.
2. Visual Examination Examiner's Qualifications: Provide as specified in this Section.
3. Visual Inspection Reports: Provide as specified in this Section.
4. Ultrasonic (Phased Array) Examiner's Qualifications: Provide as specified in this Section.
5. Ultrasonic (Phased Array) Inspection Reports: Provide as specified in this Section.
6. Independent Testing Agency Information: The Contractor and the independent testing agency shall provide a signed statement that the testing agency has no affiliation with the Contractor and can serve as an independent agency to provide the testing as specified.
7. Welder Identification List: Provide as specified in this Section.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. All piping systems with the exception of potable city water, sanitary, and other plumbing systems piping shall be designed, fabricated, erected, and tested in accordance with ASME B31.1.
2. All welders performing welding to this procedure shall be qualified to this procedure in accordance with ASME Boiler and Pressure Vessel Code, Section IX, “Welding and Brazing Qualifications.”
3. Conform to ASME Boiler and Pressure Vessel Code and ASME B31.1 Power Piping Code for administrative and technical requirements for Boiler External Piping and Nonboiler External Piping.
4. Comply with the latest editions of the publications of the following Agencies to the extent referenced in this Section:

    a. ANSI - American National Standards Institute.
    b. API - American Petroleum Institute.
    c. ASME - American Society of Mechanical Engineers.
    d. ASTM - American Society for Testing and Materials.

e. AWS - American Welding Society.
f. AWWA - American Water Works Association.
g. CISPI - Cast Iron Soil Pipe Institute Association.
h. FM - Factory Mutual.
i. NFPA - National Fire Protection Association.
j. PFI - Pipe Fabrication Institute.
k. UL - Underwriter's Laboratories, Inc.

B. Special Precautions

1. Torch cutting will be permitted only with the specific written approval of the Owner. Any cutting method, which may create sparks, must include "Fire Watch". Submit "Fire Watch" procedure for approval.
2. Draining operations must not damage building components or endanger human health.

C. Country of Fabrication:

1. All piping, fittings, and piping accessories not manufactured, fabricated, and/or assembled in the United States of America or Canada must be manufactured, fabricated, and/or assembled by an ISO 9001 registered corporation.
2. Submit ISO 9001 registration certificates for all corporations where the piping, fittings, and piping accessories are not manufactured, fabricated, and/or assembled in the United States or Canada.
3. For all piping, fittings, and piping accessories not fabricated in the United States or Canada, submit an independent test report for all materials to be provided.
4. No piping, fittings, and piping accessories manufactured, fabricated, and/or assembled in China including Taiwan are permitted to be provided in this Contract.

D. Hot Tap Service Company Qualifications

1. Hot tapping and live plugging shall be performed by a company that specializes in this work.
2. The hot tap and live plugging company shall have a minimum of 10 years of experience with similar work for this project in steam piping for utility projects. Furmanite/IPSCO, Kerr Engineering, and TD Williamson are known companies that can satisfy experience requirements. The Project Superintendent and welder from the hot tap company shall also demonstrate at least 10 years of experience with steam (high temperature) hot tap and live plugging work similar to this project.

1.5 WELDING QUALITY ASSURANCE

A. Welding Procedures: In the form of a submittal, the Contractor shall record in detail and shall qualify the Welding Procedure Specifications for every welding procedure that he proposes. Procedures shall be developed for all metals included in the work. The

procedures for making transition welds between different materials or between plates or pipes of different wall thickness shall be qualified. Qualification for each welding procedure shall conform to the requirements of ASME B31.1, and to this specification. The method for each system shall be fully described including the number of beads, the volts, the amperes, and the welding rod for various pipe thicknesses and materials. The welding procedures shall specify end preparation for butt welds including cleaning, alignment, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by approved welding procedures, unless otherwise indicated or specified. Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable welds. Welding procedures shall be identified individually and shall be clearly referenced to the type of welding required for this project. These procedures shall be the same as those used for all pipe welder qualification tests, all shop welds, and all field welds. The Contractor shall provide Procedure Qualification Records for all proposed Welding Procedure Specifications (WPS).

B. Welding Procedure Submittals: Submit the following:

1. Welding Procedure Specifications: Provide for each weld type. It is highly recommended that the Contractor use ASME Form E00006, QW-482 "Suggested Format for Welding Procedure Specification (WPS)".
2. Procedure Qualification Records: Provide for each weld type. It is highly recommended that the Contractor use ASME Form E00007, QW-483 "Suggested Format for Procedure Qualification Record (PQR)".

C. Welder Qualification:

1. WPQs: Provide welder qualifications for each welder for each weld type. It is highly recommended that the Contractor use ASME Form E00008, QW-484 "Suggested Format for Manufacturer's Record of Welder or Welding Operation Qualification Tests (WPQ)." The WPQs shall be performed under the witness of an independent agency. The witness shall be a representative of an independent testing agency, Authorized Inspector, or consultant, any of which must be approved by the National Certified Pipe Welding Bureau. The qualifying test segment must be a 2 inch nominal pipe size with wall thickness within range of the WPS. Tests position shall be "6G" per ASME Section IX.
2. Evidence of Continuity: Welder qualifications must be current. If the qualification test is more than 6 months old, provide record of welding continuity for each welder. Record of welding continuity shall show that the welder in question has performed welding to the procedure in question without a 6 month continuous span of inactivity since the date that the welder qualification test was passed for the submitted welding procedure. Record of welding continuity shall include, at a minimum, the welder's employer name and address, the date the welder qualification test was passed, and the dates indicating welding continuity including welding procedure for each date.

D. Weld Records:

1. For all welding within the scope of ASME B31.1, the Contractor shall submit for approval an administrative procedure for recording, locating, monitoring, and maintaining the quality of all welds to be performed on the project. This quality control document record shall include but not be limited to drawings and schedules identifying location of each weld by individual number, identification of welder who performed each weld by individual welder's name, stamp number, date and WPS used.
2. After achieving qualification, but before being assigned work, each qualified person shall be assigned an identifying number by the Contractor that shall be used to identify all of his welds. A list of qualified persons with their respective numbers shall be submitted by the Contractor and shall be maintained accurately with deletions and additions reported promptly.
3. Upon completing a joint, the welder shall mark the pipe not more than 6 inches from the weld with the identifying number and the last two digits of the year in which the work was performed. Identification marks shall be made by using a rubber stamp or felt-tipped marker with permanent, weatherproof ink or other methods approved by the Engineer that do not deform the metal. For seam welds, identification marks shall be placed adjacent to the welds at 3-foot intervals. Identification by die stamps or electric etchers will not be allowed. The markers are to be provided by the Contractor. Substituting a map of welds with welders' names shall not be acceptable.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Piping material shall be packaged in accordance with ASTM A 700 and as specified herein.

B. Pipe Storage: Upon the receipt of each shipment of pipe on the job, the Contractor is responsible for maintaining the marking and for the storage of all pipe in such a manner that the ASTM material specifications and method of manufacture (seamless, etc.) of each piece of pipe will be clearly discernible at the time of its installation in the system. If at the time of its installation any piece of pipe is not readily identifiable, it will be subject to rejection, or arbitrary downgrading by the Engineer to the lowest grade which has been received on the job to that date.

C. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, and clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

D. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

E. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

F. External machined surfaces, flange facings, and bolt holes shall be protected against corrosion during shipment, storage, and installation with the application of one coat of water-soluble, rust-inhibiting coating.

G. All edges prepared for field welding shall be protected against corrosion during shipment, storage, and installation with one coat of rust-inhibiting coating (deoxaluminate or Owner-approved equivalent) applied after inspection and cleaning.

PART 2 - PRODUCTS

2.1 GENERAL

A. Code: The fabrication and erection of all applicable piping shall conform to the latest edition and all current revisions of ASME Code for Power Piping B31.1. In addition, the fabrication and erection of all piping shall conform to all applicable Federal, State, and Local laws.

B. Piping Materials: Provide all pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by the intended service use, comply with governing regulations and industry standards, and obtain approval from the Engineer prior to any work.

C. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections as determined by the intended service use and install in accordance with pipe manufacturer's recommendations. In addition, obtain approval from the Engineer before performing any work.

D. All materials shall be submitted for review prior to being incorporated in the Work. Material for pipes, fittings, and accessories shall be new and in accordance with ASTM specifications. Welded attachments shall be made of material compatible with the piping. Where the material for a specific component is not specified, it shall be selected by the Contractor for review by the Engineer. Material and equipment specified by brand or manufacturer are typical and designate the type, quality, and purpose of the items. Similar and equivalent items of equal standards may be accepted if, in the opinion of the Engineer, they are equivalent in all important respects and are equally suitable for the purpose intended. The Contractor shall submit descriptive literature and secure the Engineer’s written approval for any substitutions before orders are placed.

2.2 PIPE INDEX

A. General: A “PIPING INDEX” is provided at the end of this Section and specifies the designation or “Service Group”, normal operating conditions, design conditions, pipe material, joints, flanges, fittings, unions, bolting materials, testing procedures, and internal cleaning procedures for each piping system as identified in the Contract Drawings. If there are piping systems identified on the Contract Drawings that are not identified in the Index, or there is a question of what Service Group a component belongs to, notify the Engineer.

B. Other Piping System Components

1. Gasket groups are specified in detail in Section 40 05 50 - GASKETS.
2. Valve groups are identified and specified in Section 40 05 23 – VALVES.
3. Insulation groups are specified in detail in Section 40 07 00 - PIPING AND EQUIPMENT INSULATION.

2.3 HOT TAPPING

A. Scope Description:

1. Existing pipe sizes are shown on the drawings. It is believed that the existing steam piping is Schedule STD and the condensate piping is Schedule XS. The pipe size, wall thickness, and condition of the existing piping at the hot tap shall be verified by the Contractor before performing any work or ordering materials.
2. All work shall be in compliance with ASME B31.1, including fittings, valves, and piping.
3. Refer to Part 1 requirements for submittals, quality control, and required work experience.
4. Coordinate all work with the Owner and the Engineer.
5. Due to the sensitive nature of work regarding a hot tap, notify the Owner and Engineer at least 1 week in advance before welding activities.

B. General:

1. All components shall be rated for the design conditions in the “PIPING INDEX”.
2. The timing of the work shall be scheduled to occur when flow through the pipe is on the low end because in the shoulder months of spring and fall, steam demand is lower. If there are minimum velocity requirements for the hot tap process, this needs to be taken into consideration. Consult with Owner and Engineer.

C. Components:

1. Hot tap fittings shall be flanged, 3-way tee with full encirclement.
2. Tapping machine shall be coordinated with all supplied components.
3. Provide means to pull back the cut piece out of the pipe.
4. Components and work shall be by TD Williamson, Inc, Furanite IPSCO, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Inspection by the Engineer and University: Material, equipment, design, and workmanship shall at all times be subject to the inspection of the Engineer and the University and, upon being notified in writing by the Engineer, any material, equipment, or workmanship not meeting the specified requirements shall be replaced or reworked immediately without additional cost to the University. Inspection by the Engineer and/or the University shall not relieve the Contractor from the responsibility for full compliance with the specified requirements.

B. University-Furnished Drawings: The Drawings supplied by the University including the Contract Drawings are not intended to be fabrication drawings. Dimensions for pipe fabrication shall be field checked prior to fabrication.

3.2 PREPARATION

A. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

B. Conformance: The Contractor shall be responsible for checking and conforming to size, location, and flange drilling of all piping, valves, flow nozzles, and material furnished by the University for this piping installation.

C. Measurement Verification by the Contractor: Before fabrication, the Contractor shall verify all measurements at the site and obtain all necessary additional information for completion of the Work, including the following:

1. Actual location of weld nozzles, flanges, or other type of terminal connections and verification of weld nozzle ends and flange facings that are existing, to which the Contractor’s Work must connect.
2. Exact location of existing piping with supports and hangers in place.
3. Exact location of new and existing structures and equipment.
4. Interferences and difficulties that may exist.
5. The Contractor shall take such field measurements and allow for such makeup lengths or closures necessary for accurate alignment and assembly.

3.3 INSTALLATIONS

A. General:

1. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leak-proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 0.05 inches misalignment tolerance.
2. Provide lock-out/tag-out of existing piping systems before doing tie-in work. Coordinate with the University.

B. Piping Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location arrangement and restrictions of the piping systems. Location and arrangement of piping layout shall take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.

C. Piping Alignment:

1. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
2. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Contract Drawings.
3. Locate groups of pipes parallel to each other, spaced to permit applying full insulation, servicing of valves, and thermal expansion of piping systems.

D. Install drains at low points in mains, risers, and branch lines consisting of a tee, reducing tee, weld-o-let, or soc-o-let fitting, applicable 3/4 inch shut-off valve, 3/4 inch nipple, and cap for pipe sizes 6 inches and smaller; provide 2 inch shut off valve, nipple, and cap for pipe sizes 8 inches and larger. All components shall conform to the piping systems described in this Section and to Section 40 05 23 – VALVES. The location of the high point vents and low point drains shall be approved by the Engineer.

E. Electrical Equipment Spaces: In no instance shall piping be routed above electrical equipment.

F. Interferences: Do not run piping or conduits through ducts or equipment cabinets.

G. Shop Prefabrication:

1. Where shop prefabrication is not specified but is done as the Contractor's choice, any adjustments necessary due to inaccuracies in equipment setting and dimensions or location of existing obstructions shall be done at no additional cost. No shop fabrication sketches will be checked by the Engineer, but Contractor shall submit drawings to the Engineer for information.
2. All shop fabrication shall be fabricated to dimensional tolerances in accordance with Pipe Fabrication Institute Standard ES-3. Accumulated tolerances between fixed points shall not exceed plus or minus 3/8 inch.

3. The University and the Engineer reserves the right to visit the Contractor's shop to review shop fabrications and shop quality control procedures.

H. Thermal Cutting: When thermal cutting is required, the material shall be in accordance with ASME B31.1 welding preheat requirements. Thermal cut surfaces shall be ground to remove all slag, oxide, and surface irregularities to 1/16 inch. Austenitic stainless steel pipe shall be cut by mechanical means only.

I. Welded Attachments:

1. Welded attachments shall include lugs, brackets, and similar devices welded to pipe for hangers, supports, and guides. Weld procedures used to attach such devices shall be compatible with the base material. Preheating shall be in accordance with ASME B31.1 requirements for piping material.
2. All areas where lugs or attachments are removed or repaired shall be tested hydrostatically to meet accepted standards stated in ASME B31.1. Any linear indications shall be removed and the area retested. The procedure shall be repeated until no indications are noted.

3.4 FITTINGS AND SPECIALTIES

A. Use fittings for all changes in direction and all branch connections. For piping greater than 2 inch NPS, if the change in direction is less than 5 degrees, a miter is acceptable and must be provided in accordance with ASME B31.1. No miters are acceptable for angles greater than 5 degrees. For changes in direction greater than 5 degrees, cut a forged fitting. For pipe sizes 2 inch NPS and smaller, changes in direction shall be done with standard 45 and 90 degree elbows – no miters or cut fittings acceptable.

B. Pipe Elbows: Provide pipe elbows where depicted on the Contract Drawings. Use long radius elbows except where specifically designated on the Contract Drawings.

C. Branches: Wherever branch pipe is indicated, install type of fitting shown on Contract Drawings, i.e. forged branch connection fitting (weld-o-lets and sock-o-lets), regular "T" fitting, or reducing "T" fitting. If the type of fitting is not shown on the Contract Drawings or specified in the piping specifications, the Contractor may choose between the above mentioned fittings, within the limits of the following:

1. Forged branch connection fittings may only be used if the smaller branch pipe is at least two standard nominal pipe sizes smaller than the larger main pipe. No "stub-ins" are permitted.
2. All fittings and procedures conform to the specific piping group specification as scheduled in this Section.

D. Hot Tapping: The Contractor shall provide taps into existing mains that will remain energized at up to piping system design pressure where a hot tap is specifically indicated on

the Contract Drawings. This procedure is also known as wet tapping. Hot or wet tapping shall be performed by experienced personnel with special hot tap fabrication equipment. All hot tapping shall be coordinated with the Owner and Engineer. Hot tapping is only allowed where indicated on the Contract Drawings or by written approval from the Owner or Engineer.

E. Reducers: Unless explicitly stated on Contract Drawings, use forged fittings. Use concentric fittings except for steam systems, for reducers in horizontal in direction of flow, use eccentric flat on bottom to allow condensate to continue flowing in direction of steam travel.No mitered fittings are allowed.

F. Refer to Section 40 05 20 - PIPING SPECIALTIES for specification of pipe specialties including steam traps, strainers, and automatic air vents.

3.5 JOINTS

A. Threaded Joints:

1. Thread pipe with tapered pipe threads in accordance with ANSI B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Immediately before erecting the piping, all threads on pipe and all fittings shall be thoroughly cleaned of cuttings, dirt, oil, or other foreign matter.
2. Ordinary or special-type screwed joints shall be kept to a minimum to reduce any possibility of leakage. Continuous runs of piping shall be used, wherever possible. All screwed connections shall have full threads of true taper and shall be accurate to gage. Use Teflon and pipe compound on threaded joints. Care shall be taken to prevent obstruction of pipe or tubing when using Teflon tape.
3. When screwed connections are specified to be seal welded, the pipe shall be threaded so that not more than one thread remains outside the joint. The pipe to be welded shall be cleaned to bare metal and free of oil, scale, and dirt. The joint shall be made up hand-tight, without tape, and shall be welded with not less than two light beads with the weld cleaned between successive passes. The seal weld shall completely cover the thread with no undercut on the pipe. Plugs to be installed in seal weld fitting shall be installed, using Teflon tape, after all welding is complete.

B. Welded Joints:

1. General:

a. Weld pipe joints only when ambient temperature is above 0 degree F where possible.
b. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
c. Use pipe clamps or tack-weld joints with 1 inch long welds; 4 welds for pipe sizes to 10 inches, 8 welds for pipe sizes 12 inches to 20 inches.

d. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.
e. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
f. If piping component ends are bored, such boring shall not result in the finished wall thickness after welding less than the minimum design thickness.
g. The inside diameters of piping components to be butt-welded shall be aligned as accurately as is practicable within existing commercial tolerances on diameters, wall thickness and out of roundness. Alignment shall be preserved during welding. The internal misalignment of the ends to be joined shall not exceed 0.05 inch.

2. Welding Processes:

a. All welding on metal piping systems shall be done using qualified welding and qualified welders and welding operators in accordance with Section IX of the ASME Boiler and Pressure Vessel Code.
b. All welding shall be done by a process that is compatible with the work being welded and the working conditions.
c. Where a specific welding process is called for in the piping group, it shall govern.
d. Weld Types:

1) Steam and Condensate Piping: The root pass shall be per the GTAW tungsten inert gas (TIG) method with E6010 and another hot pass with E6010. The remaining of the weld can be completed with TIG using E6010, or can be completed with SMAW using E6010 or E7018.
2) Chilled Water Piping: Two options:

a) Shop Fabricated Welds Back Side Can Be Cleaned: Flushing out the carbon steel chilled water pipe will be difficult in this project. As such, only shop welds where the back side can be cleaned of slag by the welder can be performed by the SMAW procedure with E6010 on the root with the remaining completed with E7018.
b) Field Welds and Shop Welds Where Back Side Cannot Be Cleaned: The root pass shall be per the GTAW tungsten inert gas (TIG) method with E6010 and another hot pass with E6010. The remaining of the weld can be completed with TIG using E6010, or can be completed with SMAW using E6010 or E7018.

3. Welding Grooves:

a. The ends of steel pipe and fittings to be erected with butt welded joints shall be beveled to form welding grooves in accordance with ANSI B16.25, except where otherwise noted in these Specifications, or on the Contract Drawings.

b. Welding grooves for butt welded joints in pipe of unequal wall thickness shall be beveled in accordance with ASME Code for Pressure Piping B31.1 - latest edition, latest revision and section that is applicable.

4. Backing Rings: Backing rings or consumable inserts shall not be used and are not allowed.
5. Cleaning of Welding: All slag or flux remaining on the bead of welding shall be completely removed before laying down the next successive bead and at the completion of the weld.
6. Preheating of Welded Joints: Pipe adjacent to joints before and during welding shall be preheated by any suitable method in accordance with the qualified welding procedure and in all cases shall be in accordance with ASME B31.1, Paragraph 131.
7. Weld Quality:

   a. All welds shall have full penetration and complete fusion with a minimum of weld metal protruding on the inside of the pipe.
   b. The finished weld contour shall be uniform, with the toe or edge of the weld merging smoothly into the base material. Butt welds shall have a slight reinforcement build-up gradually from the toe or edge toward the center of the weld. The limitation on butt weld reinforcement shall be in accordance with ASME B31.1, Table 127.4.2 and shall apply separately to both inside and outside surfaces of the joint. Fillet welds may be slightly concave on the finished surface.

8. Identification of Welders: Refer to Quality Assurance paragraph of Part 1 of this Section.

C. Socket Welding Joints: Where socket welding valves or fittings are used, the pipe shall be spaced with a minimum of 1/16 inch clearance between the end of the pipe and the socket so that no stresses will be imparted to the weld due to "bottoming" of the pipe in the socket. The fit between the socket and the pipe shall conform to applicable standards for socket weld fittings and in no case shall the inside diameter of the socket exceed the outside diameter of the pipe by more than 0.075 inches.

D. Non-ferrous Pipe Joints:

1. Brazed And Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ASME B31.1.
2. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.

E. Flanged Joints:

1. Match flanges within piping system and at connections with valves and equipment

where specified. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets. Hot torqueing may be required during start-up to cycling does not cause leaks.

2. All slip-on flanges are to be welded on front and back, no exceptions. Welding neck flanges shall be bored to match the attached pipe.
3. Flange faces shall be in perfect alignment, with holes straddling the principal centerlines. Ordinary or special-type flanged joints shall be kept to a minimum to reduce any possibility of leakage. Continuous runs of piping shall be used, wherever possible. All bolts in flanged construction shall be uniformly tightened with proper wrenches only. Hammering and bumping are prohibited. Care shall be taken to secure uniform pressure on the gasket and to avoid overstressing of the bolts, dishing of flanges, and compression of the gasket beyond limits. All bolts shall be well lubricated over the entire thread with a heavy graphite-and-oil mixture prior to tightening operation.
4. Bolting with Spiral-Wound Gaskets: All steel bolts shall be tightened to obtain a cold stress between 30,000 and 45,000 psi. Torque, if used, shall be correlated to bolt stress by onsite strain testing.
5. Bolting with Rubber Gaskets: Bolts shall be uniformly tightened to compress gaskets approximately one-half of their original thickness. Care shall be taken to avoid damaging the gasket by over tightening.

3.6 CLEANING, FLUSHING, AND INSPECTING

A. Exterior Cleaning: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of insulation.

B. Interior Cleaning:

1. Steam and Condensate Piping: For steam systems, Facilities Services Utility and Energy Services (FS-UES) will introduce steam to the new piping and let the condensate drain for 4 hours or longer until needed to clear condensate to below 30 micromhos conductivity. During this time, the drip legs will be blow down. Condensate will also be drained until conductivity is 50 micromhos or less.
2. Chilled Water:

    a. Refer to Division 33 for requirements for cleaning direct buried HDPE piping.
    b. There is a limited amount of carbon steel pipe in this project. Hand wipe all surfaces clean before closing up pipe. If dirt and debris is still inside the carbon steel pipe, meaning it cannot be hand wiped and it is not planned to be included in the flushing process of the HDPE pipe per Division 33, clean the interior of the carbon steel pipe with a water jet and hose it down through the drains. Allow the Engineer to inspect before closing up the pipe. Do not close up the carbon steel pipe until the Engineer has been given 3 days' notice to inspect the cleanliness of the pipe.

C. Inspection: The Engineer or the Cx Agent may randomly test the torque of bolts in the cold or hot positions to verify the specified cold stress. The Contractor shall provide access to bolts so this testing can take place. For every bolt found incorrectly torqued, the Contractor shall go back and check an additional 3 and document the results at no additional cost or delay to the project.

3.7 PIPING TESTS – HYDROSTATIC AND PNEUMATIC

A. General:

1. Provide temporary equipment for testing, including pump and gages. The gage shall be accurate to within 3 PSIG and shall be calibrated within six months of the test as recorded on a sticker on the gage. Test piping system before insulation is installed. Pressure testing shall be performed following the completion of postweld heat treatment, nondestructive examinations, and all other fabrication, assembly, and erection activities required to the provide the system or portions thereof subjected to the pressure test with pressure retaining capability. Remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time. The Contractor shall provide air vents at all high points in the system to purge air pockets while the system is filling.
2. The Contractor shall test each section of pipe before it is connected to the existing piping. Provide temporary piping including welded caps prior to the termination into near end of new piping so that new piping can be hydrostatically tested. After successfully hydrostatic testing, remove the temporary caps and provide new piping to tie into existing piping. It is recognized that the final connection pieces to existing piping will not be hydrostatically tested; however, flow (at normal operating pressure) shall be established through the final connection pieces and fittings, with no visual evidence of weeping or leakage prior to insulation.
3. Testing shall be performed with calibrated test gages (Contractor furnished) in the presence of the University or Engineer.
4. The Contractor shall furnish all temporary pipe, fittings, and pumps required to perform the tests.
5. Pipe hangers, snubbers, or restraints shall be blocked, disconnected, or pinned, as required, prior to pressure testing or cleaning and shall be restored to operating condition following such test.
6. Equipment and instruments shall be isolated and openings shall be plugged, as required, to accomplish the required testing and cleaning and to prevent over pressurizing connecting piping or equipment. Relief and safety valves shall be removed and the respective nozzle blanked for testing of the associated equipment. Do not gag relief valves – remove them.
7. The equipment to which any piping system is attached shall not be subjected to any line tests. The test pressures apply to the piping materials as specified but shall not be

assumed to apply to piping specialties, accessories, or equipment, including safety heads, rupture disks, relief valves, expansion joints, instruments, or filters. Items that may be damaged by the test pressure shall either be removed or blanked off.

8. Lines containing check valves shall have the source of test pressure located on the upstream side.
9. Testing shall not take place until all specified NDE (VT, MT, UT, etc) has been performed and reviewed and accepted by the Engineer.

B. Test Pressure:

1. The test pressure and type of test (hydrostatic or pneumatic) is specifically stated in the “PIPING INDEX”. Test pressure is 1-1/2 times design pressure per ASME B31.1, not operating pressure. Do not deviate from stated test pressure.
2. The test pressure shall be continuously maintained for a minimum time of 4 hours. During this 4 hour period, no pressure drop shall be measured. After the 4 hour period, if necessary, the pressure may then be reduced to design pressure and held for such time as may be necessary to continue to conduct the examinations for leakage. Examinations for leakage shall be made of all joints and connections. The piping system shall show no visual evidence of weeping or leaking. Hydrostatic testing shall be witnessed by the University or Engineer. After any leaks are found and corrected, the test shall be repeated.

C. Test Blinds:

1. If during the field testing of piping it becomes necessary to insert test blinds in any part of this piping, the Contractor shall provide test blinds and all work required including the flanges and welding of flanges.
2. Test blinds shall be equipped with a long handle.
3. The Contractor shall submit a written description of the location of test blinds before testing.
4. The Contractor shall remove all test blinds after testing.

D. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

E. Records:

1. It is the responsibility of the Contractor to keep accurate, updated records of all pressure testing. The Contractor shall submit a final log of all pressure testing for the University's records.
2. The Contractor shall maintain a constantly updated listed of the following for all pressure tests:

    a. Date and time of test.
    b. Test pressure.

c. Testing medium.
d. Piping system tested.
e. Extent of piping system tested so that it can be clearly identified up to what point a piping system has been tested.
f. Test results. All failures shall be indicated with the cause explicitly stated.
g. Signed witnesses of each test which shall be one employee of the Contractor, Engineer, and a University representative.

F. Hydrostatic Testing

1. All non boiler external piping shall be hydrostatically tested in accordance with Paragraph 137 of the ASME B31.1 Power Piping Code.
2. The test water for hydrostatic tests shall be clean and of such quality as to minimize corrosion of the materials in the piping system. The temperature of the test medium shall be a minimum of 60 degrees F, unless the Engineer specifies otherwise. The test pressure shall not be applied until the system and the pressurizing medium are approximately at the same temperature.
3. The Contractor shall provide air vent valves at all high points in the system to purge air pockets while the system is filling and drain valves at all low points to drain system.
4. The system shall be filled with water, care being taken that air is completely vented from the top of system so that there are no air pockets remaining.
5. Vent and drain piping shall be leak tested by using 6.5 PSIG pressure or by maintaining a 15 foot water column, either applied to the highest point of the line being tested. The extent of the test shall be an initial service leak test in accordance with Paragraph 137.7 of ASME B31.1.
6. The leak test shall be considered satisfactory if no leakage is discovered on the piping or at any joints and if no sweating due to porosity is discovered on piping or at joints. Lines requiring repairing shall be retested to the pressure originally specified. The piping system, exclusive of possible localized instances at pumps or packing, shall show no evidence of leaking.
7. Drain test water from piping systems after testing has been completed.

G. Pneumatic Testing

1. Provide pneumatic testing of piping systems only where allowed in written agreement by the Engineer and University. Assume for bid purposes that approval will not be provided for any systems in this project. Pneumatic testing shall be in accordance with ASME B31.1, Paragraph 137.5.3. Follow procedures of Initial Service Test per ASME B31.1, Paragraph 137.7 as a precaution.
2. The use of a pressurized gas can be very dangerous due to the contained energy. The Contractor shall take special precautions to ensure the protection of personnel and equipment while the testing medium is under pressure. The piping system shall be manned during the entire test with close monitoring of a calibrated pressure gage, compressed air source, and vent. Pneumatic testing systems do not immediately drop pressure if there is a leak or break so this is a major safety issue. Provide warning signs and rope off areas adjacent to piping that is being pneumatically tested.

3. The pressure testing gas shall not be flammable or toxic; preferably compressed air or nitrogen.
4. The Contractor shall perform a preliminary pneumatic test at 25 psig to identify major leaks. The system test pressure shall be increased to half of the test pressure, after which the pressure shall only be increased in increments of 10% of the test pressure until the full test pressure is achieved. The full test pressure shall be continuously maintained for no less than 4 hours. The pressure shall then be reduced to the system design pressure or 100 psig (whichever is less) and held for such a time that the Contractor shall fully examine the piping system for leakage.
5. The leakage examination shall consist of a soap bubble method or approved equal. All joints and connections shall be examined. The piping system shall show no evidence of leakage, other than possible localized instances at pump or valve packing.
6. Drain the compressed gas from the system in a slow and controlled manner after all testing has been completed.

3.8 IN-SERVICE TESTING

A. General: In-service testing is acceptable when other types of testing are not practical or when leak tightness is demonstrable due to the nature of the service and is only acceptable when approved in writing by the University and Owner. An example is piping where shut-off valves are not available for isolating a line and where temporary closures are impractical. In-service testing shall not take place until all specified NDE (VT, MT, UT, etc) has been performed and reviewed and accepted by the Engineer.

B. When performing an initial service test, the piping system shall be gradually brought up to normal operating pressure and continuously held for a minimum of 10 minutes. Examination for leakage shall be made of all joints and connections. The piping system exclusive of possible localized instances at pump or valve packing shall show no visual evidence of weeping or leaking.

3.9 PIPING TESTS - VISUAL EXAMINATION

A. General: Visually examine all pipe welds per ASME B31.1 as indicated in the “Piping Index”, located in this Section. As described below, visual examination of welds shall be performed by the Contractor. This type of testing is required by ASME B31.1 and shall not be paid for by the Engineer or University.

B. Acceptance Standards:

1. The acceptance standards for visual examination shall be as defined in ASME B31.1, Paragraph 136.4.2.A, and are repeated here for convenience. The following indications are unacceptable:

    a. Cracks-external surface.

b. Undercut on surface which is greater than 1/32 inch deep.
c. Weld reinforcement greater than that specified in Table 127.4.2. of ASME B31.1.
d. Lack of fusion on surface.
e. Incomplete penetration (applies only when inside surface is readily accessible).
f. Any other linear indications greater than 3/16 inch long.
g. Surface porosity with rounded indications having dimensions greater than 3/16 inch or four or more rounded indications separated by 1/16 inch or less edge to edge in any direction. Rounded indications are indications which are circular or elliptical with their length less than three times their width.

2. In addition, acceptance will also be based on the proper lay-out, materials, and methods, as specified.

C. Failed Welds:

1. All welds not passing visual examination shall be repaired or replaced at no expense to the University.
2. Visual defects found shall require additional VT as recommended by inspector.
3. Do not begin to repair or replace the weld until the weld report has been submitted to the Engineer and the Engineer gives approval for repairing the weld with the method that the Contractor proposes. Repair shall be performed using the qualified welding procedures applicable to the original weld.

D. Reporting:

1. Reports for visual examinations of welds shall be required for all piping larger than 3 inch NPS except for vent and drain services. Reports preformed for visual examinations by the Contractor are not required to be submitted, but shall be kept available for review at any time by the University or Engineer.
2. Each weld report shall include the following:

a. Date of weld examination.
b. Type of examination.
c. Examiner's name.
d. Welders' names including all persons who worked on the weld and their work involved.
e. Piping system.
f. Weld location.
g. Weld procedure and materials.
h. Materials and dimensions of items that were welded.
i. Visual examination results.

E. Examiners' Qualifications:

1. All persons performing visual examinations and evaluating examinations shall be certified according to AWS QC1 or those requirements stated explicitly in ASME B31.1.

It is not intended to have a third party inspector perform this service.

2. Credentials and certification of all examiners must be submitted and approved prior to an examiner performing the initial examination.

F. Visual Examination Requirements:

1. Welds designated for visual examination shall be examined after the weld is completed for cracks, contour and finish, bead reinforcement, undercutting, overlap, size of fillet welds, finished weld appearance, weld size, weld length, dimensional accuracy of weldment, and monitor post weld heat treatment.
2. Records of visual examinations must be kept as described in this Section.
3. Shop fabricated welds may be examined in the shop prior to arrival at the project site provided all other conditions of this Section are satisfied.

G. Examiner's Scope:

1. Visual examinations to be performed by the Contractor may be performed and interpreted by an employee or employees of the Contractor, provided that each individual is certified as specified. As an option, the Contractor may obtain the services of an independent testing agency to perform these examinations.
2. If the Contractor elects to utilize the services of an independent testing agency to perform any visual examinations, the following applies:

    a. The qualifications for the personnel of the independent testing agency performing the examinations shall be submitted.
    b. The Contractor shall provide all required access and lighting for the independent testing agency.
    c. The Contractor shall be responsible for all of the independent testing agencies activities, including handling submittals, performing evaluations at the required times, etc.

3. A welder who has performed any work with regard to a specific weld shall not perform the visual examination of the same weld.

3.10 PIPING TESTS – MAGNETIC PARTICLE (MT)

A. General: Not required for this project.

3.11 PIPING TESTS - ULTRASONIC EXAMINATION (UT) PHASED ARRAY

A. General: Ultrasonically examine pipe welds as indicated in Specification Section 40 05 01 – Table A1 Piping Index. Where UT is designated, butt welds and welded branch connections for sizes over NPS 2 shall be examined per the requirements specified herein. Ultrasonic testing shall be performed by an independent testing agency. UT testing shall be paid for by the Contractor.

B. Acceptance Standards: Shall be in accordance with Paragraph 136.4.6 of ASME B31.1. The Engineer may, at his sole discretion, elect to waive some of the acceptance standards on a case by case basis.

C. Procedure:

1. Ultrasonic examination will be performed in accordance with Article 5 of Section V of the ASME Boiler and Pressure Vessel Code. Ultrasonic examination shall be per the Phased Array procedure. Other types of ultrasonic testing that are not phased array are not acceptable.
2. The procedure will be as described in Paragraph T-593 of Article 5 of Section V of the ASME Boiler and Pressure Vessel Code.

D. Reporting:

1. The report of each ultrasonic examination will be submitted to the Engineer within 2 working days of the examination.
2. In addition to the requirements of Paragraph T-593 of Article 5 of Section V of the ASME Boiler and Pressure Vessel Code, each weld report will include the following:

    a. Date of weld examination.
    b. Type of examination.
    c. Examiner's name.
    d. Welders' names including all persons who worked on the weld and their work involved.
    e. Pipe system.
    f. Weld location.
    g. Weld procedure and materials.
    h. Materials and dimensions of items that were welded.
    i. Ultrasonic examination results.

E. Examiner's Qualifications: All persons performing and evaluating ultrasonic examinations will be certified for NDT Level II as recognized by the American Society for Nondestructive Testing (ANST).

F. Ultrasonic Examination Requirements:

1. The Contractor is responsible for obtaining and paying for the services of the independent testing agency. The Contractor is responsible for providing access to the welds for the Independent Testing Agency.
2. When a limited number of welds are specified (not 100%), the welds to be examined shall be random. The Engineer will designate the specific welds that are to be randomly tested as the job is in progress. The Contractor shall coordinate with the Engineer to ensure that these requirements are met.
3. It is suggested to the Contractor that the Contractor should schedule welds that

require scaffolding are complete so that the Contractor will not have to re-build scaffolding to gain access to the welds.

4. At the discretion of the Engineer, some welds to be tested by ultrasonic phased array may be a mixture of shop welds and field welds or all of field welds. The Engineer will determine during construction.

G. Failed Welds:

1. All welds not passing ultrasonic examination shall be repaired or replaced at no expense to the University or Engineer.
2. Do not begin to repair or replace the failed weld until the weld report has been submitted to the Engineer and the Engineer gives approval for repairing the weld with the method that the Contractor proposes.
3. All failed welds discovered by ultrasonic examination shall be re-examined by ultrasonic examination after the weld is repaired or replaced at no additional cost to the University with the report being submitted to the Engineer and the University within 2 working days of the examination which shall reference the repair of the particular weld.
4. Where a welder has failed an NDE examination three total times inclusive of all test types, that welder shall be permanently removed from the job.

3.12 PIPING TESTS - RADIOGRAPHIC EXAMINATION (RT)

A. General: Radiographically examine pipe welds as indicated in Specification Section 40 05 01 – Table A1 Piping Index. Where RT is designated, butt welds and welded branch connections for sizes over NPS 2 shall be examined per the requirements specified herein. Welds identified as being examined per magnetic particle shall not be examined per radiography. Radiographic (gamma ray) testing shall be performed by an independent testing agency. RT testing will be paid for by the Contractor.

B. Acceptance Standards: Shall be in accordance with Paragraph 136.4.5 of ASME B31.1. The Engineer may, at his sole discretion, elect to waive some of the acceptance standards on a case by case basis.

C. Procedure:

1. Radiographic examination shall be performed in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code.
2. Submit written procedure as described in Paragraph T-221 of Article 2 of Section V of the ASME Boiler and Pressure Vessel Code.

D. Radiation Safety Concerns:

1. RT may be minimized at the project site at the discretion of the University due to the potential concern for maintaining operations and potentially having areas being

cordoned off due to potential radiation from the RT process.

E. Reporting:

1. The report of each radiographic examination shall be submitted to the Engineer within 2 working days of the examination.
2. In addition to the requirements of Paragraph T-290 of Article 2 of Section V of the ASME Boiler and Pressure Vessel Code, each weld report shall include the following:

    a. Date of weld examination.
    b. Type of examination.
    c. Examiner's name.
    d. Welders' names including all persons who worked on the weld and their work involved.
    e. Pipe system.
    f. Weld location.
    g. Weld procedure and materials.
    h. Materials and dimensions of items that were welded.
    i. Radiography examination results.

F. Examiner's Qualifications:

1. All persons performing and evaluating radiographic examinations shall be certified for NDT Level II RT as recognized by the ANST. A Nationally Certified level III RT technician per ASNT shall be on staff at the testing laboratory. A Corporate Level III RT without National Certification is not acceptable.
2. Credentials and certification of all examiners must be submitted and approved prior to a person performing the initial examination.

G. Radiographic Examination Requirements:

1. The Contractor is responsible for obtaining and paying for the services of the independent testing agency. The Contractor is responsible for providing access to the welds for the Independent Testing Agency.
2. When a limited number of welds are specified (not 100%), the welds to be examined shall be random. The Engineer will designate the specific welds that are to be randomly tested as the job is in progress. The Contractor shall coordinate with the Engineer to ensure that these requirements are met.
3. It is suggested to the Contractor that the Contractor should schedule welds that require scaffolding are complete so that the Contractor will not have to re-build scaffolding to gain access to the welds.
4. Shop fabricated welds shall be examined in the shop (off site) to allow the Contractor to resolve issues in a more controlled environment and to reduce the annoyances of dealing with barricades and related coordination of radiation exposure at the project site.

H. Failed Welds:

1. All welds not passing radiography examination shall be repaired or replaced at no expense to the University.
2. Do not begin to repair or replace the failed weld until the weld report has been submitted to the Engineer and University and the Engineer gives approval for repairing the weld with the method that the Contractor proposes. Repair shall be performed using the qualified welding procedures applicable to the original weld.
3. All failed welds discovered by radiographic examination shall be re-examined by radiographic examination after the weld is repaired or replaced at no additional cost to the University with the report being submitted to the Engineer and the University within 2 working days of the examination which shall reference the repair of the particular weld.
4. Where not 100% of the welds for each piping system are specified to be tested, for every weld found defective by means of RT, an additional two welds besides the repaired weld shall be examined by RT at no additional cost to the University. At the discretion of the Engineer, the additional examinations may be on the same piping system with the same nominal diameter, may be of the same welder for the failed weld, and shall be selected randomly by the Engineer.
5. Where a welder has failed an NDE examination three total times inclusive of all test types, that welder shall be permanently removed from the job.

3.13 PIPING TESTS – LIQUID PENETRANT (PT)

A. General: Not required for this project.

3.14 OPERATING TEST AND FINAL INSPECTION

A. After cleaning, testing, insulation, painting, and identification, the completed Work shall be tested by an operating test performed by the University under normal service conditions. Upon completion of each operating test, the Contractor shall correct loose or faulty hangers, guides, and anchors and shall provide required devices to eliminate sway or vibration of piping.

3.15 INSULATION, PAINTING, AND IDENTIFICATION

A. Insulate all piping as indicated in Section 40 07 00 - PIPING AND EQUIPMENT INSULATION.

B. Piping identifications shall be in accordance with Section 40 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT.

C. Paint piping systems in accordance with Section 40 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT.

D. Internal Cleaning of Piping: Refer to Paragraph 3.6.

3.16 INDIVIDUAL PIPING SYSTEMS CONSIDERATIONS

A. Steam and Condensate Piping Installation

1. Provide lock-out/tag-out before performing work on existing piping.
2. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.
3. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
4. Reduce pipe sizes using eccentric reducer fitting installed flat on bottom.

END OF SECTION 40 05 01

UNIVERSITY OF FLORIDA
REITZ LAWN INNER ROAD IMPROVEMENTS
UF-644, UF-644A, UF-644B
100% CONSTRUCTION DOCUMENTS

RMF Engineering, Inc.
RMF No: 120147.B0
June 10, 2022

SPECIFICATION SECTION 40 05 01 - TABLE A1
PIPING INDEX

SYSTEM	SERVICE GROUP	DESCRIPTION	CONDITIONS		PIPE SIZE (NPS)	MATERIAL	JOINTS	FLANGES (NOTES 1 & 2)	FITTINGS (NOTE 1)	UNIONS	BOLTING MATERIALS (NOTE 3)	VALVES			GASKET	INSULATION		PAINT	PRESSURE TESTING	INTERNAL CLEANING	NDE			
			OPERATING	DESIGN								SHUT-OFF	THROTTLING	CHECK		GROUP	FINISH				VISUAL	MT	UT - PHASED ARRAY	RT
CONDENSATE, MEDIUM PRESSURE	70C	TRAP CONDENSATE FROM 70S TRAPS TO CONDENSATE MAIN	70 PSIG AT 335 DEG F	90 PSIG AT 474 DEG F	2 INCH AND SMALLER	SCH 80, SEAMLESS, ASTM A106 GR B	SOCKET WELD EXCEPT THREADED AT STEAM TRAPS (SEE NOTE 7)	USE UNIONS	ANSI CLASS 3000 FORGED STEEL SOCKETWELD (EXCEPT THREADED FOR STEAM TRAPS PER NOTE 7) IN ACCORDANCE WITH ASME B16.11. MATERIAL PER ASTM A105.	ANSI CL 3000 SOCKET WELD (EXCEPT THREADED FOR STEAM TRAPS PER NOTE 7), STEEL SEATS, PER ASTM A105	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H	2GT11S	2GB11S	2CK11S	HP	C	NONE	NONE	HYDROSTATIC TO 135 PSIG	NONE	100%	NONE	NONE	NONE
CONDENSATE, PUMPED	PC	CAMPUS CONDENSATE, RETURNED FROM CAMPUS TO RABON OR OTHER COND RECEIVER	30 PSIG AT 160 DEG F	75 PSIG AT 250 DEG F	2 INCH AND SMALLER	SCH 80, SEAMLESS, ASTM A106 GR B	SOCKET WELD EXCEPT THREADED AT STEAM TRAPS (SEE NOTE 7)	USE UNIONS	ANSI CLASS 3000 FORGED STEEL SOCKETWELD (EXCEPT THREADED FOR STEAM TRAPS PER NOTE 7) IN ACCORDANCE WITH ASME B16.11. MATERIAL PER ASTM A105.	ANSI CL 3000 SOCKET WELD (EXCEPT THREADED FOR STEAM TRAPS PER NOTE 7), STEEL SEATS, PER ASTM A105	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H	2BL13S	NONE	2CK10S	HP	B	MHs: NONE. OUTDOORS (UNDER THE BRIDGE): AL JACKET PER GROUP AA	NONE	HYDROSTATIC TO 112.5 PSIG	UF TO HEAT AND DRAIN PIPING PER SPEC PARA 3.6	100%	NONE	NONE	NONE
					2-1/2 INCH THRU 12 INCH	SCH XS, SEAMLESS, ASTM A106 GR B	BUTT WELD	ANSI CL 150 WELD NECK, R.F. PER ASME B16.5. MATERIAL SHALL BE ASTM A 105	SAME THICKNESS AS PIPE, BUTT WELD PER ASME B16.9, MATERIAL PER ASTM A 234, GR WPB	UNIONS SHALL BE MADE WITH FLANGES	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H	2BF21F	2GB20F	2CK20F							100%	NONE	100% FOR FIELD WELDS OF DIRECT BURIED SYSTEM & 2 WELDS PER MH FOR NOT DIRECT BURIED (NOTE 5)	100% FOR DIRECT BURIED BY PREFAB SUPPLIER ONLY (NOTE 4)
DRAINS, EQUIPMENT	ED	DRAINS FROM ALL SERVICES	ATMOSPHERIC	N/A	PIPING MATERIALS SHALL MATCH SYSTEM BEING DRAINED							NO VALVES IN THIS SYSTEM			A	NONE	NONE	NONE	6.5 PSIG OR 15 FT WATER COLUMN, INITIAL SERVICE LEAK TEST	NONE	NONE	NONE	NONE	NONE
STEAM, MEDIUM PRESSURE	70S	MEDIUM PRESSURE STEAM	70 PSIG AT 335 DEG F	90 PSIG AT 474 DEG F	2 INCH AND SMALLER	SCH 80, SEAMLESS, ASTM A106 GR B	SOCKET WELD EXCEPT THREADED AT STEAM TRAPS (SEE NOTE 7)	USE UNIONS	ANSI CLASS 3000 FORGED STEEL SOCKETWELD (EXCEPT THREADED FOR STEAM TRAPS PER NOTE 7) IN ACCORDANCE WITH ASME B16.11. MATERIAL PER ASTM A105.	ANSI CL 3000 SOCKET WELD (EXCEPT THREADED FOR STEAM TRAPS PER NOTE 7), STEEL SEATS, PER ASTM A105	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H	2GT11S	2GB11S	2CK10S	HP	C	MHs: NONE. OUTDOORS (UNDER THE BRIDGE): AL JACKET PER GROUP AA	NONE	HYDROSTATIC TO 135 PSIG	UF TO HEAT AND DRAIN PIPING PER SPEC PARA 3.6	100%	NONE	NONE	NONE
					2-1/2 INCH THROUGH 20 INCH	SCH STD, SEAMLESS, ASTM A106 GR B	BUTT WELD	ANSI CL 150 WELD NECK, R.F. PER ASME B16.5. MATERIAL SHALL BE ASTM A105	SAME THICKNESS AS PIPE, BUTT WELD PER ASME B16.9, MATERIAL PER ASTM A 234, GR WPB	UNIONS SHALL BE MADE WITH FLANGES	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H	2BF21F	2GB20F	2CK20F	HP						100%	NONE	100% FOR FIELD WELDS OF DIRECT BURIED SYSTEM & 4 WELDS PER MH FOR NOT DIRECT BURIED (NOTE 5)	100% FOR DIRECT BURIED BY PREFAB SUPPLIER ONLY (NOTE 4)
VENT (PIPING SYSTEM VENTS)	VENT	VENT TO ATMOSPHERE, INCLUDING HIGH AND LOW MANHOLE VENTS	5 PSIG AT 60 DEG F	15 PSIG AT 100 DEG F	2 INCH AND SMALLER	SCH 40, ERW, ASTM A53 GR B	THREADED	ANSI CL 150 WELD NECK, F.F. PER ASME B16.5. MATERIAL SHALL BE ASTM A105	ANSI CL 150, THREADED, MALLEABLE IRON PER ASME B16.3. MATERIAL PER ASTM A197	ANSI CL 150, MALLEABLE IRON, PER ASTM A197	BOLT - MILD STEEL NUT - ASTM A307, GR B	NO VALVES IN THIS SYSTEM			A	NONE	NONE	ALKYD-ENAMEL, BLACK	6.5 PSIG OR 15 FT WATER COLUMN, INITIAL SERVICE LEAK TEST	NONE	100%	NONE	NONE	NONE
					2-1/2 INCH THROUGH 6 INCH	SCH 40, ERW, ASTM A53 GR B	BUTT WELD	ANSI CL 150 WELD NECK, F.F. PER ASME B16.5. MATERIAL SHALL BE ASTM A105	SAME THICKNESS AS ATTACHED PIPE, BUTTWELD TO ASME B16.9. MATERIAL PER ASTM A234, GR WPB	UNIONS SHALL BE MADE WITH FLANGES	BOLT - MILD STEEL NUT - ASTM A307, GR B										100%	NONE	NONE	NONE
VENTS (VENT COFFER)	VENT	VENTS FROM MANHOLES	ATMOSPHERIC	N/A	2-1/2 INCH THROUGH 20 INCH	SCH STD, ERW, ASTM A53 GR B, NOTE 7	BUTT WELD	ANSI CL 150 WELD NECK, R.F. PER ASME B16.5. MATERIAL SHALL BE ASTM A105	SAME THICKNESS AS PIPE, BUTT WELD PER ASME B16.9, MATERIAL PER ASTM A 234, GR WPB	UNIONS SHALL BE MADE WITH FLANGES	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H	NO VALVES IN THIS SYSTEM			COMPRESSED SHEET, NITRILE BINDER	NONE	NONE	6.5 PSIG OR 15 FT WATER COLUMN OR INITIAL SERVICE LEAK	NONE	NONE	NONE	NONE	NONE
					2-1/2 INCH THROUGH 20 INCH	CAST IRON PIPING	COUPLINGS	NONE	CAST IRON FITTINGS	COUPLINGS	CAST IRON JOINT SYSTEM BOLTING				NONE									
					2-1/2 INCH THROUGH 20 INCH	SCH 10S, 304 SS	BUTT WELD	ANSI CL 150 SLIP ON, R.F. PER ASME B16.5. MATRERIAL SHALL BE 304 SS	SAME THICKNESS AS PIPE, BUTT WELD PER ASME B16.9, MATERIAL ASTM 304 SS	UNIONS SHALL BE MADE WITH FLANGES	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H				COMPRESSED SHEET, NITRILE BINDER									
WATER, CHILLED WATER (CARBON STEEL SYSTEM)	CHWS, CHWR	CHILLED WATER SUPPLY AND RETURN FOR ALL LOCATIONS NOT DIRECT BURIED AND FOR DIRECT BURIED CARBON STEEL	PRESSURE: 68 PSIG TEMP: SUPPLY 42 DEG F, OUTLET 52 DEG F	PRESSURE: 110 PSIG TEMP: SUPPLY 40 DEG F, RETURN 65 DEG F	2 INCH AND SMALLER	SCH 80, SEAMLESS, ASTM A53 GR B OR A106 GR B	SCREWED	USE UNIONS	CLASS 150 SCREWED BANDED MALLEABLE IRON PER ASME B16.3, MATERIAL PER ASTM A 197	CLASS 150 MALLEABLE IRON, BRASS SEAT, NUT TYPE. MATERIAL PER ASTM A 197.	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H	2GT10S	2GB10S	2CK10S	A	MHs: GROUP A FOR PIPE AND GROUP I FOR SMALL PIPE LIKE DRAINS AND VENTS PER DETAILS	MHs AND OUTDOORS: GROUP AA, OVER GROUP A INSULATION	NONE	165 PSIG	HAND WIPE AND WATER JET CARBON STEEL PER PARA. 3.6. REFER TO DIV 33 FOR HDPE CLEANING.	100%	NONE	NONE	NONE
					2-1/2 INCH THROUGH 24 INCH	SCH STD, SEAMLESS, ASTM A53 GR B OR A106 GR B	BUTT WELD	ANSI CL 150 WELD NECK, R.F. PER ASME B16.5. MATERIAL SHALL BE ASTM A105	SAME THICKNESS AS PIPE, BUTT WELD PER ASME B16.9, MATERIAL PER ASTM A 234, GR WPBW	UNIONS SHALL BE MADE WITH FLANGES	STUD - ASTM A193, GR B7 NUT - ASTM A194, GR 2H	2BF21F	NOT USED IN THIS PROJECT	NOT USED IN THIS PROJECT							100%	NONE	100% FOR FIELD WELDS OF DIRECT BURIED SYSTEMS & 2 WELDS PER MH FOR NOT DIRECT BURIED (NOTE 5)	NONE

IDENTIFIED NOTES:
1. INSIDE DIAMETER OF FLANGE/FITTING SHALL MATCH MATING PIPE INSIDE DIAMETER. THICKNESS SHALL MATCH SPECIFIED PIPE THICKNESS.
2. MACHINE TO FLAT FACE IF MATING FLANGE IS FLAT FACE.
3. BOLTING SHALL CONSIST OF A BOLT HEAD WHICH REQUIRES ONE NUT ON THE OPPOSITE SIDE OF THE THREADED END IN ACCORDANCE WITH ANSI B1.1, CLASS 2A.
4. PROVIDE 100% RT ON 70S AND PC WELDS FOR DIRECT BURIED FACTORY WELDS.
5. PROVIDE UT PHASED ARRAY FOR THE NUMBER OF WELDS AS STATED FOR PIPING IN STEAM AND CHILLED WATER MANHOLES - ENGINEER SHALL DIRECT WHICH WELDS SHALL BE TESTED PER THE SPEC. ALSO, PROVIDE UT PHASED ARRAY FOR ALL CONTRACTOR FIELD WELDS IN DIRECT BURIED PIPING SYSTEMS.
6. DIRECT BURIED STEAM PIPING IS SPECIFIED IN DIVISION 33.
7. STEAM TRAPS AND CONNECTED UNIONS SHALL BE THREADED PER DETAIL.

SECTION 40 05 20 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Requirements of the following Specification Sections apply to this Section:

1. Section 40 00 01 – GENERAL PIPING PROVISIONS
2. Section 40 05 01 – COMMON WORK RESULTS FOR PIPING
3. Section 40 05 23 – VALVES
4. Section 40 05 29 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT
5. Section 40 05 50 – GASKETS
6. Section 40 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT
7. Section 40 07 00 – PIPING AND EQUIPMENT INSULATION

1.2 DESCRIPTION OF WORK

A. This Section provides the specification for pipe specialties. Specialties include steam traps, dirt pockets/drip legs, and automatic vent valves.

B. Provide steam traps at all low points in the steam piping system where condensate can collect, as designated on the Contract Drawings. The Contractor shall notify the Engineer of low points that are created in the piping system so that a steam trap station can be added. The Contractor shall avoid such low points as physical space limits.

C. Provide drains at all low points in the chilled water piping system.

D. Provide automatic air vents at the high points in all chilled water piping as required for air and non-condensable gas removal from the piping system during normal operation and hydrostatic testing of the piping system.

1.3 SUBMITTALS

A. Shop Drawings and Product Data: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Steam Traps: Manufacturer's product data including:

a. Type
b. Materials of construction with drawing and design rating.
c. Performance based on specified differential pressure and size.

2. Strainers: Manufacturer's product data including:

a. Drawing showing type and dimensions of strainer.
b. Materials of construction for body and mesh.
c. Design rating.
d. Mesh size and pressure drop versus flow curve.

3. Automatic Vent Valves: Manufacturer's product data including:

a. Type
b. Materials of construction with drawing and design rating.
c. Performance based on specified differential pressure and size.

B. Operation and Maintenance Manuals: In accordance with Section 01 77 00 – CLOSEOUT PROCEDURES, submit the following:

1. Maintenance data and spare parts list for:

a. Steam traps.
b. Strainers.
c. Automatic vent valves.

1.4 QUALITY ASSURANCE

A. Comply with the following for steam piping and accessories:

1. ANSI/ASME B31.1: Power Piping.
2. ANSI/ASME Boiler and Pressure Vessel Code: Section VIII, Division 1 - Unfired Pressure Vessels.
3. MSS: Manufacturers Standardization Society.
4. NFPA: National Fire Protection Association Codes and Standards.

PART 2 - PRODUCTS

2.1 STEAM TRAPS

A. General

1. Refer to the Contract Drawings for details of the steam trap stations which includes the drip leg, drip leg valve, steam trap, and all steam trap related items.
2. Provide steam condensate traps at locations indicated on the Contract Drawings and of type as indicated in the "Steam Trap Schedule" listed in the Contract Drawings. The capacity of the steam trap provided shall satisfy the design flow listed on the "Steam Trap Schedule" for both the operating and maximum conditions of pressure, differential pressure, and steam temperature. Connection sizes of traps are provided as a basis of design; however, actual sizes are dependent upon the actual selection of the steam trap.
3. Steam trap sizing selection and location is based on the piping layout as presented in the Contract Drawings. The Contractor is responsible for informing the Engineer of any piping layout changes which could affect the sizing, selection, and location of the steam traps.
4. Steam traps shall be provided at all low points in the steam piping system where condensate can collect, upstream of isolation valves and a maximum spacing of one per every 500 lineal feet of steam pipe.

B. Steam Main Headers and Distribution – 70S Services

1. Service: For 70S steam mains. Refer to the “STEAM TRAP SCHEDULE” on the Contract Drawings for design pressure and temperature conditions.
2. Performance: Refer to "Steam Trap Schedule" listed in Contract Drawings. The trap shall be rated for maximum back pressure of 80 percent of inlet pressure.
3. Construction:

    a. General: Traps shall be thermostatic style. Trap shall have integral non-removable strainer (in addition to separate strainer upstream). Trap shall have stainless steel thermal element that resists shock from water hammer. Trap shall be non-repairable. All components shall be designed for maximum allowable steam conditions of 650 psig at saturated temperature.
    b. Body: Stainless steel, ASTM A351-CF3.
    c. Thermal Element: Stainless steel.
    d. Valve and Seat: Stainless steel, AISI 416.
    e. Strainer Screen: Stainless steel.

4. Connections: Size of connection shall depend on the flow requirements per “Steam Trap Schedule”. Shall have threaded end connections.
5. Acceptable Manufacturers: Watson McDaniel Model WT2000. The University stocks this model so do not submit any other manufacturer/model.

2.2 STRAINERS - STEAM TRAP SERVICE

A. Strainers for steam service shall be "Y" type, unless otherwise indicated on Contract Drawings. Strainers for steam traps stations shall be in accordance with this specification.

B. Provide a screen blowdown valve for each strainer. The valve shall be the full size of the blow-off tap. Provide shut-off valve in accordance with Section 40 05 23 - VALVES. Provide nipple with cap downstream of valve in accordance with the pipe system specification as specified in Section 40 05 01 - COMMON WORK RESULTS FOR PIPING. Select the length of the nipple connecting the blow-off valve to the strainer basket connection so that the blow-off valve is clear of the insulation.

C. Provide strainer screen with a minimum net free area of 2 1/2 times the cross-sectional area of the entering pipe.

D. All strainer screens shall be 1/8 inch thick Type 304 or 316 stainless steel with 3/64 inch mesh perforations unless otherwise required by the valve or device which it protects.

E. 70S Service:

1. Sizes 2 inches NPS and below: Body shall be carbon steel in accordance with ASTM A216 Grade WBC. Strainer shall be ANSI Class 300 and shall have a design pressure greater than 90 PSIG at 474 deg. F. Connections shall be threaded.
2. Sizes 2-1/2 inch NPS and above: Body shall be carbon steel in accordance with ASTM A216 Grade WCB. Strainer shall be ANSI Class 150 and shall have a design pressure greater than 90 PSIG at 474 deg. F. Connections shall be ANSI Class 150 flanges.

2.3 TEMPORARY STRAINERS

A. Temporary strainers consisting of 1/4 x 1/4 mesh No. 22 gauge galvanized hardware cloth, or finer as required by equipment clearances, shall be inserted by the Contractor in suction flanges of all pumps (centrifugal, etc.), where designated on the Contract Drawings, or requested by the Engineer. The hardware cloth shall be greater in diameter than the O.D. of the flange so that its presence can be detected. The Contractor shall remove this strainer after the pump has been test run and with the approval of the Engineer.

2.4 AUTOMATIC AIR VENTS

A. General: Automatic air and non-condensable gas removal device shall be of float design having cast iron body with threaded connections. Internal parts shall be all stainless steel construction. Automatic air vents shall be rated for 250 PSIG and 200 deg F water service. Provide automatic air vents as manufactured by Spirax Sarco - Model 13WHS or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install steam specialties in accordance with manufacturer's instructions and as shown on the Contract Drawings.

3.2 INSTALLATION - STEAM TRAPS

A. Provide all steam trap accessories in accordance with the details on the Contract Drawings.

B. Provide drip legs with sizes indicated on Contract Drawings.

C. Install steam traps at an elevation with respect to the drip leg in accordance with the manufacturer's instructions to insure hydraulic head during start-up.

D. Install steam traps at all low points in the steam piping system where condensate can collect, upstream of isolation valves and a maximum spacing of one per every 500 lineal feet of steam pipe.

3.3 INSTALLATION OF STRAINERS

A. Install strainers where indicated and at places not indicated but where required by a manufacturer's instruction to protect equipment.

B. Install steam strainers horizontally on their side with screen chamber at the 3 or 9 o'clock position. Install all other strainers horizontally with the screen chamber at the 6 o'clock position. Provide blowdown drain with valve and cap. Install strainers vertically only when required and when the direction of flow is down.

3.4 INSTALLATION OF AUTOMATIC VENT VALVES

A. Install automatic air vents as indicated and detailed on the drawings. Automatic air vents shall be installed at the high points in all chilled water piping as required for air and non-condensable gas removal from the piping system during normal operation and hydrostatic testing of the piping system. Provide isolation valve upstream of all automatic air vents for servicing. Provide automatic vent valves in accordance with the details on the Contract Drawings.

3.5 INSULATION, PAINTING AND, IDENTIFICATION OF STEAM SPECIALTIES

A. Insulate all pipe specialties in accordance with Section 40 07 00 - PIPING AND EQUIPMENT INSULATION. Do not insulate moving parts unless insulation sleeves are provided. Do not insulate steam traps.

B. Provide steam trap identification tags in accordance with Section 40 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT.

END OF SECTION 40 05 20

SECTION 40 05 21 – PIPE EXPANSION JOINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contact Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 01 Specification Section, apply to this Section.

B. Requirements of the following specification Sections apply to this Section.

1. Section 40 00 01 – GENERAL PIPING PROVISIONS
2. Section 40 05 01 – COMMON WORK RESULTS FOR PIPING
3. Section 40 05 23 – VALVES
4. Section 40 05 29 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT
5. Section 40 05 50 – GASKETS
6. Section 40 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT
7. Section 40 07 00 – PIPING INSULATION

1.2 SUMMARY

A. This Section includes pipe expansion joints, insulation blankets for expansion joints, and anchors for mechanical piping systems. Guides and slides are specified in Section 40 05 29 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT.

1.3 SUBMITTALS

A. Shop Drawings and Product Data: Submit the following:

1. Product data for each type of pipe expansion joint and pipe alignment guide specified.
2. Pipe expansion joint schedule showing manufacturer's figure number, size, location, and features for each required expansion joint. Indicate country of fabrication and ISO 9001 registry, if applicable. Provide calculations of each joint per EJMA 10th edition standard including stresses, cycle life, joint spring rates, etc.
3. Assembly-type shop drawings for each type of pipe expansion joint and pipe alignment guide, indicating dimensions, weights, required clearances, and methods of component assembly.
4. Provide design data, materials description, and assembly drawing of insulation blankets.
5. Maintenance data for each type pipe expansion joint specified to include in the "Operating and Maintenance Manuals" specified in Division 1 Section “Project Closeout.”

1.4 QUALITY ASSURANCE

A. All materials provided shall be designed, fabricated, installed, and tested in accordance with ASME B31.1.

B. All expansion joints shall be designed and installed in accordance with the 10th edition of Expansion Joint Manufacturer's Association (EJMA) Standards.

C. Expansion joint shall be fabricated and assembled in the United States or Canada, or the expansion joints must be manufactured by an ISO 9001 registered corporation. No expansion joints shall be provided where materials are fabricated or assembled in China including Taiwan, regardless of ISO 9001 registry.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle expansion joints with great care. Adhere to the requirements of the manufacturer.

B. Do not break the shipping tabs off the joint until it is installed and all piping to the adjacent anchors including the anchors are completed.

PART 2 - PRODUCTS

2.1 PIPE EXPANSION JOINTS, GENERAL

A. Refer to "Expansion Joint Schedule" listed in the Contract Drawings for criteria of individual pipe expansion joints.

2.2 PACKED (SLIP) EXPANSION JOINTS

A. Type: Where Contract Drawings indicate, provide slip type, packed joints. Joints shall be single slip design, as indicated in the Expansion Joint Schedule in the Contract Drawings. Single slip joints larger than 6” in diameter shall be provided with a base designed for sliding to support the joint.

1. Design:

a. Expansion joints for steam shall be rated for 150 PSIG, saturated steam service (For medium pressure steam service: Normal operating conditions are 70 PSIG superheated steam at 335 Degrees F. Maximum design conditions are 90 PSIG superheated steam at 474 Degrees F.). Provide axial movement as indicated on the Expansion Joint Schedule in the Contract Drawings. Non-axial movement

shall be minimal due to the inherent guided design of the slip joint and the external guide included in the design of the piping system. Each joint shall be hydrostatically tested by the manufacturer prior to shipping at 135 PSIG for a minimum of 10 minutes.

b. All circumferential welds shall be the butt weld type.
c. Packing cylinders shall allow packing under full line pressure. The packing cylinder tip shall incorporate a “check valve effect” tip design to prevent the blow back of packing while adding packing to the expansion joint at full line pressure.
d. The stuffing box packing area in contact with the slip shall be at least 15 times the nominal diameter of the expansion joint.
e. The packing friction force of the expansion joint shall not exceed 1,000 pounds per inch of expansion joint nominal diameter.

2. Materials:

a. Sliding Part: Shall be machined from heavy wall seamless pipe in accordance with ASTM A 106 Grade B to prevent slip collapse. Sliding part shall be coated with a minimum of 1 mil of hard chrome over 1 mil of crack free hard chrome or nickel and designed for corrosion protection and hardness.
b. Stuffing Box Guides: Shall be machined from heavy wall seamless ASTM A 106 Grade B pipe. Internal guides, external guides, and stuffing box shall be integral single piece construction.
c. Traverse Chamber: Shall be constructed from standard wall ASTM A 106 Grade B seamless pipe.
d. Packing Cylinders/Plungers: Cylinder shall be constructed of carbon steel with internal threads and mating stainless steel plunger. Cylinders shall be welded in place. Discharge tip shall be designed to resist blow-back. Provide suitable amount of parts for equal dispersion of packing. Provide packing injector/plunger, packing cylinder retainer, and cap plugs.
e. Base: Do not provide a base. The weight of the expansion joint shall be supported by the new anchor in the manhole and the new guides as indicated in the Contract Documents (which shall be provided by the Contractor).
f. Drain: Provide a drain and ball valve as a casing drain for each expansion joint. The ball valve shall be in accordance with Specification Section 40 05 23 – VALVES.
g. Limit Stop: Provide stainless steel limit stop pins designed to prevent disengagement of the sliding slip from the stuffing box in the event of an anchor failure.
h. Packing: Braided ring packing shall be reinforced graphite. Injectable packing shall be semi-plastic, asbestos-free, flake graphite, and self-lubricating. All packing shall be rated for 650 deg F service temperature. Provide an adequate supply of packing for each joint to service the joint for a minimum of three years.

B. Connections: Expansion joints shall have Class 150 flanged end connections.

C. Acceptable Manufacturers: Provide expansion joints from Advanced Thermal Systems or approved equal.

2.3 FLEXIBLE HOSE EXPANSION JOINT

A. Location: Provide flexible hose expansion loops/joints in temporary piping only. Provide "Metraloop" expansion joints from Metraflex Company. Use the expansion joints that have 4" of movement.

B. Design:

1. Expansion joints for steam shall be rated for 150 PSIG, saturated steam service (For medium pressure steam service: Normal operating conditions are 70 PSIG superheated steam at 335 Degrees F. Maximum design conditions are 90 PSIG superheated steam at 474 Degrees F.). Provide flexible hose expansion loop(s) as indicated on the Contract Drawings or as required to accommodate any thermal expansion, contraction or seismic movement of the piping system. Provide axial movement as indicated on the Expansion Joint Schedule in the Contract Drawings. Each joint shall be hydrostatically tested by the manufacturer prior to shipping at 135 PSIG for a minimum of 10 minutes.
2. Flexible hose expansion loops shall be manufactured complete with two parallel sections of corrugated metal house, compatible braid, 180 deg return bend, with inlet and outlet connections. Field fabricated loops shall not be acceptable.
3. Flexible loops shall be capable of movement in the ±X, ±Y, and ±Z planes.
4. Flexible hose expansion loops shall impart no thrust loads to system support, anchors or building structure.
5. All flexible hose expansion loops shall be manufactured in accordance with the documented manufacturers weld procedure specifications. The procedure qualification record shall be used to document the execution of this procedure and shall follow the general "guidelines" of ASME Section IX. Each individual welder shall conform to the in-house procedure qualification record and be qualified prior to each production lot. The testing of each individual welder shall be documented in a welding procedure qualification record. Refer to Section 40 05 01 – COMMON WORK RESULTS FOR PIPING.

C. Materials:

1. Corrugated Hose: Shall be constructed of Type 304 stainless steel.
2. Braid: Type 304 Stainless Steel braid shall be used for any series 300 stainless steel hose.
3. Fittings: Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.

4. Flexible hose expansion loops shall have a factory supplied, hanger / support lug located at the bottom of the 180deg return.
5. Flexible hose expansion loop(s) shall be furnished with a plugged FPT to be used for a drain or air release vent.

Loop Size	FPT Size
1" – 6"	3/8"
8" and Larger	1/2"

6. Flexible hose expansion loop(s) shall be rated with an operating pressure in accordance with the table below. The operating pressure shall be based on burst pressure with a 4 to 1 safety factor.

D. Acceptable Manufacturers: Provide "Metraloop" expansion joints from Metraflex Company or approved equal.

2.4 INSULATION BLANKETS

A. General: Provide an insulation jacket for each packed (slip) type expansion joint provided, not the flexible hoses.

B. Design

1. Provide non-porous inner and outer jackets rated for flooding conditions, constructed of minimum 20 ounce per square yard PTFE Teflon film laminated/impregnated Nomex woven cloth. Blanket construction shall be a double woven stitch with a minimum of 7 stitches per inch. No raw cut jacket edges shall be exposed.
2. Insulation shall be minimum 2 inch thick fiberglass needled mat with minimum 11 lb./ft. density, or shall be 15 mm Aspen Aerogel Pyrogel XT-E. All materials shall be rated for service of 450 degrees F. Outer jacket wall temperature shall be under 120 degrees F. Submit proof of outer temperature assuming wet conditions.
3. To accommodate leaks and detect their origins, blanket pieces shall have either a low point drain grommet or a mating seam at the low point which will allow water to seep through.
4. Provide means of prevention of shifting of insulation filler.
5. Provide lacing twists made of durable noncorrosive, non-rotting material for fastening blankets. Velcro is not acceptable. Assembly shall allow removal and installation with no tools required.

2.5 PIPE GUIDES

A. General: Refer to Section 40 05 29 – HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT for the specification of the guides. Provide a guide immediately downstream of the expansion joint regardless of whether or not any manufacturer literature says one is not required.

2.6 ANCHORS

A. Permanent Piping: Anchors for this project were specifically engineered for the specific conditions of this project. The design of the permanent anchors are presented in the structural drawings. Materials are listed below that can be used if they are not presented on the structural details. If the materials are specifically called out in the structural details, then they shall govern.

B. Temporary Piping Systems: Anchors for temporary piping flexible hose expansion joints shall be provided by the Contractor per the manufacturer's recommendations.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, steel plates, shapes, and bars, black and galvanized.

B. Bolts and Nuts: ASME B180 or ASTM A 183, steel, hex-head, track bolts and nuts.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Powder-Actuated Fasteners: Attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

E. Concrete: Portland-cement mix, 3000 psi (20 MPa).

1. Cement: ASTM C 150, Type I.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

F. Grout: ASTM C 1107, Grade B, nonshrink, nonmetallic.

1. Characteristics include post-hardening volume-adjusting dry hydraulic-cement-type grout that is nonstaining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
2. Design Mix: 5000 psi, 28-day compressive strength.
3. Water: Potable.
4. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 PIPE EXPANSION JOINT INSTALLATION

A. Install pipe expansion joints according to manufacturer's written instructions.

B. Align expansion joints to avoid end-loading and torsional stress.

C. Provide insulation/weather cover which protects joints from moisture. Clean inside of expansion joints thoroughly before putting joints into service.

D. Do not break shipping band until joint is installed and system is complete from anchor to anchor. If shipped band is broken prematurely, consult Engineer and manufacturer immediately.

E. Dimensions and End Connections: The Contractor is responsible for ensuring that the expansion joints provided conform to the dimensions required by the piping, anchor and pipe guide configuration. Stretching of expansion joints to correct for piping misalignment or to accommodate available end-to-end spacing is not allowed

F. Provide expansion joints perfectly inline with pipe. All miters (if required) shall be on the fixed side of the expansion joint. Laser align piping during welding and when aligning all supports, guides, and anchors. Refer to Section 40 05 01 – COMMON WORK RESULTS FOR PIPING. Ensure straight alignment so expansion joint will not bind. Follow all directions by expansion joint manufacturer for guide locations, except if a manufacturer states that the first guide closest to the expansion joint (within 4 pipe diameters) is not required, provide anyway.

G. When welding, the grounding electrode shall always be placed on the same side of the expansion joint as the weld being performed. Do not allow welding current to pass through the expansion joint.

3.2 EXPANSION JOINT TESTING

A. Contractor shall hydrostatically test piping system with joints in place after the shipping bands are broken and the entire piping system is connected as one system.

B. Under no instance shall new joints be tested without the entire piping system being connected as one system, including all anchors and guides installed and completed.

C. Water utilized for hydrostatic test must be at room temperature when hydrostatic test is performed.

3.3 PIPE ALIGNMENT GUIDE INSTALLATION

A. Install pipe alignment guides on piping as indicated on Contract Drawings. Pipe alignment guides must be located at distances within acceptable limits per the manufacturer. If these conditions do not exist, the Contractor is responsible for alerting the Engineer of the

situation. Otherwise, any damage resulting from guides not being located within acceptable limits of the manufacturer shall be the responsibility of the Contractor.

B. Secure pipe alignment guides as indicated on Contract Drawings.

3.4 PIPE ANCHOR INSTALLATION

A. Install pipe anchors at locations indicated to prevent stresses from exceeding those permitted by ASME B31.1.

B. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.1 and with AWS D1.1.

C. Provide grout for pipe anchors in accordance with 40 05 01 – GENERAL PIPING PROVISIONS.

D. For painted and/or hot-dipped galvanized pipe anchors provide paint and/or cold galvanizing repair coating at field welds and for touch-up of damaged painted and/or galvanized surfaces, respectively.

3.5 PAINTING

A. Touching Up: Cleaning field welds and abraded areas of shop paint and paint, exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 Mils.

B. Touch Up: Touch-up paint field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 FIELD QUALITY CONTROL

A. Inform Engineer 7 business day in advance before hydrostatic testing is performed.

END OF SECTION 40 05 21

SECTION 40 05 23 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Requirements of the following Specification Sections apply to this Section:

1. Section 40 05 01 – COMMON WORK RESULTS FOR PIPING

1.2 DESCRIPTION OF WORK

A. The extent and type of valves required by this Section shall be as indicated on the Contract Drawings and/or specified in other Division 40 Sections.

B. Valves furnished as part of factory-fabricated equipment shall conform to the requirements of this Section unless otherwise stated.

C. Strainers and other special valves are specified in Section 40 05 20 – PIPING SPECIALTIES.

1.3 SUBMITTALS

A. Shop Drawings and Product Data: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Manufacturer's technical product data, including installation instructions, for each type of valve. Include pressure drop curve or chart for each type and size of valve.
2. Submit valve schedule showing manufacturer's figure number for corresponding valve symbol used to specify valves on this specification. List all valve sizes to be supplied for each valve symbol.
3. Manufacturer's assembly-type (exploded view) shop drawings for each type of valve and valve actuator indicating dimensions, weights, materials, and methods of assembly of components.
4. Technical data for electric valve actuators that indicate all features specified.
5. Manufacturer's technical product data indicating the service rating of each valve type. In addition, this information shall indicate the maximum hydrostatic test pressure that the valve can take when only one side of the valve is being pressurized. The indicated hydrostatic pressure shall be good for not only the structural integrity of the valve, but

should also take into consideration its continued effectiveness for providing tight shut-off service as a valve without requiring any modifications or maintenance.

6. List country of manufacturer, fabrication, and assembly for all valves and valve components.
7. Submit ISO 9001 and Independent Test reports if applicable per Quality Assurance paragraph below.

1.4 QUALITY ASSURANCE

A. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

B. Country of Fabrication

1. All valves and valve components not manufactured, fabricated, and/or assembled in the United States of America or Canada must be manufactured, fabricated, and/or assembled by an ISO 9001 registered corporation.
2. Submit ISO 9001 registration certificates for all corporations where valves and valve components are not manufactured, fabricated, and/or assembled in the United States or Canada.
3. For all valves and valve components not fabricated in the United States or Canada, submit an independent test report for all materials to be provided.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Preparation For Transport: Prepare valves for shipping as follows:

1. Ensure valves are dry and internally protected against rust and corrosion.
2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
3. Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.

B. Storage: Use the following precautions during storage:

1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. Outdoor storage of valves shall not be permitted.

C. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVE FEATURES

A. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by the manufacturer for installation requirements. Comply with ASME B31.1.

B. Valve Design: ONLY provide valves with outside screw and yoke (OS&Y) stems. If non-rising stem valves are needed due to operational constraints, the University shall verify the constraints, shall review the submittals of the installation, and shall approve the installation of a non-rising stem valve.

C. Pressure and Temperature Ratings: As specified according to the individual valve specifications.

D. Sizes: Same size as upstream pipe, unless otherwise indicated.

E. Operators: Provide the following special operator features:

1. Handwheels, fastened to valve stem, for valves other than quarter turn.
2. Lever handles, on quarter-turn valves 3 inch and smaller, except for plug valves. Provide plug valves with square heads. For valves greater than 3 inch, provide gear operator with handwheel.
3. Chain-wheel operators, for all valves installed 6 feet or higher above finished floor. Extend chains to an elevation of 5 feet above finished floor. Refer to Paragraph 2.4.

F. Lock-out/Tag-out Hardware: All valves shall be supplied with lock-out/tag-out hardware as standard by the manufacturer. If the manufacturer does not have this hardware for a particular valve, pick another manufacturer that does. All lock-out/tag-out hardware must be extended beyond all insulation.

G. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation. Lock-out/tag-out hardware shall be on the extended hardware, not in the insulation.

H. By-pass and Drain Connections: Provide valved by-pass where indicated on the Contract Drawings. Comply with MSS SP-45 bypass and drain connections.

I. Neck extensions and right angle drives where indicated and where required for access to the operator.

J. Hot Tap Valves: The Contractor shall provide hot taps into existing mains that will remain energized at up to the piping system design pressure where a hot tap is specifically

indicated in the Contract Drawings. This procedure is also know as wet tapping. For these instances, the valve shall be a full port valve to satisfy the requirements of the hot tap machine and provide a true area pipe tap, and shall satisfy the requirements of the specification of the valve group.

2.2 VALVE IDENTIFICATION SYSTEM DESCRIPTION

A. General: A system has been established which identifies the specific valves for each piping system identified in the Contract Drawings. The specific valve specification is linked by the service number as depicted in Table A1 "Piping Index" at the end of Section 40 05 01 – COMMON WORK RESULTS FOR PIPING.

B. Valves are identified on the Contract Drawings by symbol. Size is indicated by the upstream size.

C. Valves are specified in this Section according to Table A1 "Piping Index" at the end of Section 40 05 01 – COMMON WORK RESULTS FOR PIPING. In general, the following is a description of the format:

1. The first symbol, consisting of one or more numerals, indicates the valve group specification that applies to this valve.
2. The second symbol, consisting of one or more letters, indicates the type of valve in accordance with the following listing:

    a. GB = Globe Valve
    b. BF = Butterfly Valve
    c. BL = Ball Valve
    d. CK = Check Valve
    e. GT = Gate Valve

3. The third symbol consists of one numeral. The numeral indicates the size group
    1 = Small Group
    2 = Large Group

4. The fourth symbol consists of one numeral. The numeral indicates valve modifications. Zero indicates standard type, while any other number indicates modifications to the valve.
    0 = Standard Type (no modifications)
    # = Modifications (see valve specifications herein)

5. The fifth symbol, consisting of a letter, indicates the type of connection to the valve as follows:

    a. F = Flanged Ends (or Lugged Ends as specified)
    b. S = Screwed Ends
    c. W = Weld Ends, Butt or Socket

d. C = Solvent Cemented
e. B = Brazed

6. For example: For a 10 inch 70S shutoff valve, refer to 2BF21F which indicates a valve of Valve Group 2, Butterfly Type, large group, Non-standard, and with flanged ends. Refer to Paragraph 2.3.B.5.a for the specification of this valve.

D. There may be some instances where it is desirable to substitute an item, such as a valve or gasket at a particular location, in place of the one specified in the groups listed in the Index. In that event, the item will be clearly indicated and specified on the Contract Drawings, and such an indication is to take precedence over the item specified in the valve group specifications. All other terms of that group specification are to be observed.

2.3 VALVE GROUPS:

A. Valve Group 1: Not Used.

B. Valve Group 2

1. Gate Valves:

a. Symbol: 2GT10S - 2 Inches and Smaller: Class 150 gate valve, screwed ends, cast bronze body and bonnet, bronze stem, union bonnet, solid disc gate, inside screw, rising stem; disc and renewable seat ring of 13 percent chromium stainless steel, body and bonnet material to conform to ASTM B 61 or B 62. The valve shall conform to MSS SP-80, Class 150-B62, Type 2. Manufacturer shall be Apollo, Nibco, Powell, or Stockham.
b. Symbol: 2GT11S - 2 Inches and Smaller: Class 300 gate valve, screwed ends, cast bronze body and bonnet, bronze stem, union bonnet, solid disc gate, inside screw, rising stem; disc and renewable seat ring of 13 percent chromium stainless steel, body and bonnet material to conform to ASTM B 61 or B 62. The valve shall conform to MSS SP-80, Class 300-B62, Type 2. Manufacturer shall be Apollo, Nibco, Powell, or Stockham.

2. Globe Valves:

a. Symbol: 2GB10S - 2 Inches and Smaller: Class 150 globe valve, screwed ends, cast bronze body and bonnet, bronze stem, union bonnet, plug or semi-plug type disc, inside screw, rising stem; disc and renewable seat ring of 13 percent chromium stainless steel, body and bonnet material to conform to ASTM B 61 or B 62. The valve shall conform to MSS SP-80, Class 150-B62, Type 2. Manufacturer shall be Apollo, Nibco, Powell, or Stockham.
b. Symbol: 2GB11S - 2 Inches and Smaller: Class 300 globe valve, screwed ends, cast bronze body and bonnet, bronze stem, union bonnet, plug or semi-plug type disc, inside screw, rising stem; disc and renewable seat ring of 13 percent

chromium stainless steel, body and bonnet material to conform to ASTM B 61 or B 62. The valve shall conform to MSS SP-80, Class 300-B62, Type 2. Manufacturer shall be Apollo, Nibco, Powell, or Stockham.

c. Symbol: 2GB20F - 2-1/2 Inches and Larger: Class 150 steel globe valve, flanged ends, bolted flanged bonnet, outside screw and yoke, rising stem, plug or semi-plug type disc, renewable seat rings and disc. Materials shall be: Body and bonnet, ASTM A 216, Grade WCB or A105; stem, 13 percent chromium stainless steel; seat ring, 13 percent chromium stainless steel; disc, 13 percent chromium stainless steel or 13 percent chromium stainless steel faced. Face to face dimension shall conform to ANSI B16.10. Flanges shall be faced and drilled to ANSI B16.5. Working pressure and temperature ratings shall comply with ANSI B16.34 (Standard Class). Manufacturer shall be Crane, Nibco, Powell, Sharpe, or Velan.

3. Check Valves:

a. Symbol: 2CK10S - 2 Inches and Smaller: Class 150 horizontal swing check valve, cast bronze body and cover, screwed ends, bronze disc, screwed cover, integral seat, body and cover material to conform to ASTM B 61 or B 62. The valve shall conform to MSS SP-80, Class 150-B62, Type 3. Manufacturer shall be Apollo, Nibco, Powell, or Stockham.

b. Symbol: 2CK11S - 2 Inches and Smaller: Class 300 horizontal swing check valve, cast bronze body and cover, screwed ends, bronze disc, screwed cover, integral seat, body and cover material to conform to ASTM B 61 or B 62. The valve shall conform to MSS SP-80, Class 300-B62, Type 3. Manufacturer shall be Apollo, Nibco, Powell, or Stockham.

c. Symbol: 2CK20F - 2-1/2 Inches and Larger: Class 150 steel horizontal swing check valve, flanged ends, bolted flanged cover and renewable seat ring. Body material shall conform to ASTM A 216, Grade WCB or A 105. Disc or disc seating face and the seat ring shall be 13 percent chromium stainless steel. Face to face dimension shall conform to ANSI B16.10. Flange shall be faced and drilled to ANSI B16.5. Working pressure and temperature ratings shall comply with ANSI B16.34 (Standard Class). Manufacturer shall be Crane, Nibco, Powell, Sharpe, or Velan.

4. Ball Valves:

a. Symbol: 2BL13S - 2 Inches and Smaller: Rated for 250 pound saturated steam service, carbon steel body with 316 stainless steel ball and stem, reinforced teflon seats and seals which are rated for 250 pound saturated steam service with flashing service. Valve shall have threaded ends. Valve shall have standard bore size. Valve shall have one piece body. Valve shall have blow-out proof stem design and shall have zinc plated carbon steel lever with vinyl grip. Valve lever shall have design so that lock-out can easily occur. Manufacturer shall be Apollo, McCanna, or Sharpe.

5. Butterfly Valves:

   a. Symbol 2BF21F - 2-1/2 Inches and Larger: Triple or quadruple offset butterfly style, rotary valve, Class 150, carbon steel body conforming to ASTM A216, Type WCB. Provide a lugged body style. The disk movement relative to the shaft rotation shall be triple offset design. Shaft shall be blow-out proof, 17-4 PH stainless, and single piece construction. Seats shall be replaceable and bolted to the valve body. Seats shall be stellite or similar hard surfaced metal. Seats shall be resilient, non-flexing laminate metal seal composite of stainless steel and graphite retained such that centering movement is permitted. Retainer screws, disk, and plate shall be stainless steel. The hardened bearing with bearing seal shall be retained in the body. The shaft seal shall be graphite with multiple stud packing gland follower for adjustability. Valve and valve seat shall be designed and rated for water and steam service at pressure and differential pressures to Class 150 ANSI B16.34 (Standard Class) for bi-directional shut-off (zero leakage) dead-end service. Position indicator for sizes 2-1/2 through 36 inches. Provide right angle gear operator with loose steel hand wheel or chain wheel attachment for remote "tee" handle operation as shown on drawings. Valve actuator shall be provided with self-locking gears. Provide stem housing to allow for minimum of 3 inches insulation. Valve shall be designed and manufactured in accordance with API 607, Fourth Edition. The Owner stocks Bray Controls Tri Lok triple offset butterfly valves. Provide these valves. Quadax quadruple offset valves will be considered as well as Velan Torqseal triple offset valves.

2.4 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Babbitt Steam Specialty Co.
   2. Roto Hammer Industries.
   3. Trumbull Industries.

B. Description: Lockable valve actuation assembly with sprocket rim, brackets, and chain.

   1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
   2. Attachment: For connection to butterfly valve stems.
   3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc coating.
   4. Chain: Hot-dip, galvanized steel, Brass, or Stainless steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.

B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position. Check to make sure the travel limit stops on butterfly valves and rotary valves are set correctly.

C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage. In cases where higher rated raised face steel flanges are mated to lower rated flat face cast iron flanges, remove raised face from steel flange before bolting together.

E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.

F. Replace defective valves with new valves.

3.2 VALVE INSTALLATIONS

A. General Application: Refer to the Contract Drawings and piping system specification sections for specific valve applications and arrangements.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install by-pass and drain valves per MSS SP-45 or as indicated on the Contract Drawings.

E. Install three-valve bypass around each control valve and throttling valve as indicated on the Contract Drawings.

F. Unless otherwise indicated on the Drawings, stems of valves in horizontal lines shall be horizontal. Valves shall not be installed with stems pointed down. All valves shall have a readily accessible location. The Contractor shall be responsible to determine valve stem locations on field-routed piping prior to fabrication of the piping.

G. When welding valves to piping, the Contractor shall insure that the valves are in the open position and shall take extreme care not to overheat and damage the seat area. All valves shall be installed in accordance with the manufacturer's instruction manual. Any valves damaged during installation shall be replaced with new, identical valves at the Contractor's expense.

H. Install valves in a position to allow full stem movement.

I. Installation of Swing Check Valves: Install for proper direction of flow and in horizontal position or vertical position with flow direction upwards, and with hinge pin level.

J. Insulation: Where insulation is indicated for the service, insulate valves in accordance with Section 40 07 00 – PIPING AND EQUIPMENT INSULATION. Provide valves with extended stems, arranged in manner to receive insulation.

3.3 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads including anti-sieze compound on bolts. Anti-sieze compound shall be rated for temperatures to 600 deg. F. Tighten bolts gradually and uniformly with a torque wrench.

C. In cases where higher rated steel raised face flanges mate to lower rated cast iron flat face flanges, remove raised face from steel flange before bolting together.

D. Use gaskets as specified in Section 40 05 50 - GASKETS.

3.4 ADJUSTING, CLEANING, PAINTING AND IDENTIFICATION

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

B. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

END OF SECTION 40 05 23

SECTION 40 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Requirements of the following Sections apply to this Section:

1. Section 40 00 01 – GENERAL PIPING PROVISIONS
2. Section 40 05 01 – COMMON WORK RESULTS FOR PIPING
3. Section 40 05 20 – PIPING SPECIALTIES
4. Section 40 05 23 – VALVES
5. Section 40 07 00 – PIPING AND EQUIPMENT INSULATION

1.2 DESCRIPTION OF WORK

A. This Section provides the specification for pipe hangers and supports of all piping systems associated with this project. This includes all ASME B31.1 piping systems and ASME B31.9 piping systems. The Contractor shall provide the pipe supports, hangers, and anchors as detailed in the Contract Drawings and shall provide all supports for these systems to satisfy ASME B31.1 and ASME B31.9 requirements of supporting the weight of the piping systems and to accommodate lateral and axial travel in the piping system associated with thermal pipe expansion and contraction.
B. This Section provides the specification for the following components:

1. Horizontal-piping hangers and supports.
2. Vertical-piping clamps.
3. Hanger-rod attachments.
4. Building attachments.
5. Saddles and shields.
6. Miscellaneous materials.
7. Pipe alignment guides.
8. Pipe slides and rollers.
9. Anchors.

C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 40 Sections.

1.3 SUBMITTALS

A. Shop Drawings, Product Data, and Quality Assurance Submittals: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Pipe hanger assembly drawing for every hanger regardless of type in accordance with recommendations provided in MSS SP-89. Provide proposed equipment manufacturer, manufacturer's model number and size, construction, finish, quantities, and/or lengths. Utilize columns shown on Contract Drawings for the location plan.
2. Pipe hanger and support schedule for the pipe hanger assembly drawings. Schedule shall list all pipe supports and spring hanger numbers and reference the piping system and Contract Drawing number for which the item is located in plan view.
3. Product data, including installation instructions for each type of hanger and support component. This information shall consist of copies of the manufacturer's catalog data for the items provided in the pipe hanger assembly drawings and shall indicate dimensions, materials of construction, maximum recommended load if applicable, any operating instructions, approximate weight, and MSS SP-69 approval. Together with the pipe hanger assembly drawings and the manufacturer's catalog data, the assembly of the complete system should be clearly identifiable.
4. Report of compliance with ASME B31.1 Power Piping Code as described in paragraph HANGER DESIGN SERVICES.
5. Additional submittal requirements required by Paragraph titled QUALITY ASSURANCE below.

B. Operating and Maintenance Data: In accordance with Section 01 70 00 –PROJECT SUBMITTALS, submit the following:

1. Operation and maintenance data for spring hanger supports.

1.4 QUALITY ASSURANCE

A. For all pipe support related welding performed on site, qualify welding processes and welding operators in accordance with AWS D1.1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
B. MSS Standard Compliance

1. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
2. Select and apply pipe hangers and supports, complying with MSS SP-69.
3. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
4. Terminology used in this Section is defined in MSS SP-90.

C. All hangers and supports shall comply with seismic design requirements. Seismic requirements are stated on the structural drawings and are not stated in this specification. You must get the drawings to conform with this specification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging, marking, shipping, receiving, and storage shall be performed per the recommendations of Paragraph 9 of MSS SP-89.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by basic designation only.
B. American Society of Mechanical Engineers (ASME)

1. B31.1: Power Piping Code
2. BPVC: Boiler Pressure Vessel Code

C. American Society for Testing and Materials (ASTM)

1. ASTM A36: Carbon Structural Steel
2. ASTM C150: Portland Cement
3. ASTM C404: Aggregates for Masonry Grout

D. American Welding Society (AWS)

1. AWS D1.1: Structural Welding Code - Steel

E. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

1. SP-58: Pipe Hangers and Supports - Materials, Design, and Manufacture
2. SP-69: Pipe Hangers and Supports - Selection and Application
3. SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices
4. SP-90: Guidelines on Terminology for Pipe Hangers and Supports

PART 2 - PRODUCTS

2.1 GENERAL

A. The Contractor shall provide all necessary pipe slides, pipe guides, hangers, beam clamps, hanger rods, turnbuckles, bracing, rolls, plates, brackets, saddles, and other accessories necessary to support the pipes from the building, stanchions, structures, and equipment. Drilling, welding, cutting, and other operations required to attach the piping to such structures shall be part of the Contract. Channels, angles, beams, and other structural steel items necessary to attach or brace pipe supports to the structure and used solely for that purpose shall be provided by the Contractor and the cost thereof included in the Contract.

B. All pipe lines shall be provided with complete hanger and support assemblies. Included but not limited to shall be the pipe hanger, load bearing insulation inserts, saddles, shields, hardware, washers, nuts, turnbuckles, rods, strap, clip angles, beam clamps, through bolts, ceiling plates, and grout. Pipe hangers for all pipe lines shall comply with MSS SP-58, SP-69, and SP-89.

C. Pipe lines to be supported include all new piping and tubing, existing piping that requires temporary supporting due to structural related work, and existing piping where required due to new piping connecting to existing piping.

2.2 HANGER DESIGN SERVICES

A. The Engineer has provided an initial design of an engineered pipe hanger system for the major piping systems identified below and will update them during the construction phase as described below. The Contractor shall provide an engineered pipe hanger system for all other piping systems of this Contract. A detailed analysis is not required to be submitted, however, the Contractor shall perform calculations to the detail necessary to convince himself that the pipe system is adequate for the service. For all pipe hangers, supports, anchors, guides, etc. (even those designed by the Engineer), the Contractor shall submit a pipe hanger assembly drawing in accordance with the recommendations provide by MSS SP-89. Provide proposed equipment manufacturer, manufacturer's model number and size, construction, finish, quantities and/or lengths. Utilize columns shown on Contract Drawings for the location plan. Indicate pipe group, line size, insulation thickness, and Contract Drawing for which the plan view of the pipe hanger location can be found.

1. Design Requirements: All pipe supports system designed by the Contractor shall be in accordance with ASME B31.1.
2. Seismic Requirements: Provide in accordance with local code requirements. Refer to structural drawings for seismic design.

B. Engineer Designed Systems:

1. The Engineer has performed a thermal stress and support analysis for the systems listed below including seismic considerations and has provided an initial design for anchors and supports.

    a. All steam and pumped condensate piping in the project.

2. The hanger system design included in the Contract Documents is provided to be used as a basis for cost and to show that a system can be developed satisfying ASME B31.1 requirements without rearranging the piping. The Engineer has utilized estimated insulation density, valve weights, and HPDE transition pieces. All of these conditions are subject to change by the actual equipment provided by the Contractor. When these items become final during the procurement by the Contractor, the Engineer will update the design. The Owner wants the Engineer to maintain responsibility for the thermal stress analysis. Thus, all pipe location dimensions and all piping related

materials (pipe, valves, components, etc.) must be submitted to the Engineer. This includes the location of direct buried piping system anchors. The Engineer will work with the Contractor to provide updates on the support design for these systems. The Contractor shall submit proposed spool drawings of each pipe of this system prior to fabrication. The Engineer will then verify that the stress analysis is not affected by the arrangement, and with the return of the spool drawing will provide comments or updates to the pipe support system. The Contractor shall then finalize the spool drawing for fabrication. Pipe support design needs to be a regular topic in project meetings to constantly update the status so that the Engineer can get the Contractor the information needed to procure the pipe hanger systems.

C. Contractor Designed Systems

1. Trap return piping – from the steam system drip leg through the trap station to the pumped return pipe. That piping needs to be supported by the Contractor.
2. Chilled water piping.
3. PSAN piping in the manholes in Division 22.

2.3 GENERAL DESIGN GUIDELINES

A. All supports and parts shall conform to the latest requirements of the ASME Code for Pressure Piping B31.1, and MSS SP-58, MSS SP-69, and MSS SP-89, except as supplemented or modified by the requirements of this Section.
B. Designs generally accepted as exemplifying good engineering practice, using stock or production parts, shall be utilized wherever possible.
C. Weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection.
D. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction while providing continuous support of the piping and prevent excessive stress resulting from transferred weight or force being introduced into the pipe or connected specialties and equipment.
E. Hanger Rods and Supports

1. All rigid rod hangers shall provide a means of vertical adjustment after erection.
2. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing.
3. Where horizontal piping movements are such that hanger rod angularity is greater than or equal to 4 degrees from the cold to hot position of the pipe, the hanger pipe and structural attachments shall be designed and positioned in such manner that the rod is vertical in the hot and cold position.
4. Hanger components shall not be used for purposes other than for which they were designed. They shall not be used for rigging and erection purposes.

F. Pipe Anchors, Guides and Bracing Requirements

1. All pipe anchors and guides shall be of welded steel construction designed with a safety factor of not less than five.
2. The Contract Drawings for this project indicate the location of all anticipated anchors, guides, and braces required to control excessive forces and moments on equipment, over stressing of pipe material, and/or extreme mal-positioning and misalignment of supports or expansion joints caused by thermal expansion and contraction.
3. The Contractor shall recognize the necessity and provide anchors, guides, and sway braces to prevent extreme mal-positioning and misalignment pipe supports, over stressing of pipe, and/or excessive forces and moments on equipment caused by hydraulic surge in the lines associated with normal operation and hydrostatic testing. These anchors, guides, and braces are not indicated on the Contract Drawings; the Contractor shall anticipate that such are necessary and shall allow for same in his contract; the Contractor shall also provide these items as necessary in the design of pipe support systems for piping systems included in the Contractor's scope of piping systems support designs.
4. After flushing and start up of all pipe lines, each shall be observed to locate excessive movement and then shall be guided or anchored by the Contractor at this time.
5. Supports, guides, and anchors shall be so designed that excessive heat will not be transmitted to the supporting steel. The temperature of supporting parts shall be based on a temperature gradient of 100 deg F per inch distance from the outside surface of the pipe.

G. Thin wall Stainless Steel and Copper Lines: Ceiling hung thin wall stainless steel and copper pipes shall be supported by pre-insulated clamp type hangers and rollers with a stainless steel bearing plate or shield secured in place between the hanger or roller and the pipe. The bearing plate or shield shall be a minimum 12 inches long, cover a minimum of 1/2 of the pipe circumference, and be made 1/8 inch thick stainless steel bent to fit the pipe insulation The maximum spacing of pipe hangers on thin wall stainless steel lines shall be no more than:

1. 1/2 inch through 1-1/4 inch = 8 feet
2. 1-1/2 inch through 4 inch = 10 feet
3. 5 inch and larger = 12 feet

H. Finishes: All hangers and support assemblies, associated accessories and hardware shall have factory galvanized finish.

2.4 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. Hangers shall be so spaced as to prevent sag and permit proper drainage. Hanger spacing shall be in accordance with Table 3 of MSS SP-69 except where indicated on the drawing and specified herein. Provide a hanger at elbows (within 2 feet) and terminations.
B. Horizontal pipe attachments shall be selected in accordance with Table 1 of MSS SP-69. Selection of components must strictly adhere to the allowable temperature ranges listed

and the presence of insulation.

C. Pipe Clamps: Double bolt pipe clamps when used on insulated pipe shall match the insulated pipe outer diameter. High density insulation inserts matching the pipe insulation shall be provided.

D. Clevis Hangers

1. Clevis hangers used on uninsulated lines shall match the pipe outer diameter. Clevis hangers used on insulated pipes shall be so sized that the inner diameter of the hanger matches the outer diameter of the piping insulation.
2. Oversized clevis hangers 4 inches and larger shall have a Schedule 40 pipe sleeve over the horizontal bolt (that is clevis hangers sized to fit over the insulation of lines). Adjustable steel clevis type pipe hangers are preferred rather than clamp hangers for uninsulated pipe. All except clamp type hangers on insulated lines shall have sufficient width to clear the pipe covering aluminum jacket.

E. Brackets used for supporting piping shall be of welded steel construction with a design safety factor of not less than five.

2.5 PIPING AND SUPPORTS, ROUTING AND LOCATION

A. Piping and conduits, except electrical conduits run in floor construction, shall be run parallel with the lines of the building, unless otherwise shown or noted on the Contract Drawings. Electrical conduits shall not be hung on hangers with any other service pipes. The different service pipes, valves, and fittings shall be so installed that after the covering is applied there will not be less than one inch clear space between the finished covering and other work and between the finished covering of parallel adjacent pipes. Exact location of electrical outlets, piping, ducts, and conduits shall be coordinated among the trades so that there will be no interference between lighting fixtures, piping, ducts, and conduits. Where conflicts between the trades result, they shall be resolved by the Contractor to the Engineer's satisfaction and at no expense to the Owner.

2.6 VERTICAL-PIPING CLAMPS

A. Provide Factory-fabricated vertical-piping clamps complying with MSS SP-58 selected by Contractor to suit vertical piping systems in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

2.7 HANGER-ROD ATTACHMENTS

A. Provide factory-fabricated hanger-rod attachments complying with MSS SP-58 as indicated on the drawings to suit pipe hangers and structure attachments in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each pipe support application. Select size of hanger-rod attachments to

suit hanger rods and pipe support load. Provide copper-plated hanger-rod attachments for copper-piping systems.

2.8 STRUCTURE ATTACHMENTS

A. Provide factory-fabricated structure attachments complying with MSS SP-58 as indicated on the drawings to suit substrate conditions in accordance with MSS SP-69 and manufacturer's published product information. Provide copper-plated building attachments for copper-piping systems.

2.9 SADDLES AND SHIELDS

A. Provide factory fabricated saddles or shields under piping hangers and supports for all insulated piping. Saddles and shields shall be sized for exact fit to mate with pipe insulation and shall comply with MSS SP-58 and selected by Installer in accordance with MSS SP-69 and manufacturer's published product information.
B. Pipe covering protection saddles for use at support points on all 100 degrees to 750 degrees insulated pipe lines shall be commercial steel plate type. The saddle shall be tack welded to the pipe and extend out past the insulation O.D.

2.10 MISCELLANEOUS MATERIALS

A. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
B. Cement Grout: Portland Cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration. Refer to Section 40 00 01 – GENERAL PIPING PROVISIONS. Pipe anchors shall utilize a high temperature rated grout mix.
C. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 INSPECTION

A. The installation, adjustment, and inspection of all hangers systems shall be performed by the Contractor in accordance with Paragraph 10 of MSS SP-89.
B. During renovation and installation of equipment, the Contractor shall be responsible for the temporary support of all piping systems where necessary due to the phasing of construction. Temporary support systems shall be in accordance with the requirements of this Section.

3.2 PREPARATION

A. Proceed with installation of permanent hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors and other building structural attachments.
B. Prior to installation of hangers, supports, anchors and associated work but after the pipe hanger submittal has been reviewed by the Engineer, the Installer shall meet at project site with Contractor, installer of each component of associated work, installers of other work requiring coordination with work of this Section, and Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with this Section.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89. Install supports with maximum spacing complying with MSS SP-69 and to permit normal pitch of pipe with deflection and bending stress maintained at a minimum.
B. Install building attachments to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
D. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
E. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
F. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

3.4 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.1 and to prevent transfer of loading and stresses to connected equipment.
B. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.1 and with AWS Standard D1.1.

3.5 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
C. Field Welding: Comply with AWS D1.1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove welding flux immediately.
    4. Finish welds at exposed connections so that no roughness shows after finishing and so that contours welded surfaces to match adjacent contours.

3.6 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve proper slope of pipe. Tighten the jam nuts against the adjusting nuts after the hanger is properly adjusted to lock it in place.
B. Touch-Up and Cleaning: Clean and touch-up all field welds, bolted connections, and abraded areas of the shop finish on all support components with cold galvanizing repair.
C. Refer to Section 40 00 01 – GENERAL PIPING PROVISIONS.

END OF SECTION 40 05 29

SECTION 40 05 50 - GASKETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Requirements of the following Specification Sections apply to this Section:

1. Section 40 00 01 – GENERAL PIPING PROVISIONS
2. Section 40 05 01 – COMMON WORK RESULTS FOR PIPING
3. All related specific piping specification Sections.

1.2 DESCRIPTION OF WORK

A. The extent and type of gaskets required by this Section shall be as indicated on the Contract Drawings and/or specified in other Division 40 Process Integration Sections.

1.3 SUBMITTALS

A. Product Data: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Manufacturer's technical product data, including materials of construction, thickness, pressure and temperature rating, manufacturer's model number, and storage requirements.

1.4 DELIVERY AND STORAGE

A. Transport, Storage, and Handling:

1. Keep gaskets in dry area protected from weather.
2. Do not prepare gaskets until ready for installation.
3. Do not reuse gaskets.

PART 2 - PRODUCTS

2.1 GASKET IDENTIFICATION SYSTEM

A. A system has been established which identifies the specific gasket for each service identified in the contract drawings. The specific gasket group is linked by the service number as listed in the Table A1 Piping Index, which appears at the end of Section 40 05 01 – COMMON WORK RESULTS FOR PIPING. An example is also presented in that section.

2.2 GASKET GROUPS

A. Gasket Group A: Gaskets shall be non-asbestos, compressed sheet, nitrile binder with a rated maximum operating temperature and pressure of 700 degrees F and 1200 psi, respectively. Gaskets shall be 1/8 inch thick and conform to the flange face on which they are used. Acceptable products from acceptable manufacturers include: Sepco Style No. 6234, manufactured by Sepco Corporation; 1599-TR, Hwy. 31, Pelham, AL 35124, Phone Number (800) 242-6514; Sur-Seal Style No. NA 700, manufactured by Sur-Seal Gasket and Packing, Inc.; 6156 Wesselman Road, Cincinnati, OH 45248; Phone Number (800) 345-8966; or approved equal.

B. Gasket Group HP: Gaskets shall be spirally wound, Type 316L stainless steel with non-asbestos filler material and carbon steel outer ring. Gaskets shall be 1/8 inch thick and conform to the flange face on which they are used. Acceptable products from acceptable manufacturers include: Flexitallic Style CG with Flexicarb filler and 316L winding, manufactured by Flexitallic Inc., 6915 Hwy. 225, Deer Park, TX 77536; Phone Number (281) 479-3491; or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Match flanges within piping system and at connections with valves and equipment where specified.

B. Clean flange faces and install gaskets.

C. Tighten bolts to provide uniform compression of gaskets.

END OF SECTION 40 05 50

SECTION 40 05 53 - IDENTIFICATION FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related work specified elsewhere:

1. Section 09 91 00 – PAINTING
2. Section 40 05 01 – COMMON WORK RESULTS FOR PIPING

1.2 DESCRIPTION OF WORK

A. Mechanical identification shall be provided for all new work in accordance with the requirements of this Specification Section.

B. Types of identification devices specified in this Section include the following:

1. Stainless Steel Identification Tags
2. Pipe Contents and Identification Markers
3. Brass Valve Tags

C. This Section specifies the color scheme for painting piping. Refer to Section 09 91 00 – PAINTING for painting specification.

D. Mechanical identification furnished as part of factory-fabricated equipment is specified as part of equipment assembly in other Division 40 Sections.

E. Refer to Division 26 Sections for identification requirements of electrical work; not work of this Section.

1.3 SUBMITTALS

A. Product Data and Samples: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Manufacturers technical product data and installation instructions for each type of identification device specified. Include a list of all piping systems indicating a proposed nomenclature.
2. Samples of each color, lettering style, and other graphic representation required for:

a. Stainless steel identification tag.
b. Pipe contents and identification markers.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. ANSI Standards: Unless otherwise stated, comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Install identifying devices before installing concealment.

PART 2 - PRODUCTS

2.1 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 40 sections. For each identification type, provide all tags from same manufacturer with same text, style, color, shape, and other identification features.

2.2 STAINLESS STEEL IDENTIFICATION TAGS

A. Description: All field devices (instrumentation) shall have identification tags as specified below. All field devices shall be identified, even those provided as a package piece of equipment. For the purpose of identifying all field devices including pressure gages, temperature gages, etc., the Contractor shall provide on each field device a stainless steel identification tag. Tags shall indicate the item tag number, including item type, and field device number i.e. "PG1-CW-3C2-7".

B. Lettering: Symbol letters and numerals shall be not less than 3/16 inch high and shall be deeply impressed into the metal tag.

C. Size and Shape: Rectangular, minimum 1/2" high by 1-1/4" wide by 0.025 inch thick.

D. Fastening: For control and pressure regulating valves, attach through punched hole on side of tag to valve body or yoke, not the valve handwheel, with Monel wire. For other field devices, attach with Monel wire where practical.

2.3 PIPE CONTENTS AND IDENTIFICATION MARKERS

A. Manufacturer: Seton – Setmark.

B. Description: The Contractor shall provide pipe markers on all new pipe provided in this Contract as described below. Pipe markers shall indicate line contents, direction of flow, and that insulation is asbestos free (if insulated). Line contents shall match service and shall be based on Table A1 Piping Index in Section 40 05 01 – COMMON WORK RESULTS FOR PIPING. Obtain approval from Owner/Engineer for identification of each service.

C. Material: Fade-resistant, vinyl material. Snap-on or strap-on type. All markers shall have a service temperature of -40 to 175 degrees F and be rated for outdoor service.

D. Arrangement: Rectangular pipe contents indication marker shall appear on both sides of the pipe with a flow direction arrow roll wrapping 360 degrees around at both ends of the pipe contents indication marker. For external diameters less than 1-1/2", provide full-band marker extending 360 degrees around pipe.

E. Colors: For steam, condensate, and chilled water systems, marker shall be yellow with black letters and arrows. For traditional building systems services such as pumped sanitary, marker shall be green with white letters. Contents markers shall have minimum 1-1/2" high letters. "Asbestos Free" markers shall have a blue background with white letters.

2.4 BRASS IDENTIFICATION TAGS

A. Description: For the purpose of identifying manual valves, steam traps, and expansion joints including those provided with a packaged piece of equipment. Provide on each valve, steam trap, and expansion joint, a brass identification tag. The identification number or designation will be provided by the Owner at the request of the Contractor. Allow for an additional two weeks beyond the allotted submittal time for the Owner to provide the identification number and also provide schematics that the Owner can see the process and write down the identification numbers:

1. Manual valves in all piping systems shall be tagged “V-XXX”, where “XXX” is a number designated by the Owner. Manual valves include gate, globe, ball, and butterfly style, but do not include strainers or check valves. The blowdown valves on strainers shall be tagged.
2. Steam traps shall be tagged “STP-XXX”, where “XXX” is a number designated by the Owner.

3. Expansion joints shall be tagged “XJ-XXX”, where “XXX” is a number designated by the Owner.

B. Scope: All existing and new components within any manholes where new work occurs in this project for steam, condensate, and chilled water related manual valves and steam traps shall receive a tag. Remove any existing tag.

C. Lettering: Symbol letters and numerals shall be not less than 1/2 inch high, shall be deeply impressed into the metal tag, and shall be black filled.

D. Size and Shape: Rectangular, minimum 1-1/2 inch high by 1-1/2 inch wide by 0.040 inch thick.

E. Fastening: For valves, attach through punched hole on side of tag to valve body or yoke, not the valve handwheel, with Monel wire.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting, or other covering or finish, install identification after completion of covering and painting. In addition, provide pipe markers only after each line has been complete, erected, purged, tested, and painted.

3.2 PIPE SYSTEM IDENTIFICATION

A. General: Provide pipe markers on every system including pipe contents and flow direction. Provide "Asbestos Free" insulation markers for all pipe that is insulated under this contract. Locations of all markers shall be subject to final approval by the Engineer.

B. Location:

1. Locate pipe markers in a conspicuous manner as follows:

   a. Near each branch.
   b. In manholes, at each pipe entrance/exit.

2. Where pipes run parallel to each other, identify each pipe in the same general location.

3.3 VALVE SYSTEM IDENTIFICATION

A. Manual Valve Identification Tags:

1. Provide an identification tag for every manual valve, no matter what size, including gate, globe, ball, and butterfly. Inscription shall be per Owner as specified in Part 2 of this Section.
2. Location: Attach tag to valve body or yoke, not the valve hand wheel.

B. Field Device Identification Tags: Provide an identification tag for every field device (pressure gauge, etc.) including device type and number, i.e. "PG1-CW-3C2-7."

3.4 PAINTING AND PAINT COLOR

A. Paint all new indoor and outdoor piping in accordance with Section 09 91 00 – PAINTING, unless noted otherwise. All exposed steel piping without insulation shall be painted. Do not paint any stainless steel, copper, PVC, or cast iron piping. Do not paint any piping that has insulation with an aluminum jacket. Do not paint aluminum jacket.

B. Colors must match existing and shall be approved by the Engineer after a sample is shown next to some existing painted piping for each service. Proposed colors are indicated in Table 1 of Section 40 05 01 – COMMON WORK RESULTS FOR PIPING.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices.

C. Painting and Insulating: Do not paint or insulate over any identification tags. Tags shall be installed after all painting is completed or shall be covered during painting.

END OF SECTION 40 05 53

SECTION 40 07 00 – PIPING AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Contract Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections apply to this Section.

B. Requirements of the following Specification Sections apply to this Section:

1. Section 40 05 01 – COMMON WORK RESULTS FOR PIPING
2. Section 40 05 23 – VALVES

1.2 DESCRIPTION OF WORK

A. Scope: Extent of the piping system and equipment required to be insulated by this Section is indicated in this Section, on the Contract Drawings, and other Division 40 Sections.

B. Types: Types of piping insulation systems specified in this Section include the following:

1. Pipe insulation.
2. Insulation jackets.
3. Insulation accessories.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Provide insulation conforming to the following standards:

1. American Society for Testing and Materials (ASTM): Manufacture and test insulation in accordance with the ASTM standards, including:

a.	ASTM B 209	Aluminum Alloys
b.	ASTM C 177	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
c.	ASTM C 195	Mineral Fiber Thermal Insulating Cement.
d.	ASTM C 196	Expanded or Exfoliated Vermiculite Thermal Insulating Cement.

e.	ASTM C 302	Test Method for Density of Preformed Pipe-Covering-Type Thermal Insulation.
f.	ASTM C 405	Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
g.	ASTM C 356	Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat.
h.	ASTM C 411	Test Method for Hot-Surface Performance of High Temperature Thermal Insulation.
i.	ASTM C 449	Mineral Fiber Hydraulic - Setting Thermal Insulating and Finishing Cement.
j.	ASTM C 534	Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
k.	ASTM C 547	Mineral Fiber Preformed Pipe Insulation.
l.	ASTM C 553	Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
m.	ASTM C 612	Mineral fiber Block and Board Thermal Insulation.
n.	ASTM C 795	Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
o.	ASTM C 921	Practice for Determining Properties of Jacketing Materials for Thermal Insulation.
p.	ASTM D 579	Greige Woven Glass Fabrics.
q.	ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials.
r.	ASTM C591	Pre-Formed Polyeurethane Pipe Insulation

2. National Fire Protection Association (NFPA): Manufacture insulation in accordance with the following NFPA standards:

a.	NFPA 25	Test Methods, Surface Burning Characteristics of Building Materials.

3. Underwriter's Laboratory Inc.

   a. UL 723 Tests for Surface Burning Characteristics of Building Materials.

B. Do not provide materials with flameproofing treatments subject to deterioration due to the effects of moisture or high humidity, where applicable.

C. Flame/Smoke Rating: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index specified herein, and smoke-developed index specified herein, as tested by ASTM E 84 (NFPA 255) method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories Inc., label or listing, or satisfactory certified test report from an approved testing laboratory to prove that fire hazard ratings for materials proposed for use do not exceed those specified.

D. The work shall be done only by mechanics thoroughly experienced in pipe and equipment insulation, and the quality of workmanship shall be the best attainable.

1.4 SUBMITTALS

A. Shop Drawings, Product Data, and Samples: In accordance with Section 01 33 00 – SUBMITTAL PROCEDURES, submit the following:

1. Manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, flame spread and smoke developed ratings, thickness, and furnished accessories for each mechanical system requiring insulation. Furnish necessary test data certified by an independent testing laboratory. Provide manufacturer's certification that insulation or any other materials provided shall not accelerate stress corrosion of stainless steel pipe per ASTM C795.
2. Submit manufacturer's sample of each piping insulation type required, and of each duct and equipment insulation type required. Affix label to sample completely describing product.
3. Insulation application schedule indicating equipment or piping systems sizes, insulation material, thickness, insulation vapor barriers, jackets, types of insulated fittings, accessories, and methods for each insulated system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver insulation, coverings, cements, adhesives, and coating to the site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.

B. Storage and Handling: Protect insulation against dirt, water, chemical, and mechanical damage. Do not install damaged or wet insulation; remove from project site.

C. Outside storage of insulating materials is prohibited.

D. Insulating materials and accessory materials shall be packed in shipping containers so constructed as to ensure safe delivery of the materials in a satisfactory condition. The shipping containers shall be legibly marked with the name of the manufacturer, material, size, type, thickness, density, and quality contained in each container.

E. The Contractor shall provide a storage area for weather protection of all insulation materials and accessory materials after their arrival at the job site.

F. Installed insulation which has not been weather-proofed shall be protected from inclement weather by an approved waterproof sheeting installed by the Contractor. Any wet or damaged insulation shall be removed and replaced by the Contractor at no additional cost.

PART 2 - PRODUCTS

2.1 INSULATION GENERAL REQUIREMENTS

A. General: Provide insulation conforming with the referenced publications and the specified temperature ranges and approved manufacturers products.

2.2 INSULATION IDENTIFICATION SYSTEM

A. A system has been established which identifies the specific insulation type, insulation thickness, and insulation finish for each service indicated in the Contract Drawings. The specific insulation type, insulation thickness, and insulation finish is linked by the service number as listed in the "Piping Index" which appears in Table A1 at the end of Section 40 05 01 – COMMON WORK RESULTS FOR PIPING.

B. Where insulation is scheduled for a pipe system below, insulation is required regardless of whether or not the letter designation for the insulation group is specifically called out on the pipe line description in the Contract Drawings. In some cases, a different amount of insulation may be required for a piping line than what is specified in the indexes. In these cases, the required insulation group will be changed and called out on the pipeline description on the Contract Drawings and its corresponding thickness shall prevail.

2.3 INSULATION INDEX:

A. Refer to the Table A1 “Piping Index” located at the end of Section 40 05 01 – COMMON WORK RESULTS FOR PIPING.

2.4 INSULATION THICKNESS SCHEDULE: NOMINAL INSULATION THICKNESS SHALL BE AS FOLLOWS:

Insul Group	A	B	C	I
1/2"	1-1/2	0.8	1.6	1-1/2
3/4"	1-1/2	0.8	1.6	1-1/2
1"	1-1/2	0.8	1.6	1-1/2
1-1/4"	1-1/2	0.8	1.8	1-1/2
1-1/2"	1-1/2	0.8	1.8	1-1/2
2"	1-1/2	0.8	1.8	1-1/2
2-1/2"	1-1/2	0.8	1.8	1-1/2
3"	1-1/2	0.8	2.0	1-1/2
4"	1-1/2	1.0	2.0	1-1/2
6"	2	1.0	2.0	1-1/2
8"	2	1.2	2.0	1-1/2
10"	2	1.2	2.2	1-1/2
12"	2	1.4	2.2	1-1/2
14"	2	1.4	2.2	1-1/2

Note: Insulation thicknesses listed are nominal thickness in inches.

2.5 PIPE INSULATION GROUP SPECIFICATIONS

A. General: Provide pipe insulation as specified below as dictated by the "Piping Insulation Service Group Index". Provide removable/reusable blankets in accordance with Insulation Group "R".

B. Group "A" - Pipe Insulation:

1. Insulation shall be 100 percent rigid cellular glass, totally inorganic, with no binder. Absorption of moisture shall be 0.2% or less per ASTM C240. Water-vapor permeability shall be 0 perm-in per ASTM E96. Average compressive strength shall be 90 psi ASTM C165. Average density shall be 7.5 lb per cubic foot per ASTM C303. Maximum service temperature shall be 900 degrees F. Thermal conductivity shall be no greater than 0.29 Btu-in/hr-sq. Ft. - degree F at mean temperature of 75 degrees F per ASTM C177 and C518. The insulation shall conform to ASTM E84 (5 Flame, 0 Smoke). Linear expansion shall be 3 inches per 100 linear feet at 600 degrees F. Insulation shall be fabricated in half sections wherever possible. For large diameter piping where half sections are not practical, curved side wall segments are preferred. Provide double layer system with staggered joints for all systems where pipe temperature is listed as 400 degrees F or greater.

2. Fittings and valves shall be insulated with the same insulation system and built-up to the same thickness as the insulation for the adjoining pipe in accordance with insulation manufacturer's instructions.
3. Provide insulation from one of the following manufacturers and product trade names:

Manufacturer	Trade Name Of Approved Product
Pittsburgh Corning 800 Presque Isle Drive Pittsburgh, PA 15239 Phone Number: (800) 359-8433	FOAMGLAS

4. Provide insulation with thickness as specified in Paragraph "Insulation Thickness Schedule".
5. The finish shall be as designated in "Piping Insulation Service Group Index" and specified in this Section.
6. Pipe surfaces shall be clean and dry prior to insulating. Insulation may be temporarily held in place with stainless steel wire or fiber reinforced tape overlapped a minimum of 6 inches prior to the insulation finish being installed. The tape and/or wire may remain on the insulation beneath the insulation finish.

C. Group “B” and “C” – Pipe Insulation:

1. Insulation shall be flexible aerogel insulation ASTM C1728, Type III, Grade 1A with minimum 12.5 lb/ft density with k value of 0.2 Btu-in/hr – ft^2 –deg F at a mean temperature of 400 deg F. Insulation shall pass fungal resistance per ASTM C1338. Insulation shall be hydrophobic.
2. Fittings and valves shall be insulated with same insulation and built up to the same thickness.
3. Insulation shall be secured by aluminum straps 1/2 inch wide by 0.020 inch thick. The straps shall be placed on 12 inch centers (maximum). Each circumferential joint shall have a strap at the midpoint of the lap.
4. Insulation shall be Aspen Aerogels, Inc. Pyrogel XTE.

D. Group "I" – Pipe Insulation:

1. Pipe insulation shall be flexible unicellular sheet insulation (FUS) ASTM C 534, Type II Sheet Flexible foam elastomeric thermal insulation of expanded closed cell structure, for maximum continuous temperature of minus -68 degrees F to 217 degrees F. Thermal conductivity shall be 157 BTU/HR FT degrees F at 75 degrees F. Insulation shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested by ASTM E84.
2. The thickness shall be as specified in the paragraph “Insulation Thickness Schedule.”
3. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with adhesive.

4. Provide insulation by Armaflex or any other manufacturers that satisfy the technical requirements of this specification.

E. Group “R” – Removable/Reusable Insulation Blanket

1. Insulating material shall be tailor-made removable/reusable blankets. The blankets shall be made with a high temperature fiberglass mat without the use of chemical binders and suitable for temperatures up to 1200 degrees F.
2. Insulating material shall be tailor-made removable/reusable blankets. The blankets shall be made with Aspen Aerogels, Inc. Pyrogel XTE and suitable for temperatures up to 1200 degrees F.
3. The blanket insulation thicknesses shall match the thicknesses as specified for each pipe system. For chilled water applications, the thickness shall be 0.6 inches.
4. The joints for multiple construction between blankets of the inner layer and those of the outer layer shall be offset from one another.
5. The inner liner material for hot surface temperatures up to 500 degrees F. shall be silicone coated glass 32 ounce. For hot surface temperatures between 500 and 1000 degrees F., the blanket insulation material shall be enclosed on all sides with a knitted wire mesh. The knitted wire mesh shall be 304 stainless steel wire, 0.011 inches knitted into a tubular fabric with a mesh size of 60 density.
6. The exterior jacket material shall be silicone glass cloth 32 ounce.
7. All blankets shall be quilted at frequent intervals with quilting fasteners.
8. The blankets shall be made and designed to fit tightly around the outside diameters of the flanges and valves, leaving no gaps when laced. The jackets shall wrap completely around gate and globe valve bonnets. Each blanket shall be constructed with 16 gauge stainless steel wire drawstrings that pass through hog rings and are spaced 3/4 inch apart. All mating edges of adjacent blankets shall be fitted with blanket hooks, spaced approximately 6 inches on centers or as required to provide securement for the stainless steel tie wire that are used to lace adjacent blankets together.

2.6 PIPE INSULATION FINISH SPECIFICATIONS

A. General:

1. Provide pipe insulation finish as specified below and where stated in the "Piping Index".
2. All joints shall be made rain or drip proof. Longitudinal joints shall be located on the side of the pipe with the open edge of the lap turned down to shed water. Circumferential joints on pipes that do not have enough slope to get a good shingle effect to keep water out of the joint shall have the inside end of the lap beaded or sealed with a permanently elastic mastic type sealant designed for this service.
3. At hangers and support points, the Contractor will supply and install a premolded high density fiberglass insulation segment with an attached vapor barrier. The Contractor shall fit his insulation to this segment. For cold systems, the Contractor shall seal the vapor barrier to the insulation.

4. Since the efficiency of this insulation for cold systems is dependent upon obtaining and maintaining an absolutely vapor tight barrier, all precautions shall be taken to not rupture the vapor barrier at any point by the use of screws, staples, etc.

B. Group "AA" - Insulation Finish

1. Chilled Water Piping: Provide PITT WRAP CW Plus jacketing system.
2. Provide an aluminum jacket over the PITT WRAP as specified below.

a. Aluminum weatherproof jacket shall be manufactured from aluminum alloy 5005 or 3003 half hard, not less than 0.016 inch thick, fabricated with 3/16 inch corrugations running lengthwise of pipeline. The aluminum shall be factory attached to a moisture barrier of kraft paper treated for this service.
b. All joints shall be made rain or drip proof. Longitudinal joints shall be located on the side of the pipe with the open edge of the lap turned down to shed water. Circumferential joints on pipes that do not have enough slope to get a good shingle effect to keep water out of the joint shall have the inside end of the lap beaded or sealed with a permanently elastic mastic type sealant designed for this service.
c. The aluminum jacket shall be secured by aluminum straps 1/2 inch wide by 0.020 inch thick. The straps shall be placed on 12 inch centers (maximum). Each circumferential joint shall have a strap at the midpoint of the lap.
d. On long radius bends, the aluminum jacket shall be in sections cut on the miter, overlapped, and forming a neat snug fit, using sufficient bands and fasteners to hold jacket properly in place.
e. All 30 inch diameter and smaller insulated elbows shall be protected with a prefabricated elbow jacket. The jacket shall be manufactured of high purity 0.024 inch aluminum with a suitable moisture barrier on the interior of the jacket to prevent decomposition of the aluminum. The prefabricated elbow jacket shall be applied directly over the insulated fitting.
f. All insulation on fittings, flanges, valves (which do not get insulation blankets), and other irregular shaped items on which the aluminum jacket cannot be neatly applied shall be finished as follows:

1) Over the smooth insulation surface and cloth reinforcing as described below, apply the mastic in two or more coats at a sufficient rate to provide a dry film thickness of 1/8 inch.
2) The mastic shall be applied by trowel or spray. The exact application conditions, procedures and recoat time shall be as recommended by the mastic manufacturer.
3) Reinforcing shall consist of a No. 10 mesh nylon or Dynel cloth. Flat surfaces shall be secured to the insulated structure on 18 inch centers maximum.
4) The mastic shall be gray or metallic gray vinyl VI-CRYL CP-10 or CP-11 manufactured by Childers Products Company, 35555-T Curtis Blvd., Eastlake, OH 44095; Phone Number: (216) 953-5200; or WC-1

manufactured by Vimasco Corporation, Dept. TR, P.O. Box 516, Nitro, West Virginia 25143; Phone Number: (888) 276-9146.

5) Upon completion of the work, the Contractor shall furnish the A/E a certificate stating that the mastic has been applied in the same manner as specified or approved by its manufacturer.

PART 3 - EXECUTION

3.1 GENERAL INSULATION INSTALLATION

A. General: Install insulation material with smooth and even surfaces. Unless otherwise specified, install insulation materials, accessories, and finishes in accordance with the manufacturer's published recommendations.

B. Fire Precaution: Care shall be exercised by the Contractor that no cutting, welding, or open flames are permitted in the areas where flammable mastics or other materials are used. The precaution period shall extend until the material has cured sufficiently so that no further fire hazard exists.

C. Insulation Release: Before insulation is applied to any piping or equipment, the Contractor shall obtain from the Engineers a written release stating that the item is ready for insulation.

D. Manufacturer's Recommendations: All materials specified herein shall be installed in full accordance with the manufacturer's recommendations for the best performance and durability of his product, notwithstanding any requirements or omissions herein with respect to preparation of equipment before insulating or method of application.

E. Surface Condition: Do not apply insulation materials until all surfaces to be covered are clean and dry, all foreign materials, such as rust, scale, and dirt have been removed, and surfaces have been painted. Insulation shall be clean and dry when installed and during the application of any finish.

F. Moisture and Vapor Seal: Provide a complete moisture and vapor seal wherever insulation terminates against metal hangers, anchors and other projections through insulation on cold surfaces for which a vapor seal is specified.

G. Asbestos Containing Material: No Contractor, Subcontractor, or Supplier shall furnish any asbestos containing material.

3.2 INSULATION FOR PIPING

A. General: Installation

1. All sectional pipe insulation shall be applied with staggered girth joints tightly butted together as recommended by the insulation manufacturer. Each section of insulation is to be held in place with separate loops of 16 gauge annealed stainless steel wire placed not more than 12 inches on center.
2. Insulation shall not be applied to any flanged, machined, or welded surfaces until they have passed all field tests, including hydrostatic, and have been released for insulation.

B. Insulation of Valves, Flanges, Fittings, Etc.

1. Insulate all valves (manual or control) 2-1/2 inch NPS and larger with removable/reusable blankets in accordance with Insulation Group “R” of this Section.
2. In all insulated lines, with the exception of valve sizes above items which are insulated with blankets, the valve bodies, fittings, and flanges shall be insulated with the same material and the same thickness as the pipe insulation.

C. Gaps and Terminations: Neatly terminate all insulation at each end of unions and at other points where required and seal. Fill gaps occurring at hangers with insulating cement and finish flush with the adjoining pipe insulation as specified for fittings.

D. Butt pipe insulation against pipe hanger insulation inserts. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

3.3 PAINTING AND IDENTIFICATION

A. Aluminum jackets shall not be painted.

B. Provide identification labels and tags for all piping systems and equipment as specified in Section 40 05 53 – IDENTIFICATION FOR PIPING AND EQUIPMENT.

C. Do not insulate or paint over factory attached nameplate labels on equipment, valves, and other devices.

END OF SECTION 40 07 00

APPENDIX – EXISTING CONDITION INFORMATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. The following pages provide information to the Contractor on the existing subsurface soil conditions, which are currently known. The subsurface soil investigation is limited in nature and the Owner does not warrant the completeness or accuracy of the information.

PART 2 - PRODUCT - (NOT APPLICABLE)

PART 3 - EXECUTION - (NOT APPLICABLE)

END APPENDIX

UNIVERSAL
ENGINEERING SCIENCES

REPORT OF PAVEMENT EVALUATION SERVICES
Inner Road
Gainesville, Alachua County, FL
UES Project No. 0230.2000067.0000
UES Report No. 1790703

Prepared for:
UF Planning Design & Construction
245 Gale Lemerand Drive
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Prepared by:
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August 14, 2020

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August 14, 2020

UF Planning Design & Construction
245 Gale Lemerand Drive
P.O. Box 115050
Gainesville, Florida 32611

Attention: Mr. Tom Feather
Project Manager

Reference: **Report of Pavement Evaluation Services**
Inner Road
Gainesville, Alachua County, Florida
UES Project No. 0230.2000067.0000 UES Report No. 1790703

Dear Mr. Feather.:

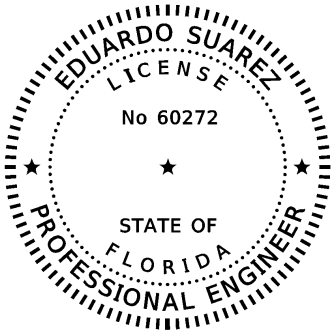
Universal Engineering Sciences, LLC (UES) has completed the pavement evaluation for the subject project in satisfaction of the contracted agreement for services. Our engineering services were performed in general accordance with the scope of services summarized in our Work Authorization Form.

This Report briefly presents our understanding of the proposed construction, describes the field exploration and presents the data obtained, and provides our engineering evaluation, and recommendations for improvement of the roadway pavement sections.

If you have any questions concerning this Report or if we may be of further assistance, please contact our office.

Respectfully submitted,

UNIVERSAL ENGINEERING SCIENCES, LLC
Certificate of Authorization 549



Timothy E. Kwiatkowski, P.E.
Project Geotechnical Engineer
Florida P.E. No. 86444

Eduardo Suarez, P.E.
Senior Geotechnical Engineer
Florida P.E. No.60272

This item has been electronically signed and sealed by Eduardo Suarez, PE on the date adjacent to the seal using Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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Report No.: 1790703
Date: August 14, 2020

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Project No.: 0230.2000067
Report No.: 1790703
Date: August 14, 2020

1.0 INTRODUCTION

1.1 GENERAL

In this report, we present the results of the shallow soil exploration and pavement evaluation for the proposed improvements of the existing Inner Road in Gainesville, Alachua County, Florida. We have divided this report into the following sections:

- SCOPE OF SERVICES - Defines what we did
- FINDINGS - Describes what we found
- RECOMMENDATIONS - Describes what we encourage you to do
- LIMITATIONS - Describes the restrictions inherent in this report
- APPENDICES - Presents support materials referenced in this report

2.0 SCOPE OF SERVICES

2.1 PROJECT DESCRIPTION

We understand that the proposed project includes pavement cores/improvement and stormwater management areas, along Inner Road within the University of Florida in Gainesville, Alachua County, Florida. The project is approximately ¼ mile in length, and is located between Newell Drive and SW 13th Street. Our office was provided with an Overall Site Plan, and Existing Site Condition Plans, prepared by RMF Engineering, Inc. Our office was not provided with any construction-related information other than that discussed herein.

2.2 PURPOSE

The objectives of this pavement evaluation were to perform a shallow soil exploration along the roadway sections proposed for improvements to provide recommendations for consideration in the design and construction of roadway improvements. To accomplish these objectives our exploration included:

1. Review of aerial photographs and published data including the USDA Soil Survey Maps and readily available area geological information.

2. Site reconnaissance to observe existing site conditions such as pavement condition, vegetation, water levels, existing utilities and adjacent structures.

3. Evaluation of soil test borings along the existing roadway.

4. Engineering visual classification of recovered soil samples.

5. Engineering visual review and evaluation of recovered pavement core samples.

6. Preparation of engineering recommendations for pavement improvements.

7. Preparation of aquifer design parameters for the proposed stormwater management areas.

This report presents an evaluation of site conditions based on traditional geotechnical procedures for site characterization. The recovered samples were not examined, visually or

analytically, either for chemical composition or for environmental hazards. Universal Engineering Sciences would be pleased to perform these services, if you desire.

Our exploration was confined to the zone of soil likely to be stressed by the proposed improvement and for typical vehicular wheel loadings. Our work did not address the potential for surface expression of deep geological conditions. This evaluation requires a more extensive range of field services than performed in this study. We will be pleased to conduct an investigation to evaluate the probable effect of the regional geology upon the proposed construction, if you desire.

2.3 FIELD EXPLORATION

Our field exploration consisted of performing twelve pavement cores/shallow soil test borings for the proposed roadway improvements, and five soil test borings within the proposed stormwater management areas. The field testing activities were started on July 15, 2020 and completed on July 23, 2020. Existing pavement conditions were evaluated by obtaining core samples of the asphalt pavement, and characterizing the pavement section.

2.3.1 Pavement Core Boring

As requested, pavement core borings were conducted at twelve locations along the existing roadway. We then completed hand auger borings to depths of 5 feet below the pavement surface at those same locations. The thickness of the asphalt course, and limerock base were measured and documented. The asphalt core samples were returned to the laboratory for further evaluation. A summary of the pavement conditions at each core/boring location is provided in Table 1 of this report.

2.3.2 Hand Auger Borings and Penetrometer Sounding Results

The shallow soil conditions for the existing roadway were explored with twelve auger borings advanced to a depth of 5 feet below the existing pavement surface in accordance with ASTM D-1452 test procedures. Auger borings were advanced using hand auger techniques. Hand augers were performed by advancing a hand held sampler into the soil and inspecting the recovered soil cuttings. All boreholes were backfilled upon field work completion. The pavement core areas were backfilled with cold patch. Samples of the soils encountered will be held in our laboratory for your inspection for 60 days and then discarded, unless we are notified otherwise.

In order to evaluate the relative density of the in situ soils adjacent to the building, we performed the Dynamic Cone Penetrometer at shallow depths in the auger borings. The Dynamic Cone Penetrometer test was performed at one foot intervals in depth according to the procedures developed by Professor G. F. Sowers and Charles S. Hedges (ASCE, 1966). The basic procedure for the Dynamic Cone Penetrometer test is as follows: A standard 1.5-inch diameter conical point is driven into the soil by a 15-pound steel hammer falling 20-inches. Following the seating of the point to a depth of 2-inches, the number of blows required to drive the sampler an additional 1.75-inches, is designated the penetration resistance, providing an index to soil strength and density.

Auger boring locations were established in the field by UES engineering personnel. The soil test boring locations shown on the attached Boring Location Plan drawings should be considered approximate.

2.3.3 Standard Penetration Test (SPT) Borings

Penetration tests were performed in accordance with ASTM Procedure D-1586, Penetration Test and Split-Barrel Sampling of Soils. This test procedure generally involves driving a 1.4-inch I.D. split-tube sampler into the soil profile in six inch increments for a minimum distance of 18 inches using a 140-pound hammer free-falling 30 inches. The total number of blows required to drive the sampler the second and third 6-inch increments is designated as the N-value, and provides an indication of in-place soil strength, density and consistency. Field tests for the geotechnical study included soil test borings at readily accessible site locations. The soil test boring locations are shown in the attached Boring Location Plan drawing. The actual test locations shown are approximate and were staked in the field by UES engineering personnel using existing landmarks and site features. The boreholes were backfilled to grade upon field work completion.

Representative portions of the subsurface soil samples recovered were transported to our Gainesville soils laboratory. The soil samples were visually classified by an experienced geotechnical engineer. The results of the classification and stratification have been shown on the attached Boring Logs and summarized later in this Report. It should be noted that soil conditions might vary between soil test boring locations, and between the subsurface soil strata interfaces which have been shown on the Boring Logs. The soil test boring data reflect information from the specific test locations only. This Report presents an evaluation of site conditions on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards.

2.3.4 Visual Classification

The soil samples recovered from the soil test borings were returned to our Gainesville soils laboratory where a geotechnical engineer visually examined them and reviewed the field descriptions in accordance with ASTM D-2488.

2.4 LABORATORY TESTING

2.4.1 Visual Classification

The soil samples recovered from the soil test borings were returned to our laboratory where an engineer visually reviewed the field descriptions in accordance with ASTM D-2488. Using the results of the laboratory tests, our visual examination, and our review of the field boring logs we classified the soil borings in accordance with the current Unified Soil Classification System (USCS). We then selected representative soil samples for laboratory testing.

2.4.2 Index Testing

Laboratory testing was performed on selected samples of the soils encountered in the field exploration to better define soil composition and properties. Testing was performed in accordance to ASTM procedures and included permeability testing (ASTM D-2434), natural moisture content (ASTM D-2216), and percent fines determination (ASTM D-1140)/Soil Sieve Analysis (ASTM D-422). The test results have been presented on the attached Boring Logs.

2.4.3 Limerock Bearing Ratio (LBR) Testing

Two LBR bulk test samples were collected within the roadway improvement areas. LBR testing was performed by certified personnel in accordance with FM 5-515 and the results are presented in the Summary of Test Results in **Appendix C.**

3.0 FINDINGS

3.1 LITERATURE REVIEW

We reviewed commonly available references for general information about the property along the possible roadway alignment. A Study Area Location Map is included in **Appendix A**.

3.1.1 Topography

The survey site plan shows the roadway to be located within rolling terrain, indicating ground surface elevations of roughly +160 to +150 feet, NGVD in the general area of the roadway site.

3.1.2 General Area Soils Information

The United States Department of Agriculture (USDA) *Soil Survey of Alachua County, Florida* describes the near-surface soil profile in the corridor as Urban Land soils. The USDA Soil Survey of Alachua County was reviewed to obtain relevant near-surface soils information along the project alignment. Urban Land soil classification indicates that 85 percent of the area is covered with shopping centers, parking lots, buildings, streets, sidewalks and other facilities. Many of these open areas have been altered by cutting and shaping or by having fill material spread on the surfaces.

3.2 GENERAL SUBSURFACE CONDITIONS

3.2.1 General

Stratification of the explored soils is based upon visual observations of the recovered soil samples, limited laboratory classification and index testing, and interpretation of the field boring logs by a geotechnical engineer. Stratification lines represent approximate boundaries between soil types; however, the actual transition between layers may be gradual. It should be noted that groundwater may be deeper than the boring depths and that groundwater conditions may vary significantly between borings and overtime. The shallow soil conditions are presented on the Report of Soil Borings in **Appendix B**. It should be understood that soil and groundwater conditions could vary between borings.

3.2.2 General Soil Profile – Pavement Cores/Borings

Generally, the roadway auger borings found sand with silt or clay to silty sand [SP-SM/SP-SC/SM][A-3/A-2-4] to depths of 3.5 to 5 feet, followed by slightly clayey sands [SC][A-2-4] to the maximum boring termination depths of 5 feet. The soil and groundwater conditions found in the roadway borings are listed in the Soil Borings Logs.

3.2.3 General Soil Profile – Stormwater Management Areas

Generally, the stormwater management borings found sand with silt or clay to silty sand [SP-SM/SP-SC/SM] to depths of 4 to 8.5 feet, followed by silty/clayey sands [SM-SC/SC] to sandy

clay [CH] to the maximum boring termination depths of 20 feet. The soil and groundwater conditions found in the stormwater management borings are listed in the Soil Borings Logs.

3.3 GENERAL PAVEMENT PROFILE

With the exception of cores C-9 (0.70 inches) and C-12 (4.80 inches) to the east extent of the project site, roadway borings taken through the existing pavement generally found from about 1.55 to 2.50 inches of asphaltic concrete course, overlying 5.00 to 9.00 inches of a crushed limerock base. Some localized areas of distress were noted along the roadway, typically associated with reflection cracks, shrinkage of the asphalt (longitudinal/transverse cracks). See photos attached in **Appendix A.**

3.4 MEASURED GROUNDWATER LEVELS

The groundwater level was not generally apparent in the soil test boring locations at the time of the field exploration program. It should also be noted that soil borings B-2 and B-3 within the proposed stormwater management areas encountered a transient perched water level at a depth of 8 feet. Absence of groundwater level data in some of the test borings implies that no groundwater was apparent within the explored depths at the time of soil test boring work completion, but does not necessarily mean that groundwater will not be encountered at these locations or within the vertical reaches of these boring locations in the future. It is possible that insufficient time was allowed for groundwater recharge into the open boreholes, in light of the prevailing soil conditions.

Existing cracks on the asphaltic concrete surface, together with open potholes, create the potential for stormwater runoff intrusion into the underlying base course and subgrade soils. Given sufficient rainfall activity, this scenario may result in the temporary saturation of these structural pavement section elements. Base courses tend to loose some of their integrity and strength when saturated and subjected to surface loading.

3.5 LABORATORY TESTING

The soil samples recovered from the field exploration program were placed in containers and returned to our soils laboratory, where the Geotechnical Engineer visually examined and classified the samples. Laboratory soil tests are performed to aid in the classification of the soils, and to help in the evaluation of engineering characteristics of the soils. Representative soil samples were selected for soil sieve analysis/percent fines determination, moisture content, and permeability testing. The test results have been presented on the attached Boring Logs and summarized in **Appendix C.**

3.5.1 Grain Sieve Analysis-Percent Passing No. 200 Sieve

Certain recovered soil samples were selected to determine the distribution of particle sizes in soils. The distribution of particle sizes larger than 75 micrometers (retained on the US No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75 micrometers is determined by a sedimentation process using a hydrometer. These tests were conducted in accordance with ASTM Procedure D-1140, *Standard Test Methods for Amount of Material in Soils Finer than the No. 200 Sieve,* and ASTM Procedure D-422*, Standard Test Method for Particle-Size Analysis of Soils.*

3.5.2 Moisture Content

Certain recovered soil samples were selected to determine their moisture content. The moisture content was the ratio expressed as a percentage of the weight of water in a given mass of soil to the weight of the solid particles. These tests were conducted in accordance with *ASTM Procedure D-2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.*

3.5.3 Permeability Testing

Representative soil samples were selected to determine the permeability rate of the soils. Constant head permeability test was performed on a representative sample of the near surface soils from the proposed stormwater management area. This test was conducted following the concepts outlined in ASTM D-2434, *Standard Test Method for Permeability of Granular Soil*s (Constant Head).

3.5.4 LBR testing

Two LBR tests were performed along the proposed roadway improvements. LBR testing was performed by certified personnel in accordance with FM 5-515 and the results are presented in **Appendix C**.

4.0 EVALUATION and RECOMMENDATIONS

4.1 GENERAL

The following recommendations are made based on our site observations, the available subsurface soil test data, and our understanding of the proposed roadway improvements. The discovery of any site or soil conditions during construction, which deviate from the soil data obtained during this geotechnical exploration, as summarized herein, should be reported to UES for our evaluation and recommendations.

Based on the serviceability of the pavement, type and extent of the cracking, the general existing conditions of the pavement have been estimated as “Fair to Poor”.

4.2 PAVEMENT SECTION COEFFICIENT VALUES

We used the Florida Department of Transportation (FDOT) “reduced values” for pavement layer structural coefficients based on our estimates of the existing pavements’ condition. We estimated the current, in-place layer values for the asphalt course, limerock stabilized base course, and stabilized subgrade. Based on the asphalt, the limerock stabilized base, and the current estimated pavement conditions, estimated Structural Numbers (SN) for the existing roadway pavement sections are presented in Table 1. We estimated a Structural Numbers (SN) for the existing roadway pavement sections of **2.33.**

Specific traffic loadings were not provided to our office for this Report preparation. The following recommendations are based on the assumption that the traffic loading will be fairly light. We strongly recommend a traffic evaluation based on existing data in order to get an accurate value of projected traffic. If these assumptions are incorrect or considered inappropriate for the expected pavement use on this project, it may be necessary to reevaluate our recommendations based on a revised projected traffic data

Table 1: Estimated Existing Structural Numbers							
Cores	Pavement Layer		Limerock		Stabilized Subgrade		Estimated Existing Structural Number
	Thick. (inch)	Str. Coeff.	Thick. (inch)	Str. Coeff.	Thick. (inch)	Str. Coeff.	
1	1.80	0.15	5.00	0.18	12.0	0.06	1.89
2	2.10	0.15	5.00	0.18	12.0	0.06	1.94
3	1.70	0.15	5.00	0.18	12.0	0.06	1.88
4	2.10	0.15	6.50	0.18	12.0	0.06	2.21
5	2.45	0.15	5.50	0.18	12.0	0.06	2.08
6	1.55	0.15	8.00	0.18	12.0	0.06	2.39
7	2.10	0.15	7.00	0.18	12.0	0.06	2.30
8	1.85	0.15	9.00	0.18	12.0	0.06	2.61
9	0.70	0.15	9.00	0.18	12.0	0.06	2.44
10	2.35	0.15	9.00	0.18	12.0	0.06	2.69
11	2.50	0.15	9.50	0.18	12.0	0.06	2.80
12	4.80	0.15	7.00	0.18	12.0	0.06	2.70
Average Structural Number							2.33

4.3 ESTIMATED SEASONAL HIGH GROUNDWATER LEVEL

A number of factors affect the seasonal high water table. The drainage characteristic of the underlying soils, the land surface elevation, relief points such as lakes, rivers, swamp areas as well as distance and direction to the relief points, are some of the more important factors influencing the seasonal high water table elevation. In addition to the above, the water table elevations associated with a 100-year flood level would be significantly higher than the normal seasonal high water table elevation.

As discussed above, the groundwater level was not generally apparent at the boring locations at the time of our exploration. It should also be noted that soil borings B-2 and B-3 within the proposed stormwater management areas encountered a transient perched water level at a depth of 8 feet. Based on the subsurface findings, a review of available published literature and our past project experience, we estimate the normal seasonal high groundwater table along the proposed roadway project alignment to be deeper than 5 feet below the existing ground surface elevations. However, stormwater can perch on top of clayey sands and clays where sandy soils are present near the surface.

4.4 PAVEMENT RECOMMENDATIONS

Based upon our site observations and exploratory testing, we offer the following professional opinions and recommendations for this project. Since the pavement quality index is considered fair to poor, the pavement is considered to need from typical preventive and/or corrective maintenance.

Based upon our site observations and exploratory testing, we offer the following professional opinions and conclusions along with recommendations for localized remedial actions and maintenance for this project. A summary of procedures for crack filling and sealing, fog seal (seal coat), and sand seal treatment recommended are presented below.

- Crack Repair with Sealing: This treatment includes using hot air lance or compressed air to blow out the debris in the crack and the filling with a sealant (low-modulus rubberized asphalt). This treatment is different than crack filling typically used with asphalt emulsion. Performance of this treatment ranges from 3 to 5 years.

- Fog seal (seal coat): This treatment includes applying diluted asphalt emulsion without a cover aggregate. Fog seal is used to seal and enrich the asphalt pavement surface, seal minor cracks. An asphalt distributor is normally used to apply the fog seal. Before placing the fog seal, the pavement should be dry and clean, and complete all necessary repair and reconditioning. Fog seal should not be used in areas with cracks larger than hairline, and where the existing surface is not sufficiently porous to absorb the emulsion. Performance of this treatment ranges form two to three years.

- Sand seal: A sand seal is normally an application of liquid asphalt or emulsions, covered with fine aggregate (sand). These seals may be used to improve skid resistance, prevent oxidation, and to seal against water infiltration. Construction procedures for sand seals are similar to those for single surface treatments. If properly constructed (controlling bleeding/excess sand) these types of seal coats should last three to six years.

Based on our survey some sections of the roadways have a lower structural number than the estimated to be needed for this type of roadway/traffic. If corrective/preventive maintenance would not extend the life of the pavement and the pavement condition is deteriorating, a rehabilitation program will be needed.

We recommend milling and resurfacing. A minimum milling depth of 1 inch is recommended. Milling may remove the majority of the cracked pavement. We recommend the placement of 1½ inches of type S-III (Type FC-9.5 friction course or Type SP-9.5 Surperpave mix). This would give the roadway a new composite structural number of **SN = 2.8**. It should be noted that any new asphalt that is placed over existing cracks in old asphalt will reflect the cracking in the new pavement. A crack relief layer may be considered to reduce reflective cracking. It should be noted that this pavement section should be compared to the actual/projected traffic loading to determine if additional asphalt is warranted. We recommend that all milling and resurfacing operations conform to the most current Florida Department of Transportation Standard Specifications for Roadway and Bridge Construction.

If new composite structural number does not comply with County Requirements or are considered inappropriate for the expected pavement use on this project, it may be necessary to reevaluate our recommendations.

4.5 STORMWATER MANAGEMENT SYSTEM

The laboratory test data indicates that the surficial sandy soils within the existing stormwater management area for this project generally have permeability rates of 0.5 to 25 feet per day at the boring locations. Based upon the above findings, we recommend that you consider the soil parameters presented in Table 2 for design of the stormwater management system on the subject project site. It should be noted that the above referenced values are measured values and do not incorporate factor of safety.

Table 2 – Stormwater Management System Soil Design Parameters					
Corresponding Soil Boring Test Locations	B-1	B-2	B-3	B-4	B-5
Average Depth to Confining Layer, feet	5.5	8.5	8.5	4	5.5
Unsaturated Vertical Infiltration rate, feet per day	11	9	6	5	7
Estimated Horizontal Hydraulic Conductivity, feet per day	17	14	9	8	10
Estimated Fillable Porosity, percentage	25	25	25	25	25
Average Estimated Depth of Seasonal High Water Table feet[1]	5	8	8	3.5	5

[1]Normal seasonal high water table (SHWT) will be the result of perched conditions.

4.6 SUITABILITY OF EXCAVATED SOILS

The recovered soil samples were classified using visual and textural means, and limited laboratory testing. We offer below ***preliminary guidelines*** for the use of on-site soils, as fill material for the project.

Soil materials excavated and classified as fine sands to sand with silts and sand with clay [SP, SP-SM, SP-SC]/(A-3), with typically 12% fines or less (silt/clay fraction), may be considered suitable for use as utility trench backfill and pavement structural fill, provided said materials are properly dried, placed, and compacted.

Soil materials excavated and classified as silty to slightly clayey fine sands [SM, SC]/(A-2-4), with typically 12% to 25% fines, may also be considered suitable for use as utility trench backfill and structural fill, after significant drying and some mixing with the fine sand material described above. Proper placement, proof rolling and compaction must also be performed.

Soil materials excavated and classified as clayey sand silt or clay [SC, ML, MH, CL, and CH]/(A-2-6 to A-7) and any organic-laden soils (5% or greater organics by weight) [PT]/[A-8] should not be reused as fill. These materials could be used in green areas, if applicable and in non-structural applications where excessive ground subsidence will not create functional or aesthetic problems.

Soil borings for a typical geotechnical report are widely spaced and generally not sufficient for reliably detecting the presence of isolated, anomalous surface or subsurface conditions, or reliably estimating unsuitable or suitable material quantities. Accordingly, UES does not recommend relying on our boring information to negate presence of anomalous materials or for estimation of material quantities unless our contracted services ***specifically*** include sufficient exploration for such purpose(s) and within the report we so state that the level of exploration provided should be sufficient to detect such anomalous conditions or estimate such quantities. Therefore, UES will not be responsible for any extrapolation or use of our data by others beyond the purpose(s) for which it is applicable or intended.

5.0 REPORT LIMITATIONS

This Report has been prepared for the exclusive use of UF Planning Design & Construction, and other members of the Design/Construction Team for the specific project discussed in this Report. This Report has been prepared in accordance with generally accepted local engineering practices; no other warranty is expressed or implied.

The evaluation and recommendations submitted in this Report are based in part upon the data collected from the shallow, limited field exploration and the provided traffic data. The nature or extent of variations throughout the subsurface profile may not be fully reflected in the findings. If any changes in the design or location or elevation of the proposed construction as outlined in this Report are planned, or if any structures are included or added that are not discussed in the Report, the conclusions and recommendations contained in this Report shall not be considered valid unless the changes are reviewed and the conclusions modified or confirmed by Universal Engineering Sciences.

Because of the natural limitations inherent in working with the subsurface, it is not possible for geotechnical/geologic professionals to anticipate and predict all possible subsurface variations and their potential affect on the subject of this study. A GBA publication, "Important Information about Your Geotechnical Engineering Report" appears in **Appendix D**, and will help explain the nature of geotechnical issues. Further, we present documents in Appendix D: Constraints and Restrictions, to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

APPENDIX A

Site Location Map

Photographs

UNIVERSAL ENGINEERING SCIENCES	**UF 644 Reitz Lawn & Inner Road Gainesville, Alachua County, Florida**		
	SITE LOCATION MAP		
	DATE: 08-04-20	UES PROJECT NO.: 0230.2000067	APPENDIX NO.: A
	SCALE: N.T.S.	REPORT NO.: 1790703	FIGURE NO.: 1

UNIVERSAL ENGINEERING SCIENCES	**UF 644 Reitz Lawn & Inner Road Pavement Evaluation Gainesville, Alachua County, Florida**		
	Site Photographs		
	DATE: 08-13-20	UES PROJECT NO.: 0230.2000067	APPENDIX NO.: A
	SCALE: N.T.S.	REPORT NO.: 1790703	FIGURE NO.: A2

UNIVERSAL ENGINEERING SCIENCES	**UF 644 Reitz Lawn & Inner Road Pavement Evaluation Gainesville, Alachua County, Florida**		
	Site Photographs		
	DATE: 08-13-20	UES PROJECT NO.: 0230.2000067	APPENDIX NO.: A
	SCALE: N.T.S.	REPORT NO.: 1790703	FIGURE NO.: A3

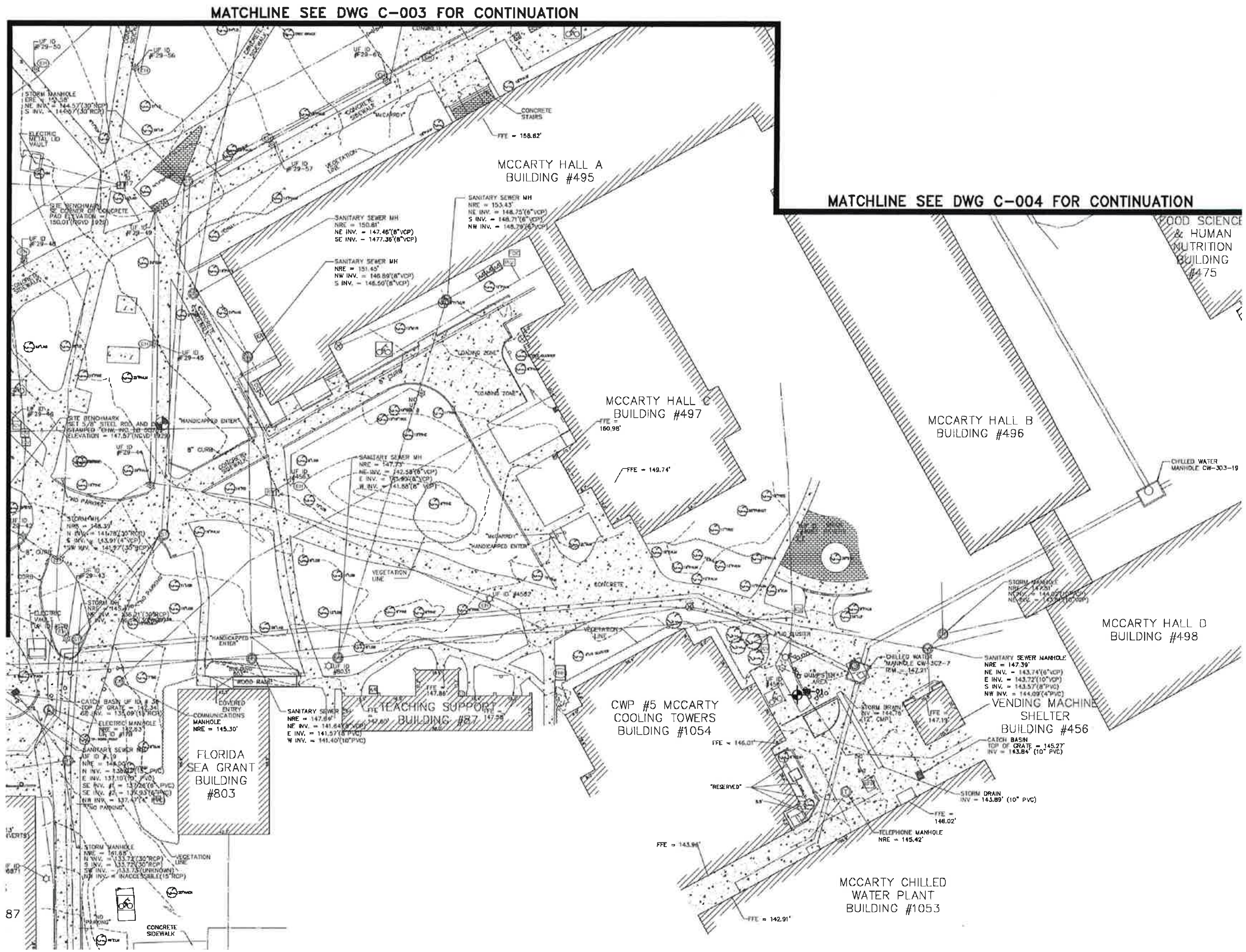
UNIVERSAL ENGINEERING SCIENCES	**UF 644 Reitz Lawn & Inner Road Pavement Evaluation Gainesville, Alachua County, Florida**		
	Site Photographs		
	DATE: 08-13-20	UES PROJECT NO.: 0230.2000067	APPENDIX NO.: A
	SCALE: N.T.S.	REPORT NO.: 1790703	FIGURE NO.: A4

APPENDIX B

Boring Location Plan

Boring Logs

Key to Boring Logs



LEGEND

BORING LOCATION

NOTE: ALL SOIL TEST BORING LOCATIONS SHOWN ARE APPROXIMATE.

UNIVERSITY OF FLORIDA

DRAWN BY: KD DATE: 7/8/20

CHECKED BY: ES DATE: 7/8/20

SCALE: 1"=50' ACADFILE:0230.2000067-A

PROJECT NO: 0230.2000067.0000 REPORT NO: 1790702

UF 644 REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS

REITZ UNION LAWN AND INNER ROAD

GAINESVILLE, ALACHUA COUNTY, FLORIDA

BORING LOCATION PLAN

UNIVERSAL

ENGINEERING SCIENCES

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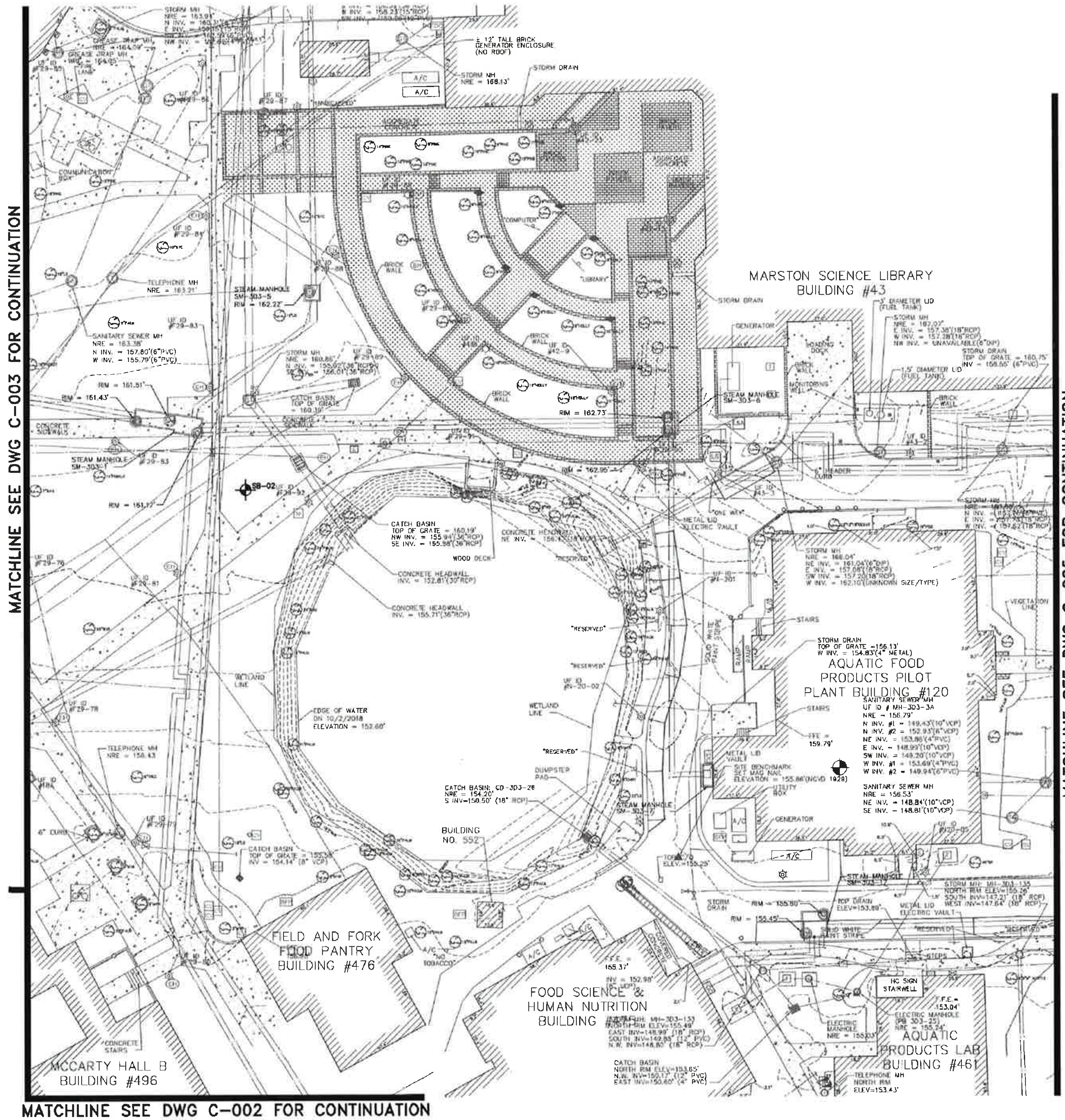

LEGEND

BORING LOCATION

NOTE: ALL SOIL TEST BORING LOCATIONS SHOWN ARE APPROXIMATE.

UNIVERSITY OF FLORIDA

DRAWN BY:	KD	DATE:	7/8/20
CHECKED BY:	ES	DATE:	7/8/20
SCALE:	1"=50'	ACADFILE:	0230.2000067-A
PROJECT NO:	0230.2000067.0000	REPORT NO:	1790702

UF 644 REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, ALACHUA COUNTY, FLORIDA

BORING LOCATION PLAN

UNIVERSAL
ENGINEERING SCIENCES

PAGE NO:
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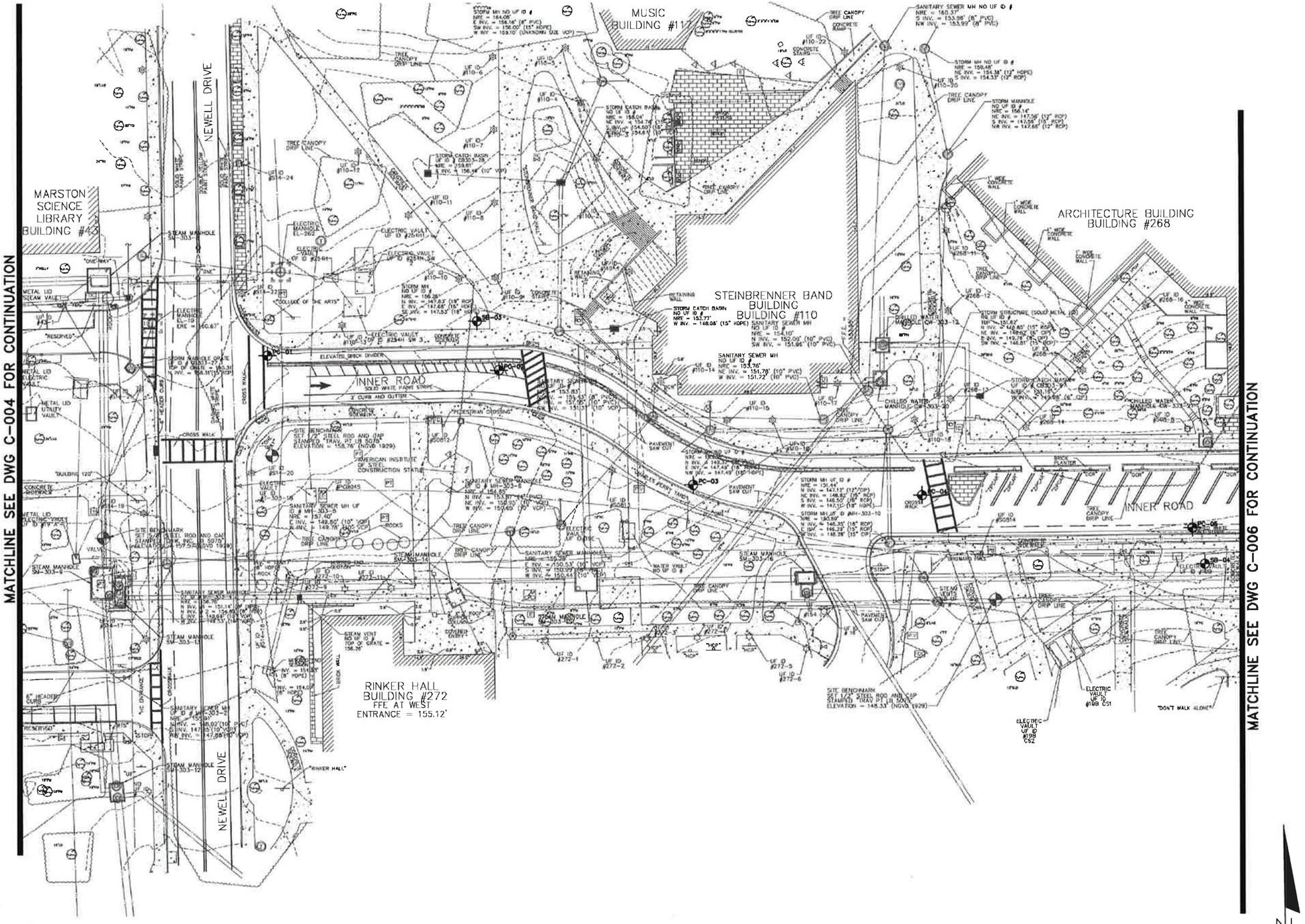

LEGEND

⊕ BORING LOCATION

NOTE: ALL SOIL TEST BORING LOCATIONS SHOWN ARE APPROXIMATE.

UNIVERSITY OF FLORIDA

UF 644 REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, ALACHUA COUNTY, FLORIDA

BORING LOCATION PLAN

DRAWN BY: KD	DATE: 7/8/20	SCALE: 1"=50'	ACADFILE:0230.2000067-A
CHECKED BY: ES	DATE: 7/8/20	PROJECT NO: 0230.2000067.0000	REPORT NO: 1790702

UNIVERSAL
ENGINEERING SCIENCES

PAGE NO:
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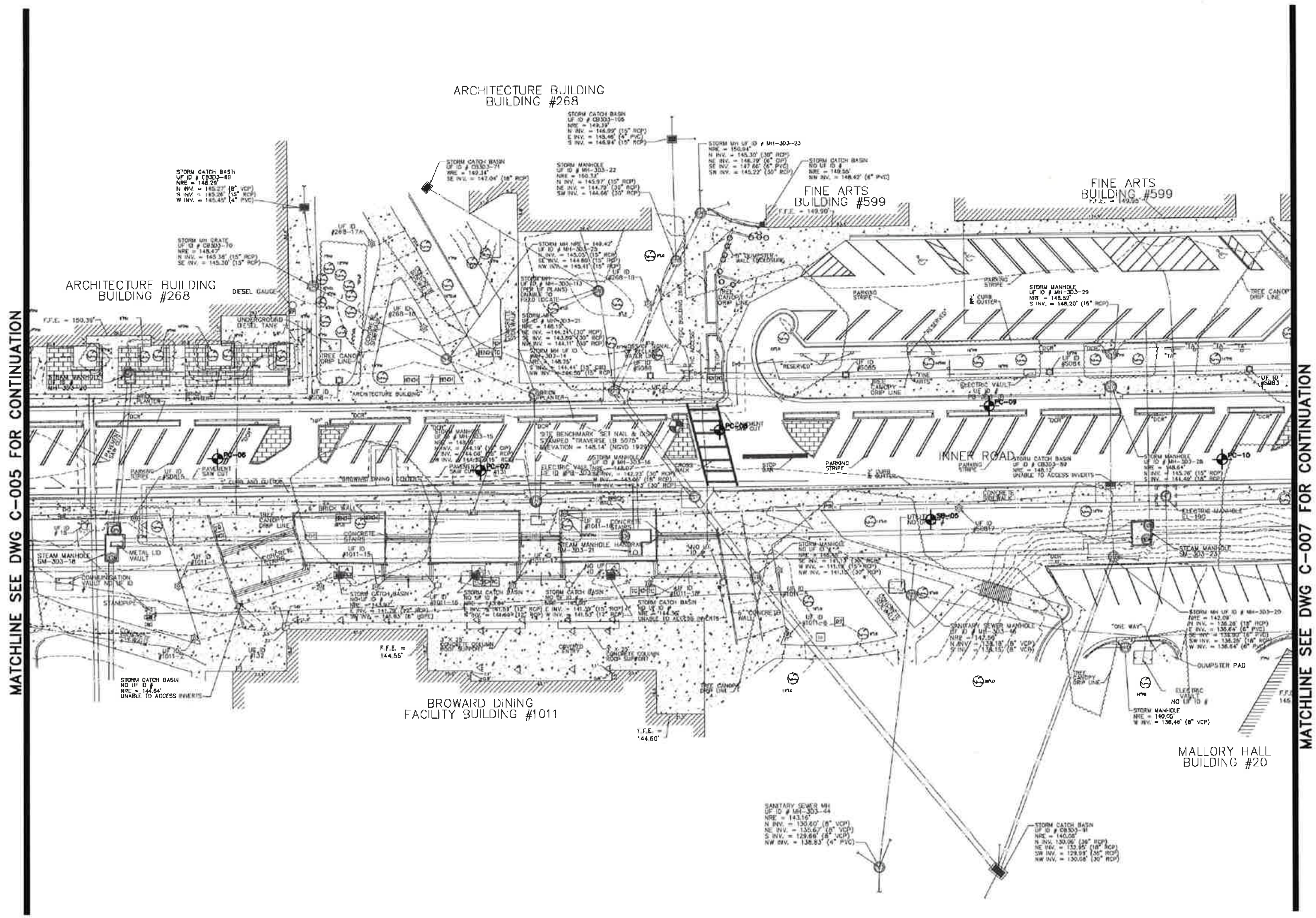

LEGEND

BORING LOCATION

NOTE: ALL SOIL TEST BORING LOCATIONS SHOWN ARE APPROXIMATE.

UNIVERSITY OF FLORIDA

DRAWN BY:	KD	DATE:	7/8/20
CHECKED BY:	ES	DATE:	7/8/20
SCALE:	1"=50'	ACADFILE:	0230.2000067-A
PROJECT NO:	0230.2000067.0000	REPORT NO:	1790702

UF 644 REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS

REITZ UNION LAWN AND INNER ROAD

GAINESVILLE, ALACHUA COUNTY, FLORIDA

BORING LOCATION PLAN

UNIVERSAL

ENGINEERING SCIENCES

PAGE NO:

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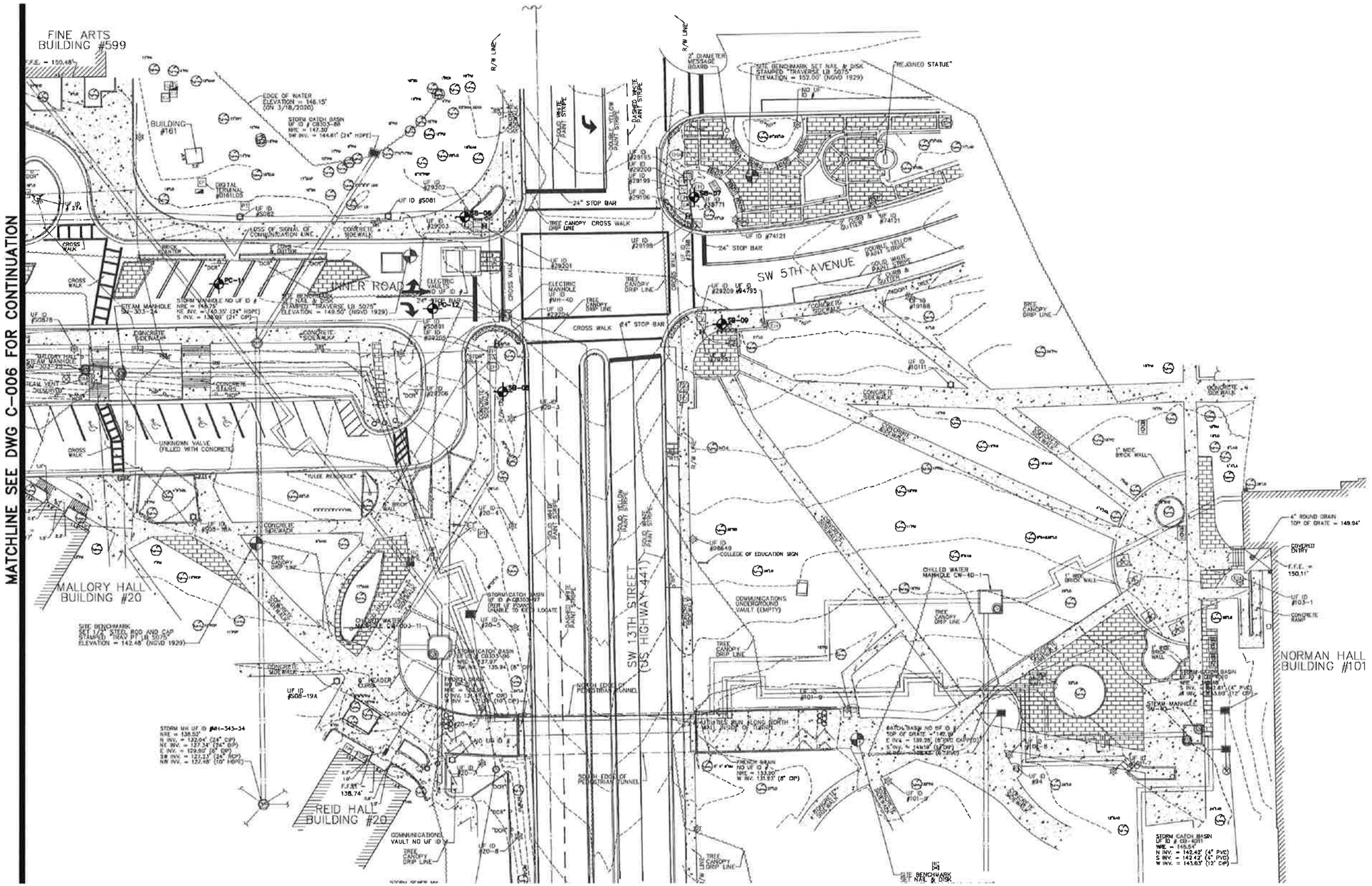

LEGEND

BORING LOCATION

NOTE: ALL SOIL TEST BORING LOCATIONS SHOWN ARE APPROXIMATE.

UNIVERSITY OF FLORIDA

UF 644 REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, ALACHUA COUNTY, FLORIDA

BORING LOCATION PLAN

DRAWN BY: KD	DATE: 7/8/20	SCALE: 1"=50'	ACADFILE:0230.2000067-A
CHECKED BY: ES	DATE: 7/8/20	PROJECT NO: 0230.2000067.0000	REPORT NO: 1790702

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ENGINEERING SCIENCES

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UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-6

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-1** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA
LOCATION: SEE BORING LOCATION PLANS
REMARKS: HAND AUGERED UPPER 5.5'

GS ELEVATION(ft):
WATER TABLE (ft): NE
DATE OF READING: NA
EST. WSWT (ft):

DATE STARTED: 7/23/20
DATE FINISHED: 7/23/20
DRILLED BY: R. PEREZ
TYPE OF SAMPLING:ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						Brown SAND, with silt [SP-SM] and trace of limerock						
3						Tan SAND, with silt [SP-SM]	6	7			25	
4						Gray silty SAND [SM]						
6						Loose to dense gray and orange clayey SAND [SC]						
7		4-4-5	9									
8		11-15-20	35									
10		12-14-21	35									
14						Medium dense light gray silty clayey SAND [SM-SC]						
15		4-6-8	14									
19						Very stiff greenish-gray sandy CLAY [CH]						
20		4-7-9	16									
						Boring Terminated at 20'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-7

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-2** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA
LOCATION: SEE BORING LOCATION PLANS
REMARKS: HAND AUGERED UPPER 5.5'
PERCHED WATER TABLE

GS ELEVATION(ft):
WATER TABLE (ft): 8
DATE OF READING: 7/23/20
EST. WSWT (ft):

DATE STARTED: 7/23/20
DATE FINISHED: 7/23/20
DRILLED BY: R. PEREZ
TYPE OF SAMPLING:ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						Brown silty SAND [SM] (Fill)						
4						Loose tan SAND, with silt [SP-SM]						
7		3-3-4	7			Medium dense brown silty SAND [SM], with roots	6	6			23	
8		4-5-5	10	▼								
9						Medium dense brown clayey SAND [SC]						
10		5-9-10	19									
15		6-7-13	20									
17						Light green silty CLAY [CH]						
20		7-8-7	15			Boring Terminated at 20'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-8

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-3** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA
LOCATION: SEE BORING LOCATION PLANS
REMARKS: PERCHED WATER TABLE

GS ELEVATION(ft):
WATER TABLE (ft): 8
DATE OF READING: 7/21/20
EST. WSWT (ft):

DATE STARTED: 7/23/20
DATE FINISHED: 7/23/20
DRILLED BY: R. PEREZ
TYPE OF SAMPLING:ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						Loose brown and tan SAND, with clay [SP-SC]						
1												
2		3-3-4	7									
3						Loose tan SAND, with silt [SP-SM]						
4		3-3-3	6				7	6			17	
5						Loose to medium dense light brown silty SAND [SM]						
6		3-3-5	8									
7		5-6-7	13									
8				▼								
9		3-4-5	9			Medium dense light gray clayey SAND [SC]						
10		6-10-11	21									
11												
12												
13												
14						Very stiff greenish CLAY [CH]						
15		10-13-15	28									
16												
17												
18												
19												
20		6-9-11	20			Boring Terminated at 20'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-9

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-4** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS: HAND AUGERED UPPER 4'

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/21/20

DATE FINISHED: 7/21/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						Brown SAND, with silt [SP-SM] and limerock						
1												
2						Light gray clayey SAND [SC]						
3						Tan SAND, with silt [SP-SM]						
4						Loose light gray clayey SAND [SC]	8	4			17	
5		3-3-3	6									
6						Stiff to very stiff light green slightly sandy CLAY [CH]						
7		3-4-5	9									
8		10-11-13	24									
9												
10		10-10-13	23									
11												
12												
13												
14						Medium dense greenish-gray very clayey SAND to sandy CLAY [SC/CH]						
15		7-10-11	21									
16												
17												
18												
19												
20		6-7-8	15			Boring Terminated at 20'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-10

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-5** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/21/20

DATE FINISHED: 7/21/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						Loose to medium dense brown and tan SAND, with silt [SP-SM]						
1												
2		3-3-3	6									
3												
4		3-5-6	11			Medium dense light tan silty SAND [SM]	16	6			0.5	
5		5-6-7	13									
6						Medium dense tan clayey SAND [SC]						
7		9-11-13	24									
8		9-8-13	21									
9												
10		10-13-16	29									
11												
12												
13												
14						Dense to loose light tan silty clayey SAND [SM-SC], with trace of clay						
15		13-15-17	32									
16												
17												
18												
19												
20		3-5-4	9			Boring Terminated at 20'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-11

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-1** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/15/20

DATE FINISHED: 7/15/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						1.8" Asphaltic Concrete						
1		10-20-24				5" Crushed Limerock Base						
2		10-12-9				Brown SAND, with silt [SP-SM] and trace of limestone (A-3)						
3		5-6-5										
4		6-5-5				Light brown SAND [SP] (A-3)						
5		5-6-6				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-12

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-2** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/15/20

DATE FINISHED: 7/15/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						2.1" Asphaltic Concrete						
1		20-14-16				5" Crushed Limerock Base Brown SAND, with silt [SP-SM] (A-3)						
2		12-10-12										
3		7-8-8				Tan SAND, with silt [SP-SM] (A-3)						
4		8-8-9					9	5				
5		16-20-23				Light brown SAND, with trace of clay [SP-SC] (A-2-4) Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-13

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-3** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/15/20

DATE FINISHED: 7/15/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						1.7" Asphaltic Concrete						
1		14-18-21				5" Crushed Limerock Base						
						Light brown SAND, with trace of clay and limerock [SP-SC] (A-3)						
2		18-25-29				Light orange clayey SAND [SC] (A-2-4)						
3		16-20-26				Tan silty SAND [SM] (A-2-4)						
4		13-21-25										
5		14-20-25				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-14

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-4** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/15/20

DATE FINISHED: 7/15/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						2.1" Asphaltic Concrete						
		25-29-31				6 1/2" Crushed Limerock Base						
1						Brown SAND, with silt and red brick [SP-SM](A-3)	9	6				
2						Boring Terminated at 2' / Refusal						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-15

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-5** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/15/20

DATE FINISHED: 7/15/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						2.45" Asphaltic Concrete						
1		30-50-55				5 1/2" Crushed Limerock Base						
2		30-35-40				Brown silty SAND [SM], with trace of rock (A-2-4)						
3		20-30-35										
4		10-10-12				Tan and orange clayey SAND [SC] (A-2-4)						
5		7-10-12				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-16

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-6** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/16/20

DATE FINISHED: 7/16/20

DRILLED BY: J. STILLSON

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						1.55" Asphaltic Concrete						
1						8" Crushed Limerock Base						
2		10-12-13				Brown silty SAND [SM], with trace of limerock (A-2-4)						
3		10-10-10										
4		5-7-11				Orange, gray clayey SAND [SC] (A-2-4)	26	16				
5		6-8-12				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-17

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-7** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/16/20

DATE FINISHED: 7/16/20

DRILLED BY: J. STILLSON

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						2.1" Asphaltic Concrete						
1		35-50+				7" Crushed Limerock Base						
2		10-10-10				Brown silty SAND [SM], with limerock (A-2-4)						
3		10-12-12				Brown fine SAND, with silt [SP-SM] (A-3)						
4		6-8-8				Light gray and orange clayey SAND [SC] (A-2-4)						
5		5-6-7				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-18

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-8** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/16/20

DATE FINISHED: 7/16/20

DRILLED BY: J. STILLSON

TYPE OF SAMPLING: ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						1.85" Asphaltic Concrete						
1		50+				9" Crushed Limerock Base						
2		11-12-13				Brown silty SAND [SM], with trace of limerock (A-2-4)						
3		10-12-12				Orange fine SAND, with silt [SP-SM] (A-2-4)						
4		10-11-12					11	8				
5		10-10-12				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-19

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-9** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/16/20

DATE FINISHED: 7/16/20

DRILLED BY: J. STILLSON

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						0.7" Asphaltic Concrete						
1						9" Crushed Limerock Base						
						Brown SAND, with silt [SP-SM] (A-3)						
2		10-10-12										
3		8-9-10										
4		14-15-15										
5		10-12-15				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-20

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-10** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/16/20

DATE FINISHED: 7/16/20

DRILLED BY: J. STILLSON

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						2.35" Asphaltic Concrete						
1						9" Crushed Limerock Base						
						Brown SAND, with silt [SP-SM] (A-3)						
2		12-12-12										
3		10-10-11										
4		10-13-15				Orange SAND, with silt [SP-SM] (A-2-4)						
5		10-13-14				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-21

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-11** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/16/20

DATE FINISHED: 7/16/20

DRILLED BY: J. STILLSON

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						2.5" Asphaltic Concrete						
1		26-26-26				9 1/2" Crushed Limerock Base						
2		10-10-11				Brown SAND, with silt [SP-SM] (A-3)						
3		9-10-10					9	7				
4		10-16-17				Orange SAND, with silt [SP-SM] (A-2-4)						
5		10-16-15				Boring Terminated at 5'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	B-22

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **C-12** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS:

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/16/20

DATE FINISHED: 7/16/20

DRILLED BY: J. STILLSON

TYPE OF SAMPLING:ASTM D-1452

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0						4.8" Asphaltic Concrete						
1		5-5-6				7" Crushed Limerock Base						
						Brown SAND, with silt [SP-SM] (A-3)						
2		5-6-6										
3		5-5-5										
4		5-6-8										
						Light gray SAND, with silt [SP-SM] (A-3)						
5		8-8-10										
						Boring Terminated at 5'						

DATE OF SURVEY: JULY 2020

DATE TESTED: JULY 2020

TESTED BY: UNIVERSAL ENGINEERING SCIENCES

PROJECT

CROSS SECTION SOIL SURVEY FOR THE DESIGN OF ROADWAY

SUBMITTED BY: UNIVERSAL ENGINEERING SCIENCES

ROAD NO.: INNER ROAD

COUNTY: ALACHUA

REPORT OF TESTS OF MATERIALS FROM ROADWAY FOR USE IN EMBANKMENT AND SUBGRADE

	LIMEROCK BEARING RATIO		MOISTURE CONTENT		SIEVE ANALYSIS RESULTS % PASSING								
STRATUM NO.	NO. OF TESTS	LBR	NO. OF TESTS	MOISTURE CONTENT	NO. OF TESTS	4 MESH	10 MESH	40 MESH	60 MESH	100 MESH	200 MESH	AASHTO CLASS.	MATERIAL DESCRIPTION
1	-	-	-	-	-	-	-	-	-	-	-	-	ASPHALTIC CONCRETE / CRUSHED LIMEROCK BASE
2	1	42	3	5-7	3	99-100	98-100	83-86	38-42	15-16	9	A-3	LIGHT TAN TO BROWN SAND TO SAND WITH SILT
3	2	54-82	2	8-16	2	100	100	80-81	38-43	17-20	11-26	A-2-4	BROWN TO GRAY AND ORANGE SILTY TO SILTY CLAYEY SAND

EMBANKMENT AND SUBGRADE MATERIAL

1. STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. MAKE FINAL CHECK AFTER GRADING.
2. REMOVAL OF PLASTIC MATERIAL OCCURRING WITHIN THE ROADWAY SHALL BE IN ACCORDANCE WITH STANDARD PLANS INDEX 120-002 AND THE MATERIAL UTILIZED IN THE EMBANKMENT CONSTRUCTION SHALL BE IN ACCORDANCE WITH STANDARD PLANS INDEX 120-001.
3. STRATUM NO. 2 IS A SELECT MATERIAL AND APPEARS SATISFACTORY FOR USE IN THE EMBANKMENT WHEN UTILIZED IN ACCORDANCE WITH STANDARD PLANS INDEX 120-001.
4. STRATUM NO. 3 IS A SELECT MATERIAL AND APPEARS SATISFACTORY FOR USE IN THE EMBANKMENT WHEN UTILIZED IN ACCORDANCE WITH STANDARD PLANS INDEX 120-001. HOWEVER THIS MATERIAL MAY RETAIN EXCESS MOISTURE AND BE DIFFICULT TO DRY. IT SHOULD BE USED IN THE EMBANKMENT ABOVE THE WATER LEVEL EXISTING AT THE TIME OF CONSTRUCTION.

SOIL STRATA DESCRIPTIONS ARE ONLY FOR SOIL SAMPLES TAKEN FROM THE BORINGS SHOWN IN THESE PLANS AND ARE NOT TO BE CONSIDERED AS A GUARANTEE OF SOIL CONDITIONS OTHER THAN AT THE EXACT LOCATIONS OF THOSE BORINGS.

ALL TEST VALUES WERE OBTAINED FROM SAMPLES TAKEN FROM ONE OR MORE OF THE BORINGS AND ARE NOT INTENDED TO GUARANTEE ANY TEST VALUES OTHER THAN AN APPROXIMATION AT THE LOCATIONS OF THE BORINGS.

TEST VALUES SHOWN AS A RANGE OF VALUES MAY NOT INCLUDE THE HIGH AND/OR LOW VALUES FOR A SPECIFIC STRATUM. DURING THE PROCESS OF THE WORK, THE CONTRACTOR MIGHT ENCOUNTER SOILS HAVING TEST VALUES WHICH ARE HIGHER OR LOWER THAN THOSE TEST VALUES ABOVE. IF THERE ARE ANY QUESTIONS CONCERNING THE PREVAILING SUBSURFACE CONDITIONS, OR ANY OF THE TEST VALUES SHOWN FOR ANY SOIL STRATUM, IT IS THE RESPONSIBILITY OF THE INDIVIDUAL RAISING THE QUESTION TO PERFORM HIS OR HER OWN SUBSURFACE INVESTIGATION.

GROUND WATER LEVELS SHOULD BE EXPECTED TO FLUCTUATE DUE TO SEASONAL CLIMATIC VARIATIONS AND SURFACE RUN-OFF.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

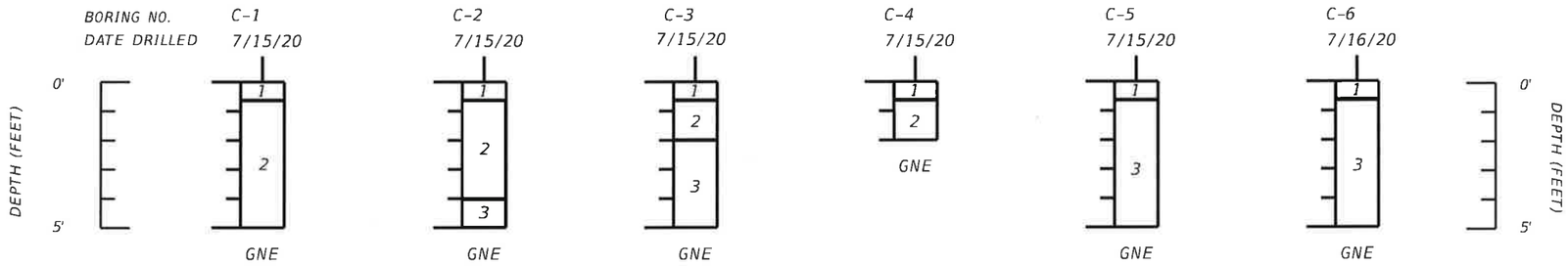
EDUARDO SUAREZ, P.E.
LICENSE NUMBER 60272
UNIVERSAL ENGINEERING SCIENCES
4475 S.W. 35TH TERRACE
GAINESVILLE, FLORIDA 32608
CERTIFICATE OF AUTHORIZATION 549

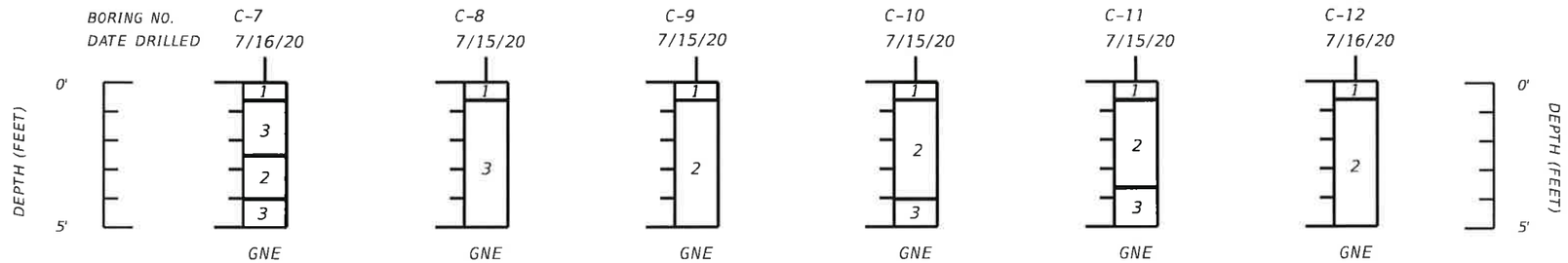
UF INNER ROAD IMPROVEMENTS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
INNER RD	ALACHUA	

ROADWAY SOIL SURVEY SHEET
INNER ROAD

SHEET NO. B-23





REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

EDUARDO SUAREZ, P.E.
LICENSE NUMBER 60272
UNIVERSAL ENGINEERING SCIENCES
4475 S.W. 35TH TERRACE
GAINESVILLE, FLORIDA 32608
CERTIFICATE OF AUTHORIZATION 549

UF INNER ROAD IMPROVEMENTS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
INNER RD	ALACHUA	

$USERS $DATES $TIMES $FILES

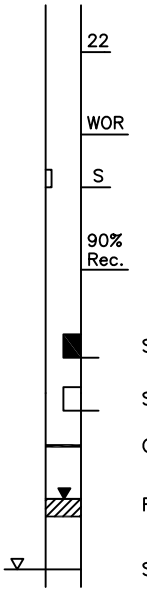
ROADWAY SOIL SURVEY SHEET
INNER ROAD

SHEET NO. B-24

UNIVERSAL
ENGINEERING SCIENCES

KEY TO BORING LOGS

SYMBOLS



22	Number of Blows of a 140–lb Weight Falling 30 in. Required to Drive Standard Spoon One Foot
WOR	Weight of Drill Rods
S	Thin–Wall Shelby Tube Undisturbed Sampler Used
90% Rec.	Percent Core Recovery from Rock Core–Drilling Operations
	Sample Taken at this Level
	Sample Not Taken at this Level
	Change in Soil Strata
	Free Ground Water Level
	Seasonal High Ground Water Level

GRANULAR MATERIALS

Relative Density	Safety Hammer SPT N (Blows/Ft.)	Automatic Hammer SPT N (Blows/Ft.)
Very Loose	Less than 4	Less than 3
Loose	4–10	3–8
Medium Dense	10–30	8–24
Dense	30–50	24–40
Very Dense	>50	>40

COHESIVE MATERIALS

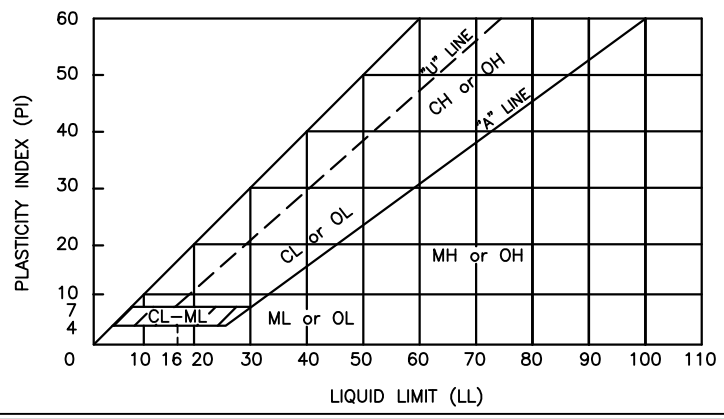
Consistency	Safety Hammer SPT N (Blows/Ft.)	Automatic Hammer SPT N (Blows/Ft.)
Very Soft	Less than 2	Less than 1
Soft	2–4	1–3
Firm	4–8	3–6
Stiff	8–15	6–12
Very Stiff	15–30	12–24
Hard	>30	>24

UNIFIED CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 200 sieve	CLEAN GRAVELS	GW	Well–graded gravels and gravel–sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel–sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels, gravel–sand–silt mixtures
			GC	Clayey gravels, gravel–sand–clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well–graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand–silt mixtures
			SC	Clayey sands, sand–clay mixtures
FINE-GRAINED SOILS 50% or more passes No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomacaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly organic Soils			PT	Peat, muck and other highly organic soils

* Based on the material passing the 3–in. (75mm) sieve.

PLASTICITY CHART



APPENDIX C

Laboratory Soil Test Results

LBR Test Results

SUMMARY OF LABORATORY RESULTS

UNIVERSAL
ENGINEERING SCIENCES

PROJECT: UF 644 Reitz Lawn & Inner Road **REPORT: 1790703**

CLIENT: UF Planning Design & Construction **August 6, 2020**

BORING NO.	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	SAMPLE TYPE*	NATURAL MOISTURE (%)	ATTERBERG LIMITS		PERMEABILITY (FT/DAY)	SIEVE ANALYSIS (% PASSING)						AASHTO SOIL CLASSIFICATION	UNIFIED SOIL CLASSIFICATION
					LIQUID LIMIT (%)	PLASTICITY INDEX (%)		No. 4	No. 10	No. 40	No. 60	No. 100	No. 200		
B-1	3.5	Tan Sand, with silt	SS	7			25						6		SP-SM
B-2	6.5	Tan Sand, with silt	SS	6			23						6		SP-SM
B-3	3.5	Tan Sand, with silt	SS	6			17						7		SP-SM
B-4	3.5	Tan Sand, with silt	SS	4			17						8		SP-SM
B-5	4.5	Light Tan Silty Sand	SS	6			0.5						16		SM
C-2	3.5	Tan Sand, with silt	A	5				100	100	86	42	15	9	A-3	SP-SM
C-4	1	Brown Sand, with silt	A	6				99	98	83	40	16	9	A-3	SP-SM
C-6	4	Orange/Gray Clayey Sand	A	16				100	100	81	43	29	26	A-2-4	SC
C-8	4.5	Orange Sand, with silt	A	8				100	100	80	38	17	11	A-2-4	SP-SM
C-11	3	Brown Sand, with silt	A	7				100	100	84	38	15	9	A-3	SP-SM

SS-Split-Spoon
A-Auger
ST-Shelby Tube

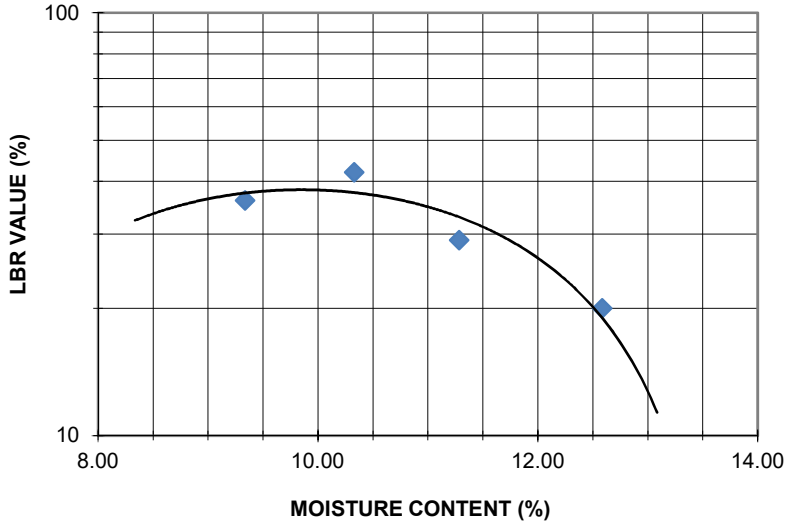
LIMEROCK BEARING RATIO TEST RESULTS
(FM 5-515)

TESTED FOR: UF Planning Design & Construction
P.O. Box 115050
Gainesville, FL 32611

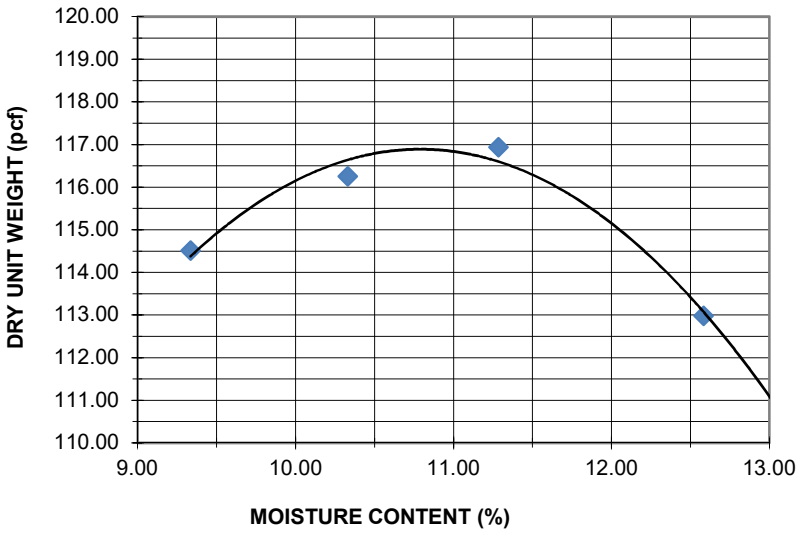
PROJECT: UF 644 Reitz Lawn & Inner Road
Inner Road
Gainesville, Alachua County, FL

DATE TESTED: July 16, 2020 **REPORT NO:** 1790703

SAMPLE LOCATION: SB-3
SOIL DESCRIPTION: Brown Sand with silt



PROJECT LBR REQUIREMENT: **40** LBR VALUE: **42**



OPT MOISTURE: **11.0** MAX DENSITY: **116.9**

UNIVERSAL ENGINEERING SCIENCES
4475 S.W. 35TH TERRACE, GAINESVILLE, FL. 32608
(352)372-3392 (352)336-7914 (FAX)

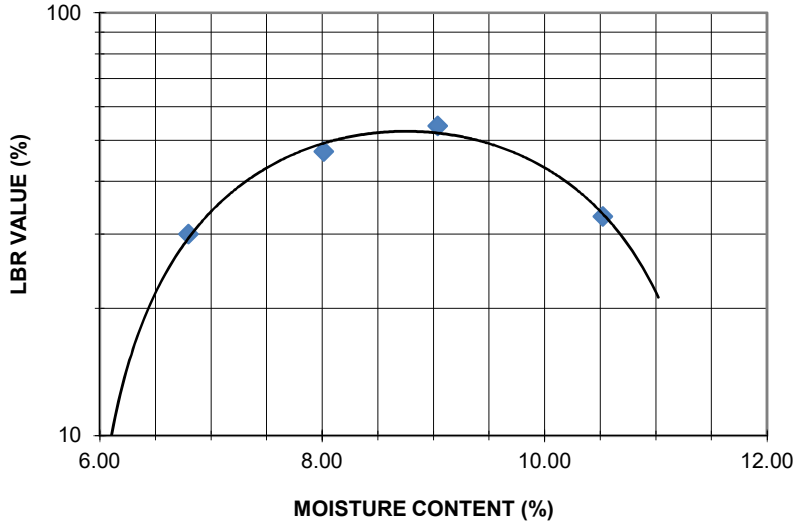
LIMEROCK BEARING RATIO TEST RESULTS
(FM 5-515)

TESTED FOR: UF Planning Design & Construction
P.O. Box 115050
Gainesville, FL 32611

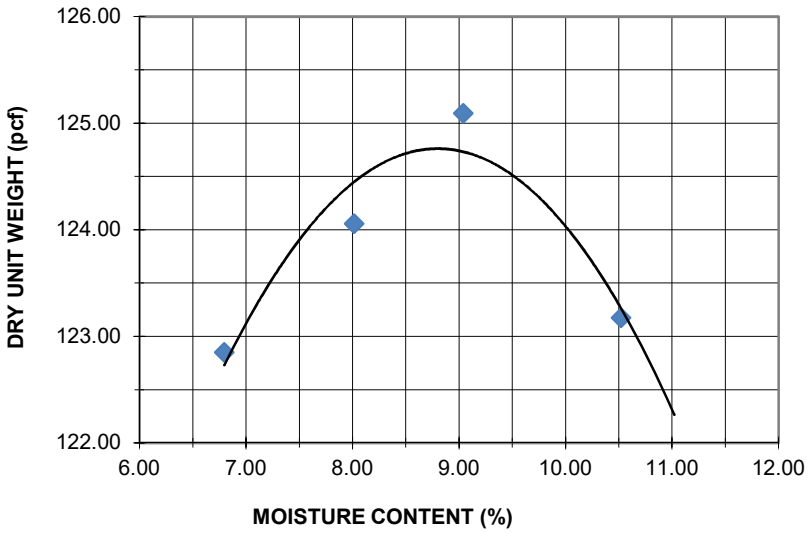
PROJECT: UF 644 Reitz Lawn & Inner Road
Inner Road
Gainesville, Alachua County, FL

DATE TESTED: July 16, 2020 **REPORT NO:** 1790703

SAMPLE LOCATION: SB-4
SOIL DESCRIPTION: Brown Clayey Sand, with trace rock



PROJECT LBR REQUIREMENT: **40** LBR VALUE: **54**



OPT MOISTURE: **9.2** MAX DENSITY: **125.1**

UNIVERSAL ENGINEERING SCIENCES
4475 S.W. 35TH TERRACE, GAINESVILLE, FL. 32608
(352)372-3392 (352)336-7914 (FAX)

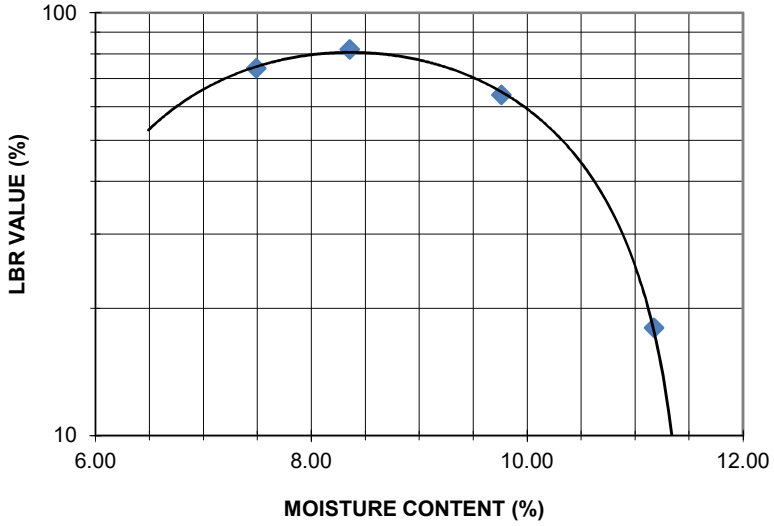
LIMEROCK BEARING RATIO TEST RESULTS
(FM 5-515)

TESTED FOR: UF Planning Design & Construction
P.O. Box 115050
Gainesville, FL 32611

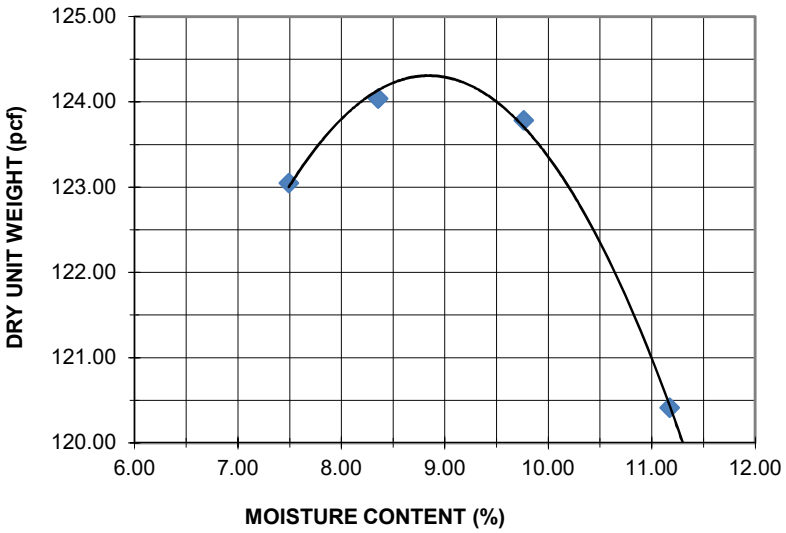
PROJECT: UF 644 Reitz Lawn & Inner Road
Inner Road
Gainesville, Alachua County, FL

DATE TESTED: July 16, 2020 **REPORT NO:** 1790703

SAMPLE LOCATION: SB-5
SOIL DESCRIPTION: Brown Silty Sand, with trace rock



PROJECT LBR REQUIREMENT: **40** LBR VALUE: **82**



OPT MOISTURE: **9.0** MAX DENSITY: **124.2**

UNIVERSAL ENGINEERING SCIENCES
4475 S.W. 35TH TERRACE, GAINESVILLE, FL. 32608
(352)372-3392 (352)336-7914 (FAX)

APPENDIX D

Important Information About Your Geotechnical Engineering Report Constraint and Restrictions

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

CONSTRAINTS & RESTRICTIONS

The intent of this document is to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

WARRANTY

Universal Engineering Sciences has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

UNANTICIPATED SOIL CONDITIONS

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Universal Engineering Sciences is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects. Universal Engineering Sciences cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of exploration. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.

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Universal Engineering Sciences, LLC
GENERAL CONDITIONS

SECTION 1: RESPONSIBILITIES

1.1 *Universal Engineering Sciences, LLC*, ("UES"), has the responsibility for providing the services described under the Scope of Services section. The work is to be performed according to accepted standards of care and is to be completed in a timely manner. The term "UES" as used herein includes all of *Universal Engineering Sciences, LLC's* agents, employees, professional staff, and subcontractors.

1.2 The Client or a duly authorized representative is responsible for providing UES with a clear understanding of the project nature and scope. The Client shall supply UES with sufficient and adequate information, including, but not limited to, maps, site plans, reports, surveys and designs, to allow UES to properly complete the specified services. The Client shall also communicate changes in the nature and scope of the project as soon as possible during performance of the work so that the changes can be incorporated into the work product.

1.3 The Client acknowledges that UES's responsibilities in providing the services described under the Scope of Services section is limited to those services described therein, and the Client hereby assumes any collateral or affiliated duties necessitated by or for those services. Such duties may include, but are not limited to, reporting requirements imposed by any third party such as federal, state, or local entities, the provision of any required notices to any third party, or the securing of necessary permits or permissions from any third parties required for UES's provision of the services so described, unless otherwise agreed upon by both parties.

1.4 Universal will not be responsible for scheduling our services and will not be responsible for tests or inspections that are not performed due to a failure to schedule our services on the project or any resulting damages.

1.5 **PURSUANT TO FLORIDA STATUTES §558.0035, ANY INDIVIDUAL EMPLOYEE OR AGENT OF UES MAY NOT BE HELD INDIVIDUALLY LIABLE FOR NEGLIGENCE.**

SECTION 2: STANDARD OF CARE

2.1 Services performed by UES under this Agreement will be conducted in a manner consistent with the level of care and skill ordinarily exercised by members of UES's profession practicing contemporaneously under similar conditions in the locality of the project. No other warranty, express or implied, is made.

2.2 The Client recognizes that subsurface conditions may vary from those observed at locations where borings, surveys, or other explorations are made, and that site conditions may change with time. Data, interpretations, and recommendations by UES will be based solely on information available to UES at the time of service. UES is responsible for those data, interpretations, and recommendations, but will not be responsible for other parties' interpretations or use of the information developed.

2.3 Execution of this document by UES is not a representation that UES has visited the site, become generally familiar with local conditions under which the services are to be performed, or correlated personal observations with the requirements of the Scope of Services. It is the Client's responsibility to provide UES with all information necessary for UES to provide the services described under the Scope of Services, and the Client assumes all liability for information not provided to UES that may affect the quality or sufficiency of the services so described.

2.4 Should UES be retained to provide threshold inspection services under Florida Statutes §553.79, Client acknowledges that UES's services thereunder do not constitute a guarantee that the construction in question has been properly designed or constructed, and UES's services do not replace any of the obligations or liabilities associated with any architect, contractor, or structural engineer. Therefore it is explicitly agreed that the Client will not hold UES responsible for the proper performance of service by any architect, contractor, structural engineer or any other entity associated with the project.

SECTION 3: SITE ACCESS AND SITE CONDITIONS

3.1 Client will grant or obtain free access to the site for all equipment and personnel necessary for UES to perform the work set forth in this Agreement. The Client will notify any and all possessors of the project site that Client has granted UES free access to the site. UES will take reasonable precautions to minimize damage to the site, but it is understood by Client that, in the normal course of work, some damage may occur, and the correction of such damage is not part of this Agreement unless so specified in the Proposal.

3.2 The Client is responsible for the accuracy of locations for all subterranean structures and utilities. UES will take reasonable precautions to avoid known subterranean structures, and the Client waives any claim against UES, and agrees to defend, indemnify, and hold UES harmless from any claim or liability for injury or loss, including costs of defense, arising from damage done to subterranean structures and utilities not identified or accurately located. In addition, Client agrees to compensate UES for any time spent or expenses incurred by UES in defense of any such claim with compensation to be based upon UES's prevailing fee schedule and expense reimbursement policy.

SECTION 4: SAMPLE OWNERSHIP AND DISPOSAL

4.1 Soil or water samples obtained from the project during performance of the work shall remain the property of the Client.

4.2 UES will dispose of or return to Client all remaining soils and rock samples 60 days after submission of report covering those samples. Further storage or transfer of samples can be made at Client's expense upon Client's prior written request.

4.3 Samples which are contaminated by petroleum products or other chemical waste will be returned to Client for treatment or disposal, consistent with all appropriate federal, state, or local regulations.

SECTION 5: BILLING AND PAYMENT

5.1 UES will submit invoices to Client monthly or upon completion of services. Invoices will show charges for different personnel and expense classifications.

5.2 Payment is due 30 days after presentation of invoice and is past due 31 days from invoice date. Client agrees to pay a finance charge of one and one-half percent (1 ½ %) per month, or the maximum rate allowed by law, on past due accounts.

5.3 If UES incurs any expenses to collect overdue billings on invoices, the sums paid by UES for reasonable attorneys' fees, court costs, UES's time, UES's expenses, and interest will be due and owing by the Client.

SECTION 6: OWNERSHIP AND USE OF DOCUMENTS

6.1 All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by UES, as instruments of service, shall remain the property of UES.

6.2 Client agrees that all reports and other work furnished to the Client or his agents, which are not paid for, will be returned upon demand and will not be used by the Client for any purpose.

6.3 UES will retain all pertinent records relating to the services performed for a period of five years following submission of the report, during which period the records will be made available to the Client at all reasonable times.

6.4 All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by UES, are prepared for the sole and exclusive use of Client, and may not be given to any other party or used or relied upon by any such party without the express written consent of UES.

SECTION 7: DISCOVERY OF UNANTICIPATED HAZARDOUS MATERIALS

7.1 Client warrants that a reasonable effort has been made to inform UES of known or suspected hazardous materials on or near the project site.

7.2 Under this agreement, the term hazardous materials include hazardous materials (40 CFR 172.01), hazardous wastes (40 CFR 261.2), hazardous substances (40 CFR 300.6), petroleum products, polychlorinated biphenyls, and asbestos.

7.3 Hazardous materials may exist at a site where there is no reason to believe they could or should be present. UES and Client agree that the discovery of unanticipated hazardous materials constitutes a changed condition mandating a renegotiation of the scope of work. UES and Client also agree that the discovery of unanticipated hazardous materials may make it necessary for UES to take immediate measures to protect health and safety. Client agrees to compensate UES for any equipment decontamination or other costs incident to the discovery of unanticipated hazardous waste.

7.4 UES agrees to notify Client when unanticipated hazardous materials or suspected hazardous materials are encountered. Client agrees to make any disclosures required by law to the appropriate governing agencies. Client also agrees to hold UES harmless for any and all consequences of disclosures made by UES which are required by governing law. In the event the project site is not owned by Client, Client recognizes that it is the Client's responsibility to inform the property owner of the discovery of unanticipated hazardous materials or suspected hazardous materials.

7.5 Notwithstanding any other provision of the Agreement, Client waives any claim against UES, and to the maximum extent permitted by law, agrees to defend, indemnify, and save UES harmless from any claim, liability, and/or defense costs for injury or loss arising from UES's discovery of unanticipated hazardous materials or suspected hazardous materials including any costs created by delay of the project and any cost associated with possible reduction of the property's value. Client will be responsible for ultimate disposal of any samples secured by UES which are found to be contaminated.

SECTION 8: RISK ALLOCATION

8.1 Client agrees that UES's liability for any damage on account of any breach of contract, error, omission or other professional negligence will be limited to a sum not to exceed $50,000 or UES's fee, whichever is greater. If Client prefers to have higher limits on contractual or professional liability, UES agrees to increase the limits up to a maximum of $1,000,000.00 upon Client's written request at the time of accepting our proposal provided that Client agrees to pay an additional consideration of four percent of the total fee, or $400.00, whichever is greater. The additional charge for the higher liability limits is because of the greater risk assumed and is not strictly a charge for additional professional liability insurance.

SECTION 9: INSURANCE

9.1 UES represents and warrants that it and its agents, staff and consultants employed by it, is and are protected by worker's compensation insurance and that UES has such coverage under public liability and property damage insurance policies which UES deems to be adequate. Certificates for all such policies of insurance shall be provided to Client upon request in writing. Within the limits and conditions of such insurance, UES agrees to indemnify and save Client harmless from and against loss, damage, or liability arising from negligent acts by UES, its agents, staff, and consultants employed by it. UES shall not be responsible for any loss, damage or liability beyond the amounts, limits, and conditions of such insurance or the limits described in Section 8, whichever is less. The Client agrees to defend, indemnify and save UES harmless for loss, damage or liability arising from acts by Client, Client's agent, staff, and other UESs employed by Client.

SECTION 10: DISPUTE RESOLUTION

10.1 All claims, disputes, and other matters in controversy between UES and Client arising out of or in any way related to this Agreement will be submitted to alternative dispute resolution (ADR) such as mediation or arbitration, before and as a condition precedent to other remedies provided by law, including the commencement of litigation.

10.2 If a dispute arises related to the services provided under this Agreement and that dispute requires litigation instead of ADR as provided above, then:

(a) the claim will be brought and tried in judicial jurisdiction of the court of the county where UES's principal place of business is located and Client waives the right to remove the action to any other county or judicial jurisdiction, and

(b) The prevailing party will be entitled to recovery of all reasonable costs incurred, including staff time, court costs, attorneys' fees, and other claim related expenses.

SECTION 11: TERMINATION

11.1 This agreement may be terminated by either party upon seven (7) days written notice in the event of substantial failure by the other party to perform in accordance with the terms hereof. Such termination shall not be effective if that substantial failure has been remedied before expiration of the period specified in the written notice. In the event of termination, UES shall be paid for services performed to the termination notice date plus reasonable termination expenses.

11.2 In the event of termination, or suspension for more than three (3) months, prior to completion of all reports contemplated by the Agreement, UES may complete such analyses and records as are necessary to complete its files and may also complete a report on the services performed to the date of notice of termination or suspension. The expense of termination or suspension shall include all direct costs of UES in completing such analyses, records and reports.

SECTION 12: ASSIGNS

12.1 Neither the Client nor UES may delegate, assign, sublet or transfer their duties or interest in this Agreement without the written consent of the other party.

SECTION 13. GOVERNING LAW AND SURVIVAL

13.1 The laws of the State of Florida will govern the validity of these Terms, their interpretation and performance.

13.2 If any of the provisions contained in this Agreement are held illegal, invalid, or unenforceable, the enforceability of the remaining provisions will not be impaired. Limitations of liability and indemnities will survive termination of this Agreement for any cause.

SECTION 14. INTEGRATION CLAUSE

14.1 This Agreement represents and contains the entire and only agreement and understanding among the parties with respect to the subject matter of this Agreement, and supersedes any and all prior and contemporaneous oral and written agreements, understandings, representations, inducements, promises, warranties, and conditions among the parties. No agreement, understanding, representation, inducement, promise, warranty, or condition of any kind with respect to the subject matter of this Agreement shall be relied upon by the parties unless expressly incorporated herein.

14.2 This Agreement may not be amended or modified except by an agreement in writing signed by the party against whom the enforcement of any modification or amendment is sought.

Rev. 06/10/2015

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REPORT OF GEOTECHNICAL CONSULTING SERVICES

Traffic Signal Mast Arm
Inner Road & NW 13th Street
Gainesville, Alachua County, Florida

UES Project No. 0230.2000067.0000
UES Report No. 1790702

Prepared for:

UF Planning Design & Construction
245 Gale Lemerand Drive
P.O. Box 115050
Gainesville, FL 32611
(352) 273-4681

Prepared by:

Universal Engineering Sciences, LLC
4475 SW 35th Terrace
Gainesville, Florida 32608
(352) 372-3392

August 14, 2020

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Consultants in: Geotechnical Engineering • Environmental Engineering
Construction Materials Testing • Threshold Inspection • Private Provider Inspection

LOCATIONS:
Atlanta
Daytona Beach
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Gainesville
Jacksonville
Kissimmee
Leesburg
Miami
Ocala
Orlando (Headquarters)
Palm Coast
Panama City
Pensacola
Rockledge
Sarasota
Tampa
West Palm Beach

August 14, 2020

UF Planning Design & Construction
245 Gale Lemerand Drive
P.O. Box 115050
Gainesville, FL 32611

Attention: Mr. Tom Feather
Project Manager III

Reference: **Report of Geotechnical Consulting Services**
Traffic Signal Mast Arm
Inner Road & NW 13th Street
Gainesville, Alachua County, Florida
UES Project No.: 0230.2000067 UES Report No.: 1790702

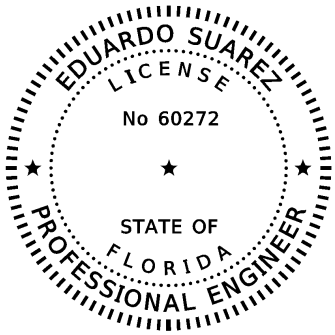
Dear Mr. Feather:

Universal Engineering Sciences, LLC (UES) has completed the geotechnical exploration program for this project in accordance with the authorized scope of services. This report presents the results of our subsurface field exploration and laboratory soil testing programs, engineering evaluations of geotechnical project issues, recommendations for geotechnical site preparation, recommendations for foundation design and construction.

We appreciate the opportunity to have assisted you on this project and look forward to a continued association. Please do not hesitate to contact our office if you should have any questions, or to assist your office with the remaining phases of project design and construction.

Respectfully submitted,

UNIVERSAL ENGINEERING SCIENCES, LLC
Certificate of Authorization 549



Timothy E. Kwiatkowski, P.E.
Project Geotechnical Engineer
Florida P.E. No. 86444

Eduardo Suarez, P.E.
Senior Geotechnical Engineer
Florida P.E. No. 60272

This item has been electronically signed and sealed by Eduardo Suarez, PE on the date adjacent to the seal using Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

TABLE OF CONTENTS

Project No.: 0230.2000067
Report No.: 1790702
Date: August 14, 2020

1.0 INTRODUCTION

1.1 GENERAL

In this report, we have presented the results of the subsurface exploration of the site for the proposed Signal Mast Arm structures located at the intersection of Inner Road and NW 13th Street in Gainesville, Alachua County, Florida. We have divided this report into the following sections:

- SCOPE OF SERVICES - Defines what we did
- FINDINGS - Describes what we encountered
- RECOMMENDATIONS - Describes what we encourage you to do
- LIMITATIONS - Describes the restrictions inherent in this report
- APPENDICES - Presents support materials referenced in this report

2.0 SCOPE OF SERVICES

2.1 PROJECT DESCRIPTION

We understand that the proposed construction will include traffic control signals at the intersection using mast arm structures. The mast arm structures will be supported on individual drilled pier (shaft) foundations.

The project is located at the intersection of Inner Road and NW 13th Street in Gainesville, Alachua County, Florida. We have assumed the drilled shaft foundations will be designed as shown in FDOT Standards for Mast Arm.

Our recommendations are based upon the above considerations. If our foundation estimates and assumptions are incorrect we should be advised so that we may review our engineering evaluations, conclusions and recommendations. The above constitutes all of the project information provided to our office at the time of this report preparation.

2.2 PURPOSE

The purposes of this exploration were:

- To explore the prevailing site subsurface conditions beneath the area of the proposed traffic signal structure locations,

- To perform a series of laboratory tests on selected subsurface soil specimens, recovered from the field exploration program to assist with engineering soil classifications,

- To discuss the groundwater table characteristics,

- To evaluate and discuss geotechnical issues deemed relevant to the proposed design and construction,

- To provide geotechnical engineering recommendations for soil design parameters for the proposed project.

This report presents an evaluation of site conditions on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards. Universal Engineering Sciences would be pleased to perform these services, if you desire.

Our exploration was confined to the zone of soil likely to be stressed by the proposed construction. Our work did not address the potential for surface expression of deep geological conditions. This evaluation requires a more extensive range of field services than performed in this study. We will be pleased to conduct an exploration to evaluate the probable effect of the regional geology upon the proposed construction, if you desire.

2.3 FIELD EXPLORATION

The field geotechnical testing activities were started on July 22, 2020, and completed on July 23, 2020. Field tests for this portion of the geotechnical study included four (4) soil test borings performed at the locations shown on the attached Boring Location Plan. The actual test locations shown are approximate, and were staked in the field by UES engineering personnel using existing landmarks and site features. All boreholes were grouted upon field work completion.

2.3.1 Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) borings were advanced to a maximum depth of 30 feet below the existing site grades. Penetration tests were performed in accordance with ASTM Procedure D-1586, Penetration Test and Split-Barrel Sampling of Soils. This test procedure generally involves driving a 1.4-inch I.D. split-tube sampler into the soil profile in six inch increments for a minimum distance of 18 inches using a 140-pound hammer free-falling 30 inches. The total number of blows required to drive the sampler the second and third 6-inch increments is designated as the N-value, and provides an indication of in-place soil strength, density and consistency.

Representative portions of the subsurface soil samples recovered were transported to our Gainesville soils laboratory. The soil samples were visually classified by an experienced geotechnical engineer. The results of the classification and stratification have been shown on the attached Boring Logs and summarized later in this Report. It should be noted that soil conditions might vary between boring locations, and between the subsurface soil strata interfaces which have been shown on the Boring Log. The soil test boring data reflects information from the specific test location only. This Report presents an evaluation of site conditions on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards.

2.4 LABORATORY TESTING

2.4.1 Visual Classification

The soil samples recovered from the soil test boring was returned to our laboratory where an engineer visually reviewed the field descriptions in accordance with ASTM D-2488. Using the results of the laboratory tests, our visual examination, and our review of the field boring logs we classified the soil boring in accordance with the current Unified Soil Classification System (USCS). We then selected representative soil samples for laboratory testing.

2.4.2 Index Testing

Laboratory testing was performed on selected samples of the soils encountered in the field exploration to better define soil composition and properties. Testing was performed in accordance to ASTM procedures and included Percent fines (ASTM C-136), Atterberg limits (ASTM D-4318), natural moisture content (ASTM D-2216), and Corrosion Series. The test results have been presented on the attached Boring Logs.

3.0 FINDINGS

3.1 REGIONAL GEOLOGY

The general geology of central Alachua County is characterized by a surface veneer of Pleistocene and Pliocene sands and sandy clays overlying the Miocene age Hawthorn Group, a highly variable mixture of interbedded quartz sands, clays, carbonates, pebbles and grains occurring in thickness of up to 150 feet. Underlying the Hawthorn Group is the upper Eocene age Ocala Formation, occurring as a uniform limestone, which is approximately 200 feet thick and overlies the Eocene age Avon Park Formation, which can be up to 500 feet thick. Both the Ocala and Hawthorn Formations dip to the northeast by approximately one degree.

The general hydrogeology of Alachua County consists of three aquifer systems; a surficial aquifer, an intermediate aquifer, and the Floridan aquifer system. The surficial aquifer exists as an unconfined water table situated over the impermeable Hawthorn Group and is usually a subdued reflection of surface topography. The intermediate aquifer system includes all rocks that collectively retard the exchange of water between the overlying surficial aquifer system and the underlying Floridan aquifer system. Water in this system is contained under confined conditions. The Floridan aquifer system is a thick carbonate sequence that functions regionally as a water-yielding hydraulic unit. The direction of shallow groundwater flow is generally toward surface water bodies. The surface of the upper Floridan Aquifer in the general project site area is estimated in the elevation range of +40 to +50 feet NGVD.

3.2 KARST TOPOGRAPHY

About 10% of the earths land (and 15% of the United States) crust is composed of, or underlain by, soluble limestone. When limestone interacts with underground water, over time, the water dissolves the limestone to form karst topography, a mix of caves, underground channels, and rough and undulating ground surfaces. The underground water of karst topography carves channels and caves that become susceptible to collapse from the surface. When enough limestone is eroded from underground, a sinkhole may develop. Sinkholes can range in size and depth from a few feet to over 300 feet. The topography of North Central Florida is characteristic of karst terrain, with sinkholes caused by natural climatic variability, as well as, man-made activities, such as, the drop in groundwater levels from well pumping.

Per contract scope of services, our exploration was confined to the zone of soil likely to be stressed by the proposed construction. Our work did not address the potential for surface expression of deep geological conditions, such as sinkhole development related to karst activity. This evaluation requires a more extensive range of field services than performed in this study.

3.3 GENERAL AREA SOIL INFORMATION

The United States Department of Agriculture (USDA) *Soil Survey of Alachua County, Florida* describes the near-surface soil profile in the corridor as Urban Land soils. The USDA Soil Survey of Alachua County was reviewed to obtain relevant near-surface soils information along the project alignment. Urban Land soil classification indicates that 85 percent of the area is covered with shopping centers, parking lots, buildings, streets, sidewalks and other facilities. Many of these open areas have been altered by cutting and shaping or by having fill material spread on the surfaces.

3.4 SURFACE CONDITIONS

UES personnel visited the project parcel during the performance of the field portion of this geotechnical study. Our on-site observations are summarized as follows. The corners of the intersection consist of maintained right-of-way areas, with some trees at the southwest corner of the intersection. No standing surface water was observed during our site visit. Surface organic soils, surface debris, unusual ground depressions, and rock outcropping were not observed on the project site. There are underground service and utility lines within the existing right-of-ways.

3.5 SUBSURFACE CONDITIONS

The field exploration performed for this project disclosed subsurface conditions that were consistent with the local geology and general area soils information described above. Soil classifications and descriptions for this geotechnical study are based both on the results of the laboratory soil testing programs and on visual examinations of soil specimens by the Geotechnical Engineer. The subsurface soil conditions encountered in the soil test boring have been summarized in the attached Boring Logs and described below.

Two soil test borings were performed at the proposed traffic signal structure locations, and the findings are summarized below. The borings were terminated at a depth of 30 feet below site grade. The soil test boring encountered loose to medium dense sand with silt or clay to silty sand [SP-SM/SP-SC/SM] to depths of 5.5 to 13.5 feet followed by very clayey sand to sandy clay [SC/CH] to the boring termination depth of 30 feet below ground surface.

3.6 GROUNDWATER DEPTH

A transient perched groundwater level was generally encountered at depths of 9 to 10 feet below existing site grades at the boring locations at the time of our exploration. Fluctuations of groundwater level conditions on this project parcel should be expected to occur seasonally as a result of rainfall, surface runoff, and nearby construction activities.

3.7 LABORATORY TESTING

The soil samples recovered from the field exploration program were placed in plastic containers and returned to our soils laboratory, where the Geotechnical Engineer visually examined and classified the samples. Laboratory soil tests are performed to aid in the classification of the soils, and to help in the evaluation of engineering characteristics of the soils. Representative soil samples were selected for percent fines determination, Atterberg Limits, moisture content, and corrosion series. The test results have been presented on the attached Boring Logs and summarized in Table 1.

Table 1 – Laboratory Soil Test Results				
Soil Boring	**Sample Depth**	**Type of Test**	**Results**	**Soil Description**
B-6	19 feet	Moisture Content	36 %	Silty Clay
		Atterberg Limits	LL = 43 %, PI = 23 %	
B-7	9 feet	% Finer #200	11 %	Sand with clay
		Moisture Content	21 %	
B-8	6 feet	% Finer #200	21 %	Clayey Sand
		Moisture Content	16 %	
B-9	24 feet	Moisture Content	47 %	Silty Clay

3.7.1 Percent Passing No. 200 Sieve

Certain recovered soil samples were selected to determine the percentage of fines. In these tests the soil sample was dried and washed over a U.S. No. 200 mesh sieve. The percent of soil by weight passing the sieve was the percentage of fines or portion of the sample in the silt and clay size range. This test was conducted in accordance with ASTM Procedure D-1140, *Standard Test Methods for Amount of Material in Soils Finer than the No. 200 Sieve.*

3.7.2 Atterberg Limits

A recovered soil sample was selected for Atterberg Limits testing to evaluate the soil plasticity characteristics. The soil's Plasticity Index (PI) is the range of moisture content over which the soil deforms as a plastic material. It is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). The LL is the moisture content at which the soil will flow as a heavy viscous fluid. The PL is the lowest moisture content at which the soil is sufficiently plastic so as to be manually rolled into a 1/8-inch diameter thread. These tests were conducted in general accordance with ASTM Procedure D-4318, *Standard Test Methods for LL, PL and Plasticity Index of Soils.*

3.7.3 Moisture Content

Certain recovered soil samples were selected to determine their moisture content. The moisture content was the ratio expressed as a percentage of the weight of water in a given mass of soil to the weight of the solid particles. These tests were conducted in accordance with ASTM Procedure D-2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.

3.7.4 Corrosion Series – Environmental Classification

Selected soil samples were tested for corrosion potential. Testing was completed in accordance with ASTM procedures and included pH (ASTM D-1293), electrical resistivity (ASTM D-1125), chloride content (ASTM D-512) and sulfate content (ASTM D-4130). The corrosion test results are summarized on Table 2. Based on this data and the FDOT Structures Design Guidelines, the substructure environmental classification for soils at this site is slightly aggressive for concrete and slightly aggressive for steel. The controlling factor in the test results was the pH level (pH=7.78).

Table 2 – Corrosion Series Test Results							
Boring No.	Sample Depth (feet)	Minimum Resistivity (ohm-cm)	Chloride, Cl^B (ppm)	Sulfate, SO_4 (ppm)	pH	Substructure Environmental Classification	
						Concrete	Steel
SB-8	0-1	7,000	75	87	7.78	Slightly Aggressive	Slightly Aggressive
SB-9	0-1	4,700	75	18	8.01	Slightly Aggressive	Slightly Aggressive

4.0 RECOMMENDATIONS

4.1 GENERAL

The following recommendations are made based upon a review of the attached soil test data, our understanding of the proposed construction, and experience with similar projects and subsurface conditions. If plans change from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes. Additionally, if subsurface conditions are encountered during construction, which were not encountered in the soil borings, report those conditions immediately to us for observation and recommendations.

In this section of the report, we present our detailed recommendations for groundwater control, mast arm foundation, site preparation, and construction related services.

4.2 GEOTECHNICAL CONSIDERATIONS

Based on the project information provided, it is anticipated the proposed traffic signal structures will be supported on drilled shaft foundations. Structural loads must be transferred to deeper, sound bearing soil layers, in order to obtain adequate foundation bearing capacity and satisfactory long-term foundation performance.

4.3 GROUNDWATER CONSIDERATIONS

The groundwater level will fluctuate seasonally depending upon local rainfall. The rainy seasons in North Florida are normally between June and September, and December and February. Based upon our review of regional hydrogeology and the Alachua County Soil Survey, we estimate the normal seasonal high groundwater level will be deeper than 6 feet below the ground surface at the boring locations; however, stormwater can perch on the clayey sands when sandy soils are present at the surface. Isolated areas with a transient perched groundwater should be expected. The perched groundwater will be a transient condition, directly related to rainfall and site grading.

It should be noted that the normal estimated seasonal high water levels do not provide any assurance that groundwater levels will not exceed these estimated levels during any given year in the future. Should the impediments to surface water drainage be present, or should rainfall intensity and duration, or total rainfall quantities, exceed the normally anticipated rainfall quantities, groundwater levels might once again exceed our seasonal high estimates. We recommend positive drainage be established and maintained on the site during construction. We further recommend permanent measures be constructed to maintain positive drainage from the site throughout the life of the project.

4.4 DRILLED SHAFT FOUNDATION RECOMMENDATIONS

The geotechnical information presented in Tables 3 through 6 are provided to aid the foundation design process, and is a representation of the soil conditions encountered in the soil test borings performed for this project. It should be noted that the soil parameters presented do not incorporate a factor of safety.

Table 3 – Soil Design Parameters Recommended – SB6

Depth Below Site Grade (ft)		Soil Description	Avg. Blow Count Value N	Saturated Unit Weight (pcf)	Friction Angle (degrees)	Shear Strength Cohesion (psf)	Earth Pressure Coefficients	
From	To						Active K_A	Active K_P
0	13.5	Sand with silt to Silty Sand [SP-SM/SM]	6	105	29	0	0.35	2.88
13.5	30	Sandy Clay [CH]	15	110	0	1,500	1.00	1.00

Table 4 – Soil Design Parameters Recommended – SB7

Depth Below Site Grade (ft)		Soil Description	Avg. Blow Count Value N	Saturated Unit Weight (pcf)	Friction Angle (degrees)	Shear Strength Cohesion (psf)	Earth Pressure Coefficients	
From	To						Active K_A	Active K_P
0	13.5	Sand with silt to silty-clayey Sand [SP-SM/SM/SM-SC]	10	105	30	0	0.33	3.00
13.5	30	Sandy Clay [CH]	20	110	0	2,000	1.00	1.00

Table 5 – Soil Design Parameters Recommended – SB8

Depth Below Site Grade (ft)		Soil Description	Avg. Blow Count Value N	Saturated Unit Weight (pcf)	Friction Angle (degrees)	Shear Strength Cohesion (psf)	Earth Pressure Coefficients	
From	To						Active K_A	Active K_P
0	18.5	Silty Sand to Silty-Clayey Sands [SM/SM-SC]	18	105	31	0	0.32	3.12
18.5	30	Sandy Clay [CH]	11	110	0	1,500	1.00	1.00

Table 6 – Soil Design Parameters Recommended – SB9

Depth Below Site Grade (ft)		Soil Description	Avg. Blow Count Value N	Saturated Unit Weight (pcf)	Friction Angle (degrees)	Shear Strength Cohesion (psf)	Earth Pressure Coefficients	
From	To						Active K_A	Active K_P
0	13.5	Silty Sand to Clayey Sand [SM/SC]	23	110	32	0	0.31	3.25
13.5	30	Very Clayey Sand to Sandy Clay [SC/CH]	15	110	0	1,500	1.00	1.00

The Geotechnical Engineer should observe and document the drilled installation operations. The installation of the drilled shaft foundation should be in general accordance with FDOT Standard Specifications for Road and Bridge Construction, sections 455-13 through 455-24 (Drilled Shaft Foundations).

4.5 CONSTRUCTION RELATED SERVICES

We recommend the Owner retain Universal Engineering Sciences to perform construction materials tests and observations on this project. Field tests and observations include verification of foundation subgrades by performing quality assurance tests on the placement of compacted structural fill. We can also provide concrete testing, structural steel testing, and general construction observation services.

The geotechnical engineering design does not end with the advertisement of the construction documents. The design is an on-going process throughout construction. Because of our familiarity with the site conditions and the intent of the engineering design, we are most qualified to address problems that might arise during construction in a timely and cost-effective manner.

5.0 REPORT LIMITATIONS

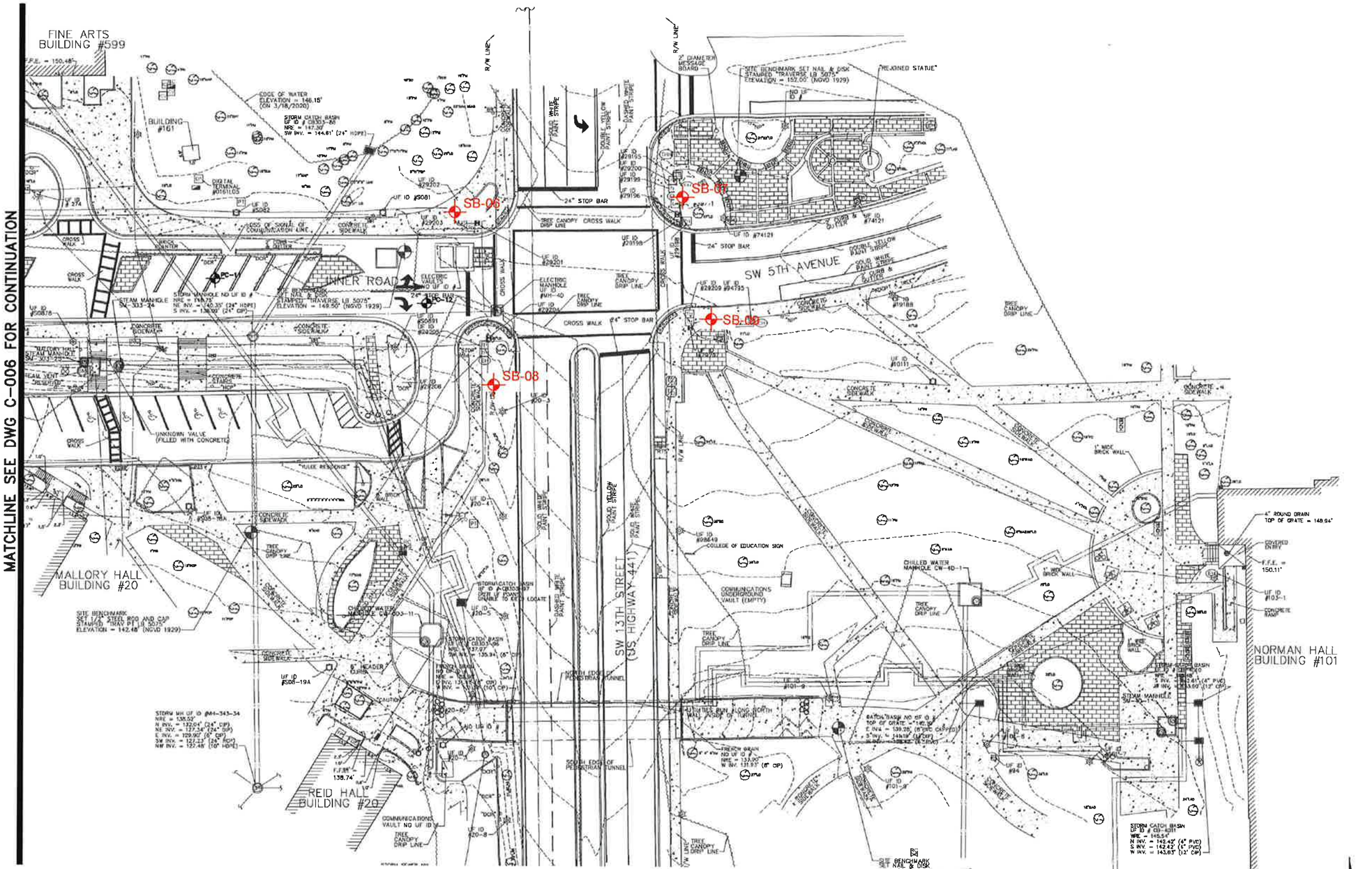
This Report has been prepared for the exclusive use of UF Planning Design & Construction, and other members of the Design/Construction Team for the specific project discussed in this Report. This Report has been prepared in accordance with generally accepted local geotechnical engineering practices; no other warranty is expressed or implied. During the early stages of most construction projects, geotechnical issues not addressed in this report may arise. Because of the natural limitations inherent in working with the subsurface, it is not possible for a geotechnical engineer to predict and address all possible problems. A Geoprofessional Business Association (GBA) publication, "Important Information About Your Geotechnical Engineering Report" appears in Appendix B, and will help explain the nature of geotechnical issues. Further, we present documents in Appendix B: Constraints and Restrictions, to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

APPENDIX A

Boring Location Plan

Boring Logs

Key to Boring Logs



LEGEND

BORING LOCATION

NOTE: ALL SOIL TEST BORING LOCATIONS SHOWN ARE APPROXIMATE.

UF 644 REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, ALACHUA COUNTY, FLORIDA

UNIVERSITY OF FLORIDA

DRAWN BY: KD	DATE: 7/8/20	SCALE: 1"=50'	ACADFILE:0230.2000067-A
CHECKED BY: ES	DATE: 7/8/20	PROJECT NO: 0230.2000067.0000	REPORT NO: 1790702

BORING LOCATION PLAN

UNIVERSAL
ENGINEERING SCIENCES

PAGE NO:
A - 1

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	A-2

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-6** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA
LOCATION: SEE BORING LOCATION PLANS
REMARKS: HAND AUGERED UPPER 4'
PERCHED WATER TABLE

GS ELEVATION(ft):
WATER TABLE (ft): 10
DATE OF READING: 7/22/20
EST. WSWT (ft):

DATE STARTED: 7/22/20
DATE FINISHED: 7/22/20
DRILLED BY: R. PEREZ
TYPE OF SAMPLING:ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0–4						Brown SAND, with silt [SP-SM]						
3–4						Loose tan SAND, with silt [SP-SM]						
5		2-2-2	4									
6–8		2-2-3	5			Loose brown silty SAND [SM], with roots						
8		2-3-2	5									
9–10		2-3-3	6	▼		Loose brown silty SAND [SM]						
14–15		7-13-16	29			Very stiff green CLAY [CH]						
19–20		7-8-8	16			Very stiff to firm green silty CLAY [CL/CH], with gray sand and trace of phoshpatics		36	43	23		
24–25		2-2-3	5									
29–30		2-2-3	5									
30						Boring Terminated at 30'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	A-3

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-7** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS: HAND AUGERED UPPER 4'
PERCHED WATER TABLE

GS ELEVATION(ft):

WATER TABLE (ft): 9

DATE OF READING: 7/22/20

EST. WSWT (ft):

DATE STARTED: 7/22/20

DATE FINISHED: 7/22/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0–4						Light brown SAND, with silt [SP-SM]						
4–7		3-2-3	5			Loose to medium dense tan SAND, with silt [SP-SM]						
		4-5-5	10									
7–9		5-4-4	8	▼		Loose light brown silty clayey SAND [SM-SC]						
9–14		5-7-9	16			Medium dense light brown SAND, with clay [SP-SC]	11	21				
14–19		10-11-15	26			Very stiff green CLAY [CH]						
19–24		10-13-15	28			Very stiff green silty CLAY [CH], with phosphatics						
24–29		5-6-8	14									
29–30		5-8-8	16									
30						Boring Terminated at 30'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	A-4

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-8** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS: HAND AUGERED UPPER 5.5'

GS ELEVATION(ft):

WATER TABLE (ft): NE

DATE OF READING: NA

EST. WSWT (ft):

DATE STARTED: 7/22/20

DATE FINISHED: 7/22/20

DRILLED BY: R. PEREZ

TYPE OF SAMPLING:ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0–5						Brown SAND, with silt [SP-SM] (Fill)						
0–5						Light orange slightly silty SAND [SM], with trace of clay						
6–10		5-6	11			Medium dense light gray clayey SAND [SC]	21	16				
6–10		5-5-7	12									
9–10		5-10-17	27			Medium dense light gray silty clayey SAND [SM-SC], with trace of clay						
14–15		10-11-13	24									
19–20		10-13-15	28			Very stiff to firm light green silty CLAY [CH], with trace sand and trace of phosphatics						
24–25		4-3-3	6									
29–30		2-3-2	5									
30						Boring Terminated at 30'						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	0230.3000067.0000
REPORT NO.:	1790702
PAGE:	A-5

PROJECT: UF REITZ UNION LAWN AND INNER ROAD IMPROVEMENTS
REITZ UNION LAWN AND INNER ROAD
GAINESVILLE, FLORIDA

BORING NO: **B-9** SHEET: 1 of 1

SECTION: TOWNSHIP: RANGE:

CLIENT: UNIVERSITY OF FLORIDA

LOCATION: SEE BORING LOCATION PLANS

REMARKS: HAND AUGERED UPPER 5.5'
PERCHED WATER TABLE

GS ELEVATION(ft):

WATER TABLE (ft): 9

DATE OF READING: 7/23/20

EST. WSWT (ft):

DATE STARTED: 7/23/20

DATE FINISHED: 7/23/20

DRILLED BY: R. PEREZ

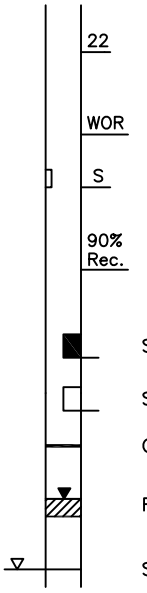
TYPE OF SAMPLING: ASTM D-1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N VALUE	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT/ DAY)	ORG CONT. (%)
0–4						Brown and tan silty SAND [SM], with roots						
4–6						Medium dense tan silty SAND [SM]						
6–7		5-6-6	12									
7–8						Medium dense tan SAND [SP]						
8–9		10-13-16	29									
9–10		11-13-15	28	▼		Medium dense tan clayey SAND [SC]						
10–14												
14–15		7-10-11	21			Medium dense light gray very clayey SAND to sandy CLAY [SC/CH]						
15–19												
19–20		6-12-14	26			Very stiff to firm green silty CLAY [CH], with trace of phosphatics						
20–24												
24–25		3-4-3	7					47				
25–29												
29–30		3-3-3	6									
30						Boring Terminated at 30'						

UNIVERSAL
ENGINEERING SCIENCES

KEY TO BORING LOGS

SYMBOLS



22	Number of Blows of a 140–lb Weight Falling 30 in. Required to Drive Standard Spoon One Foot
WOR	Weight of Drill Rods
S	Thin–Wall Shelby Tube Undisturbed Sampler Used
90% Rec.	Percent Core Recovery from Rock Core–Drilling Operations
	Sample Taken at this Level
	Sample Not Taken at this Level
	Change in Soil Strata
	Free Ground Water Level
	Seasonal High Ground Water Level

GRANULAR MATERIALS

Relative Density	Safety Hammer SPT N (Blows/Ft.)	Automatic Hammer SPT N (Blows/Ft.)
Very Loose	Less than 4	Less than 3
Loose	4–10	3–8
Medium Dense	10–30	8–24
Dense	30–50	24–40
Very Dense	>50	>40

COHESIVE MATERIALS

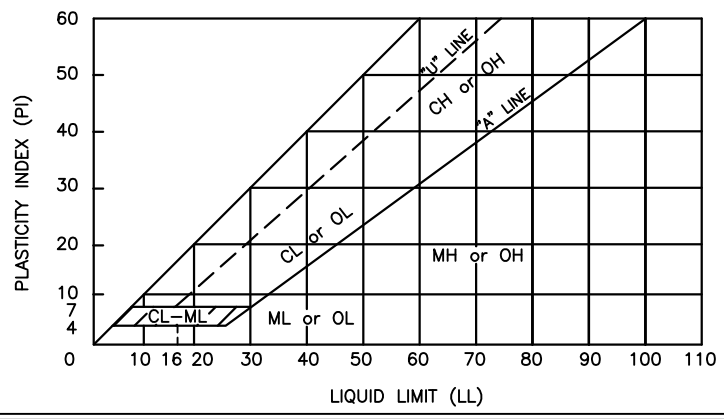
Consistency	Safety Hammer SPT N (Blows/Ft.)	Automatic Hammer SPT N (Blows/Ft.)
Very Soft	Less than 2	Less than 1
Soft	2–4	1–3
Firm	4–8	3–6
Stiff	8–15	6–12
Very Stiff	15–30	12–24
Hard	>30	>24

UNIFIED CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 200 sieve	CLEAN GRAVELS	GW	Well–graded gravels and gravel–sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel–sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels, gravel–sand–silt mixtures
			GC	Clayey gravels, gravel–sand–clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well–graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand–silt mixtures
			SC	Clayey sands, sand–clay mixtures
FINE-GRAINED SOILS 50% or more passes No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomacaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly organic Soils			PT	Peat, muck and other highly organic soils

* Based on the material passing the 3–in. (75mm) sieve.

PLASTICITY CHART



APPENDIX B

Important Information About Your Geotechnical Engineering Report Constraint and Restrictions

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

CONSTRAINTS & RESTRICTIONS

The intent of this document is to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

WARRANTY

Universal Engineering Sciences has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

UNANTICIPATED SOIL CONDITIONS

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Universal Engineering Sciences is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects. Universal Engineering Sciences cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of exploration. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.

UNIVERSAL
ENGINEERING SCIENCES

Universal Engineering Sciences, LLC
GENERAL CONDITIONS

SECTION 1: RESPONSIBILITIES

1.1 *Universal Engineering Sciences,* LLC, ("UES"), has the responsibility for providing the services described under the Scope of Services section. The work is to be performed according to accepted standards of care and is to be completed in a timely manner. The term "UES" as used herein includes all of *Universal Engineering Sciences, LLC's* agents, employees, professional staff, and subcontractors.

1.2 The Client or a duly authorized representative is responsible for providing UES with a clear understanding of the project nature and scope. The Client shall supply UES with sufficient and adequate information, including, but not limited to, maps, site plans, reports, surveys and designs, to allow UES to properly complete the specified services. The Client shall also communicate changes in the nature and scope of the project as soon as possible during performance of the work so that the changes can be incorporated into the work product.

1.3 The Client acknowledges that UES's responsibilities in providing the services described under the Scope of Services section is limited to those services described therein, and the Client hereby assumes any collateral or affiliated duties necessitated by or for those services. Such duties may include, but are not limited to, reporting requirements imposed by any third party such as federal, state, or local entities, the provision of any required notices to any third party, or the securing of necessary permits or permissions from any third parties required for UES's provision of the services so described, unless otherwise agreed upon by both parties.

1.4 Universal will not be responsible for scheduling our services and will not be responsible for tests or inspections that are not performed due to a failure to schedule our services on the project or any resulting damages.

1.5 **PURSUANT TO FLORIDA STATUTES §558.0035, ANY INDIVIDUAL EMPLOYEE OR AGENT OF UES MAY NOT BE HELD INDIVIDUALLY LIABLE FOR NEGLIGENCE.**

SECTION 2: STANDARD OF CARE

2.1 Services performed by UES under this Agreement will be conducted in a manner consistent with the level of care and skill ordinarily exercised by members of UES's profession practicing contemporaneously under similar conditions in the locality of the project. No other warranty, express or implied, is made.

2.2 The Client recognizes that subsurface conditions may vary from those observed at locations where borings, surveys, or other explorations are made, and that site conditions may change with time. Data, interpretations, and recommendations by UES will be based solely on information available to UES at the time of service. UES is responsible for those data, interpretations, and recommendations, but will not be responsible for other parties' interpretations or use of the information developed.

2.3 Execution of this document by UES is not a representation that UES has visited the site, become generally familiar with local conditions under which the services are to be performed, or correlated personal observations with the requirements of the Scope of Services. It is the Client's responsibility to provide UES with all information necessary for UES to provide the services described under the Scope of Services, and the Client assumes all liability for information not provided to UES that may affect the quality or sufficiency of the services so described.

2.4 Should UES be retained to provide threshold inspection services under Florida Statutes §553.79, Client acknowledges that UES's services thereunder do not constitute a guarantee that the construction in question has been properly designed or constructed, and UES's services do not replace any of the obligations or liabilities associated with any architect, contractor, or structural engineer. Therefore it is explicitly agreed that the Client will not hold UES responsible for the proper performance of service by any architect, contractor, structural engineer or any other entity associated with the project.

SECTION 3: SITE ACCESS AND SITE CONDITIONS

3.1 Client will grant or obtain free access to the site for all equipment and personnel necessary for UES to perform the work set forth in this Agreement. The Client will notify any and all possessors of the project site that Client has granted UES free access to the site. UES will take reasonable precautions to minimize damage to the site, but it is understood by Client that, in the normal course of work, some damage may occur, and the correction of such damage is not part of this Agreement unless so specified in the Proposal.

3.2 The Client is responsible for the accuracy of locations for all subterranean structures and utilities. UES will take reasonable precautions to avoid known subterranean structures, and the Client waives any claim against UES, and agrees to defend, indemnify, and hold UES harmless from any claim or liability for injury or loss, including costs of defense, arising from damage done to subterranean structures and utilities not identified or accurately located. In addition, Client agrees to compensate UES for any time spent or expenses incurred by UES in defense of any such claim with compensation to be based upon UES's prevailing fee schedule and expense reimbursement policy.

SECTION 4: SAMPLE OWNERSHIP AND DISPOSAL

4.1 Soil or water samples obtained from the project during performance of the work shall remain the property of the Client.

4.2 UES will dispose of or return to Client all remaining soils and rock samples 60 days after submission of report covering those samples. Further storage or transfer of samples can be made at Client's expense upon Client's prior written request.

4.3 Samples which are contaminated by petroleum products or other chemical waste will be returned to Client for treatment or disposal, consistent with all appropriate federal, state, or local regulations.

SECTION 5: BILLING AND PAYMENT

5.1 UES will submit invoices to Client monthly or upon completion of services. Invoices will show charges for different personnel and expense classifications.

5.2 Payment is due 30 days after presentation of invoice and is past due 31 days from invoice date. Client agrees to pay a finance charge of one and one-half percent (1 ½ %) per month, or the maximum rate allowed by law, on past due accounts.

5.3 If UES incurs any expenses to collect overdue billings on invoices, the sums paid by UES for reasonable attorneys' fees, court costs, UES's time, UES's expenses, and interest will be due and owing by the Client.

SECTION 6: OWNERSHIP AND USE OF DOCUMENTS

6.1 All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by UES, as instruments of service, shall remain the property of UES.

6.2 Client agrees that all reports and other work furnished to the Client or his agents, which are not paid for, will be returned upon demand and will not be used by the Client for any purpose.

6.3 UES will retain all pertinent records relating to the services performed for a period of five years following submission of the report, during which period the records will be made available to the Client at all reasonable times.

6.4 All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by UES, are prepared for the sole and exclusive use of Client, and may not be given to any other party or used or relied upon by any such party without the express written consent of UES.

SECTION 7: DISCOVERY OF UNANTICIPATED HAZARDOUS MATERIALS

7.1 Client warrants that a reasonable effort has been made to inform UES of known or suspected hazardous materials on or near the project site.

7.2 Under this agreement, the term hazardous materials include hazardous materials (40 CFR 172.01), hazardous wastes (40 CFR 261.2), hazardous substances (40 CFR 300.6), petroleum products, polychlorinated biphenyls, and asbestos.

7.3 Hazardous materials may exist at a site where there is no reason to believe they could or should be present. UES and Client agree that the discovery of unanticipated hazardous materials constitutes a changed condition mandating a renegotiation of the scope of work. UES and Client also agree that the discovery of unanticipated hazardous materials may make it necessary for UES to take immediate measures to protect health and safety. Client agrees to compensate UES for any equipment decontamination or other costs incident to the discovery of unanticipated hazardous waste.

7.4 UES agrees to notify Client when unanticipated hazardous materials or suspected hazardous materials are encountered. Client agrees to make any disclosures required by law to the appropriate governing agencies. Client also agrees to hold UES harmless for any and all consequences of disclosures made by UES which are required by governing law. In the event the project site is not owned by Client, Client recognizes that it is the Client's responsibility to inform the property owner of the discovery of unanticipated hazardous materials or suspected hazardous materials.

7.5 Notwithstanding any other provision of the Agreement, Client waives any claim against UES, and to the maximum extent permitted by law, agrees to defend, indemnify, and save UES harmless from any claim, liability, and/or defense costs for injury or loss arising from UES's discovery of unanticipated hazardous materials or suspected hazardous materials including any costs created by delay of the project and any cost associated with possible reduction of the property's value. Client will be responsible for ultimate disposal of any samples secured by UES which are found to be contaminated.

SECTION 8: RISK ALLOCATION

8.1 Client agrees that UES's liability for any damage on account of any breach of contract, error, omission or other professional negligence will be limited to a sum not to exceed $50,000 or UES's fee, whichever is greater. If Client prefers to have higher limits on contractual or professional liability, UES agrees to increase the limits up to a maximum of $1,000,000.00 upon Client's written request at the time of accepting our proposal provided that Client agrees to pay an additional consideration of four percent of the total fee, or $400.00, whichever is greater. The additional charge for the higher liability limits is because of the greater risk assumed and is not strictly a charge for additional professional liability insurance.

SECTION 9: INSURANCE

9.1 UES represents and warrants that it and its agents, staff and consultants employed by it, is and are protected by worker's compensation insurance and that UES has such coverage under public liability and property damage insurance policies which UES deems to be adequate. Certificates for all such policies of insurance shall be provided to Client upon request in writing. Within the limits and conditions of such insurance, UES agrees to indemnify and save Client harmless from and against loss, damage, or liability arising from negligent acts by UES, its agents, staff, and consultants employed by it. UES shall not be responsible for any loss, damage or liability beyond the amounts, limits, and conditions of such insurance or the limits described in Section 8, whichever is less. The Client agrees to defend, indemnify and save UES harmless for loss, damage or liability arising from acts by Client, Client's agent, staff, and other UESs employed by Client.

SECTION 10: DISPUTE RESOLUTION

10.1 All claims, disputes, and other matters in controversy between UES and Client arising out of or in any way related to this Agreement will be submitted to alternative dispute resolution (ADR) such as mediation or arbitration, before and as a condition precedent to other remedies provided by law, including the commencement of litigation.

10.2 If a dispute arises related to the services provided under this Agreement and that dispute requires litigation instead of ADR as provided above, then:

(a) the claim will be brought and tried in judicial jurisdiction of the court of the county where UES's principal place of business is located and Client waives the right to remove the action to any other county or judicial jurisdiction, and

(b) The prevailing party will be entitled to recovery of all reasonable costs incurred, including staff time, court costs, attorneys' fees, and other claim related expenses.

SECTION 11: TERMINATION

11.1 This agreement may be terminated by either party upon seven (7) days written notice in the event of substantial failure by the other party to perform in accordance with the terms hereof. Such termination shall not be effective if that substantial failure has been remedied before expiration of the period specified in the written notice. In the event of termination, UES shall be paid for services performed to the termination notice date plus reasonable termination expenses.

11.2 In the event of termination, or suspension for more than three (3) months, prior to completion of all reports contemplated by the Agreement, UES may complete such analyses and records as are necessary to complete its files and may also complete a report on the services performed to the date of notice of termination or suspension. The expense of termination or suspension shall include all direct costs of UES in completing such analyses, records and reports.

SECTION 12: ASSIGNS

12.1 Neither the Client nor UES may delegate, assign, sublet or transfer their duties or interest in this Agreement without the written consent of the other party.

SECTION 13. GOVERNING LAW AND SURVIVAL

13.1 The laws of the State of Florida will govern the validity of these Terms, their interpretation and performance.

13.2 If any of the provisions contained in this Agreement are held illegal, invalid, or unenforceable, the enforceability of the remaining provisions will not be impaired. Limitations of liability and indemnities will survive termination of this Agreement for any cause.

SECTION 14. INTEGRATION CLAUSE

14.1 This Agreement represents and contains the entire and only agreement and understanding among the parties with respect to the subject matter of this Agreement, and supersedes any and all prior and contemporaneous oral and written agreements, understandings, representations, inducements, promises, warranties, and conditions among the parties. No agreement, understanding, representation, inducement, promise, warranty, or condition of any kind with respect to the subject matter of this Agreement shall be relied upon by the parties unless expressly incorporated herein.

14.2 This Agreement may not be amended or modified except by an agreement in writing signed by the party against whom the enforcement of any modification or amendment is sought.

Rev. 06/10/2015