Addendum 1
August 21, 2025
South Jersey Port Corporation
Request for Proposals
SJPC-25-E23 Building Y-2 Emergency Fire Main Repair
Broadway Marine Terminal

NOTICE

This Addendum is considered part of this Request for Proposals and must be acknowledged with your submission.

Schedule – First paragraph, Page 4 of the information for bidders. The deadline for questions is hereby extended to Tuesday, September 2nd, 2025, at 5:00 PM.

Revised Bid Form – Use the revised Bid Form provided with this Addendum.

Specifications – Note change to Specifications Scope of Work Section 1.2-K, DGA only surface restoration and replacement of damaged fencing were added.

Revised Drawings – See changes to Sheets, C-1, C-2, and D-1 clouded in red.

ANSWERS TO FORMALLY SUBMITTED QUESTIONS

Question 1. The watermain restoration on plan sheet C-1 is called out for the waterline from VH 823B to the second 8'' 45-degree bend. After site visit there seems to be no asphalt in this area only DGA, do we need to still pave that portion of the watermain trench. Should the quantity on the bid item sheet be adjusted.

Answer 1. Sheet D-1, "Roadway Trench Detail D.I. Pipe" shows the pavement restoration for existing paved areas. There is some bituminous existing paving on the west end of the area. The area north of Y-2 which is currently DGA will be not be paved. See adjusted paving quantities on the plan Sheet C-1, added detail on Sheet D-1, and adjusted quantities on the revised bid form.

Question 2. On plan sheet C-1 the two water lines heading to the building are shown to be tied into existing cast iron mains. Are we to install a blowoff at the end of the laterals for blowoff of air and hydrostatic testing before connection occurs?

Answer 2. Yes.

Question 3. On plan sheet C-2 the water line heading to VH 822A, there seems to be an 18'' wide concrete wall about 4-5' out from building wall. What are we to do with removing the concrete wall?

Answer 3. The existing reinforced concrete wall appears on the plan Sheet C-2. It is 8'-0" from the south face of the Y-2 Building. The concrete wall is 12 inches thick. Contractor shall saw cut and demolish a slot in the wall or core drill in order to get the new 8" DI pipe within 5 feet of the building. Pay Item 27 on the Bid Form

Question 4. On plan sheet C-2 the 2 water lines heading to the building are shown to be capped. Are we to install a permanent blowoff at the end of the laterals for blowoff of air and hydrostatic testing?

Answer 4. Yes.

Question 5. Are we removing the existing watermain on sheet C-2 before installation of proposed 12'' DIP?

Answer 5. Yes. See the attached exhibit marked "Existing Fire Lines from 1946 Map". The connection of new pipe to the existing 16" CIP system begins just east of C.O.V. 40 with Item 35 - 16"x12" MJT Restrained CLDIP Reducer. Then demolish the 16"CIP (turns into a 12" CIP) in order to install the new 12"DIP in the same path. Salvage goes to the contractor.

Question 6. On plan sheet C-2 the end of the waterline at the most western end, we are leaving a 12x12x8'' Tee. Is there an existing main we should be tying into for the hydrant at the end of the port dock to remain online?

Answer 6. No connection to existing pipe is required here. At that location, provide a new 12"x8" DIP reducer and an 8" end cap with a temporary thrust block.

SJPC 25-E23
BUILDING Y-2 EMERGENCY FIRE MAIN REPAIR
BROADWAY MARINE TERMINAL

BID FORM
REVISED BY ADDENDUM 1

Having carefully examined the Bid Documents, including, but not limited to, the Plans, Drawings, Technical Specifications, and form Agreement for this project, and having examined all conditions affecting the work, the undersigned Bidder proposes to complete the all the work as set forth therein, and to furnish all equipment, supervision, transportation, labor, materials, goods and services required to execute the work in accordance with the Bid Documents, including, but not limited to, the Plans, Drawings, Technical Specifications, and Agreement, for the following Unit Price Costs, unless noted otherwise:

It is understood and agreed that any incidental work necessary to complete the Project in its entirety will be included in the line items, unit prices and lump sum bid, whether the line item or items shall specifically state the nature of the incidental work. The line item or items which the incidental work, and the incidental costs, are included shall be selected by the Bidder. It is also understood and agreed that each line item of work shall include all supervision and personnel costs, markups, and other costs envisioned by the Bidder. In other words, all line item costs bid shall be "all-inclusive". Therefore, the unit prices to be entered on this Bid Form are obtained by dividing the total cost bid to complete the line item by the quantity shown of the form. The bid shall be determined by adding all line item costs for all Bid Items under Base Bid. This grand total Base Bid Price shall constitute the Lump Sum Base Bid Cost of the Project.

Negotiations for the adjustments of the unit price of any item will be completed only when that item and other work or items affecting its quantity have been completed and the total net change in the quantity of such item can be ascertained with sufficient accuracy to determine if it be eligible for consideration in accordance with the foregoing provisions.

The Bidder must also furnish a price for **all** Optional Bids or Alternates requested, as well as **all** separate unit price items requested. Failure to do so will constitute an incomplete bid, which will be rejected by the South Jersey Port Corporation ("SJPC").

The Bidder agrees that this bid will be valid and binding for a period of ninety (90) days to allow the SJPC time to evaluate the complete Bid Proposal to allow for the decision. The SJPC's Engineer, or his designee, will officially notify the Bidder of the acceptance of their bid within ninety (90) days following the bid date pending compliance with delivering the requested documentation.

The undersigned accepts responsibility for having completely examined and understood the intent of the Bid Documents, including, but not limited to, Plans, Drawings, Technical Specifications, and form Agreement to be signed upon award; and, for having fully examined the site of the work; and, for having obtained all pertinent information affecting the work.

Bidder shall provide a lump sum proposal in US dollars to supply all necessary design services, materials, goods, labor, tools, consumables, transportation, watercraft, cranes, supervision, PPE, all materials and material controls, and any temporary facilities as necessary to provide for the complete and functional scope of work as described.

Estimated Time Required to Complete All Work in Calendar Days: 60 Days

Bidder shall provide rough schedule, including estimated start and completion dates.

Show major milestones including equipment delivery, field mobilization, construction, testing, and closeout.

All work shall be performed on weekdays during daylight hours between 7:30 am and 4:30pm. Work may be performed on Saturdays and/or other hours pending prior written approval by SJPC.

We Acknowledge Receipt of the Following Addenda:

1. ADDENDUM NO. _____1_____ Dated: __8/21/2025__
2. ADDENDUM NO. _____ Dated: _____
3. ADDENDUM NO. _____ Dated: _____
4. ADDENDUM NO. _____ Dated: _____

Bidders must acknowledge all Addenda on this Bid Form.

Check the SJPC website for all addenda.

Failure to acknowledge all the Addenda will disqualify your bid.

If no addenda are received, indicate by printing or typing the word "NONE" in the space for first addendum.

SJPC 25-E23
BUILDING Y-2 EMERGENCY FIRE MAIN REPAIR
BROADWAY MARINE TERMINAL
REVISED BID FORM

Item	Quan	Units	Description	Unit Price	Amount
1	1	UN	MOBILIZATION (MAX 3% OF TOTAL CONTRACT AMOUNT)	$	$
2	700	LF	8" CLASS 52 DUCTILE IRON PIPE, WRAPPED IN POLYETHYLENE	$	$
3	450	LF	12" CLASS 52 DUCTILE IRON PIPE, WRAPPED IN POLYETHYLENE	$	$
4	1	UN	8" 22.5 DEGREE MJT RESTRAINED CLDIP FITTING	$	$
5	3	UN	8" 45 DEGREE MJT RESTRAINED CLDIP FITTING	$	$
6	4	UN	12" X 12" X 8" MJT RESTRAINED CLDIP TEE, COMPLETE	$	$
7	1	UN	16" X 16" X 12" MJT RESTRAINED CLDIP TEE, INCLUDING SLEEVES,	$	$
8	1	UN	8" X 8" X 8" MJT RESTRAINED CLDIP TEE, IF & WHERE DIRECTED	$	$
9	8	UN	8" MJT RESTRAINED END CAP	$	$
10	2	UN	12" MJT RESTRAINED END CAP	$	$
11	517	SY	DENSE GRADED AGGREGATE BASE COURSE, 6" THICK	$	$
12	100	CY	TRENCH STABILIZATION, IF & WHERE DIRECTED	$	$
13	0	LS	SOIL EROSION AND SEDIMENT CONTROL	$	$
14	111	TON	HOT MIX ASPHALT BASE COURSE, 19M64, 6" THICK	$	$
15	37	TON	HOT MIX ASPHALT SURFACE COURSE, 12.5M64, 2" THICK	$	$
16	47	GAL	TACK COAT	$	$
17	10	SY	6" CONCRETE	$	$
18	20	TON	LOAD. HAUL AND DISPOSE OF CONTAMINATED SOIL OFF SITE (IF &	$	$
19	200	TON	LOAD, HAUL EXISTING SOIL (CLASSIFIED AS ID-27 OR ID-27A	$	$

20	100	CY	SELECT BACKFILL, IF & WHERE DIRECTED	$	$
21	5	UN	SOIL TESTING, IF & WHERE DIRECTED	$	$
22	30	CY	FLOWABLE FILL, IF AND WHERE DIRECTED	$	$
23	1	LS	TRAFFIC AND MAINTENANCE CONTROL	$	$
24	30	HR	FLAGGERS FOR TRAFFIC CONTROL, IF & WHERE DIRECTED	$	$
25	5	UN	12" X 8" MJT RESTRAINED CLDIP REDUCER	$	$
26	7	UN	TEST PITS, INCLUDING RESTORATION	$	$
27	50	CY	REMOVAL AND DISPOSAL OF UNDERGROUND EXISTING FOUNDATIONS, IF & WHERE DIRECTED	$	$
28	1	LS	DEWATERING	$	$
29	1	AL	ALLOWANCE FOR UNFORSEEN CONDITIONS	$ 50,000.00	$ 50,000.00
30	5	UN	8" MJT RESTRAINED RESILIENT SEAT GATE VALVE, COMPLETE	$	$
31	20	LF	16" CLASS 52 DUCTILE IRON PIPE, WRAPPED IN POLYETHYLENE	$	$
32	2	UN	FURNISH AND INSTALL FIRE HYDRANTS,COMPLETE	$	$
33	8	UN	6" STEEL BOLLARDS, FILLED WITH CONCRETE AND PLASTIC COVER	$	$
34	1	UN	12" MJT RESTRAINED RESILIENT SEAT GATE VALVE, COMPLETE	$	$
35	1	UN	16" X 12" MJT RESTRAINED CLDIP REDUCER	$	$
36	1	UN	12" X 12" X 12" MJT RESTRAINED CLDIP TEE, IF & WHERE DIRECTED	$	$
37			TOTAL CONSTRUCTION COST, BASE BID Items #1 - #36, Inclusive	$	$

SJPC 25-E23
BUILDING Y-2 EMERGENCY FIRE MAIN REPAIR
BROADWAY MARINE TERMINAL

TOTAL CONTRACT AMOUNT - Line 37 of Bid Form

(Printed / Written and Numerical)

_____

$_____

Contractor: _____

Primary Contact Name: _____

Title: _____

Signature: _____

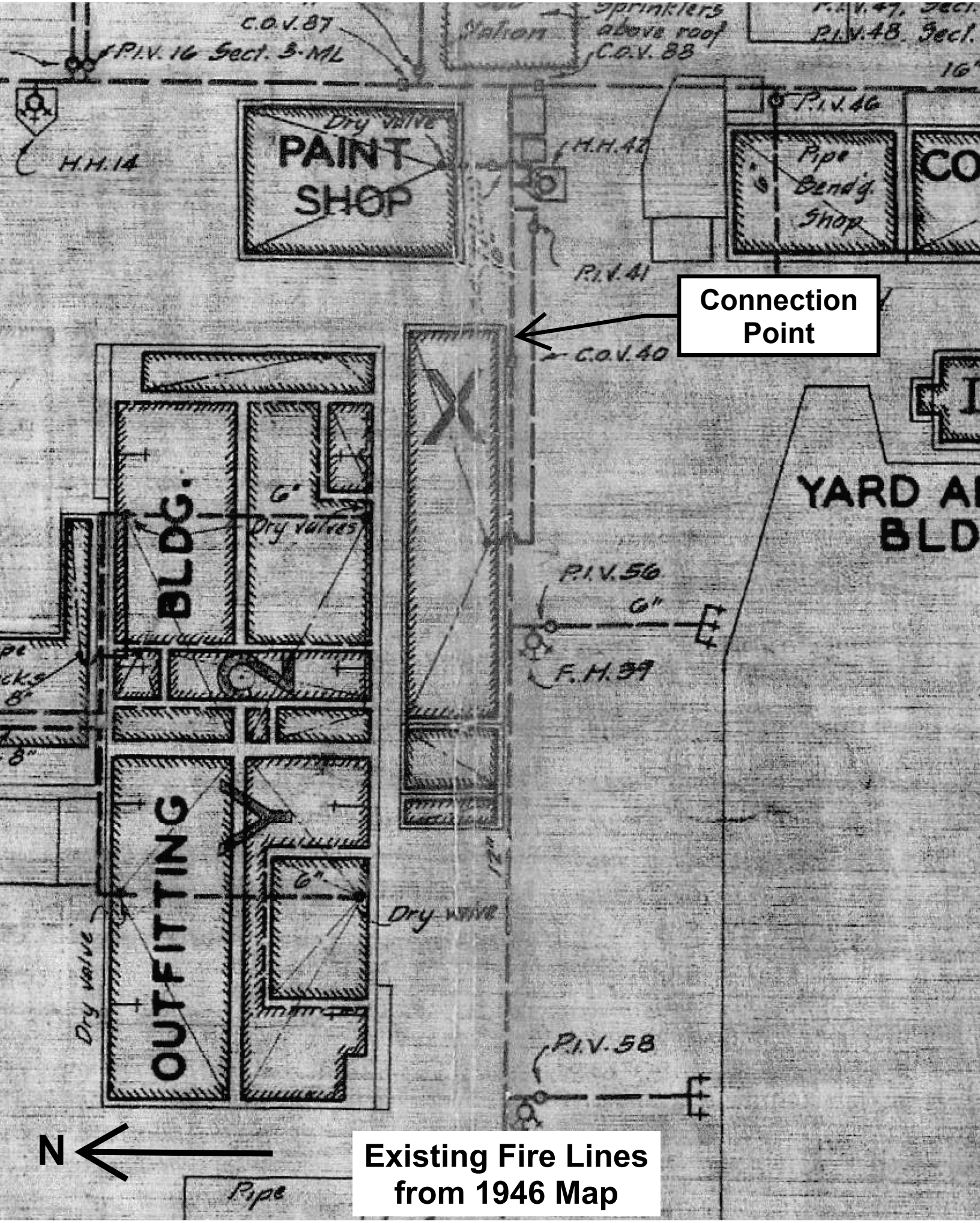
Date: _____

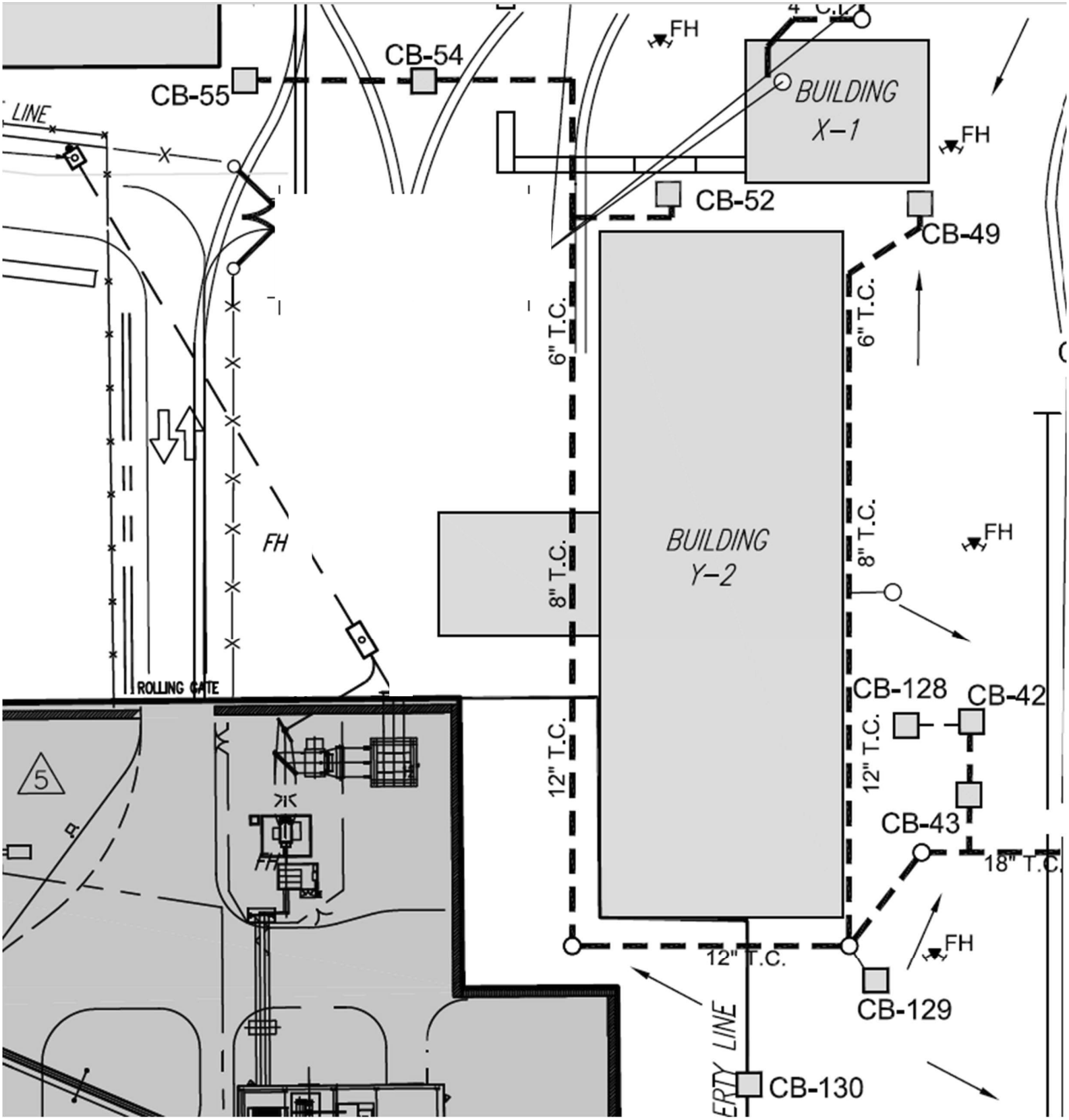
Business Address: _____

_____

Phone No: _____

Email Address: _____


C.O.V. 87
P.I.V. 16 Sect. 3-ML
Sprinklers above roof C.O.V. 88
P.I.V. 48 Sect.
P.I.V. 46
Dry valve
PAINT SHOP
H.H. 14
H.H. 42
Pipe Bend'g. Shop
P.I.V. 41
Connection Point
C.O.V. 40
YARD
BLD
BLDG.
6" Dry Valves
P.I.V. 56
6"
F.H. 39
OUTFITTING
6"
Dry valve
Dry valve
P.I.V. 58
N
Pipe
Existing Fire Lines from 1946 Map



Storm Drainage System
Y-2 Building
Broadway Marine Terminal

FOR INFORMATION ONLY

SPECIFICATIONS
for the

Building Y-2 Emergency Fire Main Repair

Prepared for
South Jersey Port Corp
Camden, New Jersey

August 2025

REMINGTON & VERNICK ENGINEERS

2059 Springdale Rd
Cherry Hill, NJ 08033
(856) 795-9595

RVE Project No. 3965X004

Stephanie Cuthbert, P.E. Lic. No. 42136

Date

Table of Contents
South Jersey Port Corporation
Building Y-2 Emergency Fire Main Repair
Camden– Camden County, New Jersey
3965X004

August 2025

PREVAILING WAGES (STATE OF NEW JERSEY PREVAILING WAGE RATES ARE AVAILABLE FOR BIDDER REVIEW AT THE PLACE OF DISTRIBUTION; A COPY WILL BE INCLUDED WITH EACH CONTRACT SET PROVIDED TO THE AWARDED CONTRACTOR).

SCOPE OF WORK

1.1 GENERAL

In general, the work on this project consists of the replacement of the existing fire main that surrounds Building Y-2 in North Broadway, including but not limited to replacing laterals to the existing valve houses. All work is to be performed within the South Jersey Port Corporation Broadway Terminal location in the City of Camden, Camden County, New Jersey, as shown on the plans and as specified herein.

1.2 DESCRIPTION OF WORK

The work of this project consists of the following:

A. All related incidental work includes soil erosion and sediment control measures, traffic control, dewatering, cleaning, and restorations.

B. Contractors shall have the necessary equipment to cut, remove, and dispose of buried foundation sections that may intersect the excavation for the installation of the new fire water main. By submission of this bid, contractors acknowledge that they are aware of the unknowns that may be encountered during construction that may affect the progress of work to be completed.

C. Test pits are included to allow the contractor to locate and confirm existing fire services to make the appropriate pipe connections by performing test pits at every valve house before any excavation starts to confirm the existing material and size of the service lines entering the valve house. The cost of all test pit work shall be included in the price for line item #48 " TEST PITS, INCLUDING RESTORATION" and shall include all necessary excavation, equipment, restoration and delivery.

D. Furnish and install the fire main and hydrant assemblies as shown and specified. Work shall include all project-related appurtenances including but not limited to valves, fittings, piping, restraints, and fire hydrants.

E. All hydrants and all new sections of fire main are subject to pressure testing prior to final approval.

F. The contractor is responsible for coordinating with the Owner and the local fire department to conduct the necessary fire watches when performing all valve house fire main connections.

G. The contractor is responsible for the testing of all soils that are required to be removed from the project as well as proper disposal of the soil. An Environmental Investigation was performed during the design and is attached as an appendix. All excavated soils to be removed from the site are to be handled and disposed of in accordance with the appropriate regulations. All stockpiled soil shall be removed at a minimum of every 30 days.

H. The contractor is responsible for the proper handling of any dewatering of groundwater as well as the proper disposal of the groundwater. An Environmental Investigation was performed by RVE and is attached as an appendix. All groundwater to be removed is to be handled and disposed of in accordance with the appropriate regulations.

I. Contractor is responsible for coordinating with South Jersey Port Corp for all ship deliveries and may be required to stop work during unloading of ships due to heavy truck traffic. Delays resulting from said shutdowns will not be reimbursed and are to be anticipated and included in all unit prices bid as part of the project and will not be considered as downtime for the project.

J. Furnish and install all restorations as required and specified herein.

K. All areas disturbed during construction activities shall be restored by the contractor as described in the bidding documents. The cost of all restoration work shall be included in the price bid for the associated line item. Final site restorations shall include the following:

a) Restore to existing grade. Provide 2" of HMA surface material and 6" of HMA base course material on 6" of dense graded aggregate, for trenches as indicated on plans
b) Restore to existing grade. Provide 6" of dense graded aggregate, for trenches as indicated on plans
c) Restore fencing. Contractor shall restore fencing to existing conditions as indicated on plans.

L. The Allowance line item shall include work not in the contract that the contractor is directed to perform in writing by the Owner, or the project Engineer at an agreed upon price. Cost of the work shall be approved by the Owner prior to the Contractor initiating the work. Any unused monies shall be retained by the Owner. Work under the allowance is subject to the conditions set forward in the General Conditions.

M. The contractor shall be responsible for site safety within the work area.

N. The contractor shall be responsible for the safe keeping of their equipment on site.

1.03 SPECIAL RESTRICTIONS

A. Traffic control and operations of the port are to be considered of high importance and all work is not to be disruptive to any of the tenants or their operations. The contractor is to perform all work in a manner that does not interrupt the operations of the port in any way. All costs are to be included in the various items of the proposal. No additional payments to the contractor will be considered due to the operations of the port.

The Contractor shall be responsible for coordination with South Jersey Port Corp for traffic concerning container ships and tractor trailers. Notably, there may be high periods of traffic with trucks transporting goods as well as unloading from ships that will come to the port. There may be other construction work being performed at the same time as the fire main replacement. Contractor is to coordinate with all other contractors on site to alleviate conflicts of working locations and blocking traffic flow.

B. Mobilization Costs: Costs shall be included in the price bid for the "Mobilization" line item as shown in the Proposal. This cost shall not be more than 3% of the total project cost. Payment of mobilization line item is to be paid at a maximum of fifteen percent (15%) of the line item per payment request until the total amount is paid in full.

C. The contractor is responsible for getting the required TWIC cards for each employee that will be working on site.

D. The contractor shall be responsible for coordinating his work and that of all other contractors on the project. Any costs related to his coordinating shall be included in his proposal.

E. The plans are appended hereto and are a part of these specifications.

F. South Jersey Port Corp may use unused allowance money for other work as directed at an agreed upon cost in writing.

G. The Scope of Work outlines the general items and distribution of work and shall not be construed as being all inclusive.

END OF SCOPE

SECTION 003100

AVAILABLE PROJECT INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. Document Includes:

1. Subsurface investigation report.

B. Available Project information has been furnished by Engineer for use in designing this Project.

1. Each Bidder shall be fully familiar with available Project information, which has been prepared for Owner by Engineer.
2. Available Project information is offered solely for reference and shall be considered part of Contract Documents.
3. Data contained in Documents prepared by Engineer is believed to be reliable; however, Contractor is Required to perform all sampling as required.
4. In preparing their Bids, Bidders shall consider and evaluate data contained in available Project information as well as Contract Documents prepared by Engineer.

1.2 SUBSURFACE INVESTIGATION REPORT

A. A copy of an Environmental Investigation report for Site is attached as Appendix A, and is identified as follows:

1. Title: Technical Memorandum 1.0: Broadway Terminal Fire Water Main Replacement – Environmental Investigation
2. Date: 11/30/2023
3. Prepared by: Remington & Vernick Engineers

B. This report identifies properties of below-grade conditions of soils and ground water contamination.

C. Recommendations described in report are not requirements of Contract unless specifically referenced in Contract Documents.

D. Unforeseen Conditions:

1. This report, by its nature, cannot reveal every condition existing on Site.
2. Should subsurface conditions be found to vary substantially from this report, changes in design and construction will be made, with resulting changes to Contract Price and/or Contract Time.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Available Project Information. Include all such costs in the unit price bid for which it is a part.

END OF DOCUMENT 003100

SECTION 010000

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Only major items of work are given in the Bid Form, but it is the intent of the specifications to secure a completely interconnected and functionable system, and if any workmanship or materials be required which are obviously necessary to carry out the full intent and meaning of the plans and specifications or to be reasonably inferred therefrom, the cost of such workmanship or materials shall be included in the unit price for the major items of work.

C. Contractor shall notify all utility companies prior to construction of the work under this contract including the utility "Call Before You Dig" requirement at 1-800-272-1000 for any excavation or asphalt paving work under the contract.

D. Prior to any excavation, the Contractor shall have all utilities marked, and shall excavate or otherwise determine the exact location and elevations of said utilities. The Contractor shall notify the Engineer of any conflicts. The Contractor shall arrange for any necessary utility relocations or plan changes and shall reschedule Contractor's operations appropriately.

E. The Contractor, in the construction of any project, shall not stockpile materials or equipment on any private property; except areas designated by the plans or as directed by the Engineer or Owner. If so required, the Engineer may direct the Contractor to have Contractor's equipment removed from any project during weekend hours.

F. All work of refilling sunken ditches, repaving over trenches and keeping streets and sidewalks in passable condition shall be done to the satisfaction of the owner during the construction of the above work as well as during the maintenance period. If any work is not done within five (5) days after written notice is given by the Engineer, the work may be done by the Owner and charged to the Contractor.

G. Special care shall be taken to prevent contamination, siltation, or interfering in any way with the stream flows or ponds along the line of work. No waste matter of any kind will be allowed to discharge into the stream flows or impounded water or any ponds or other bodies of water.

H. The Contractor is hereby advised that Public Law 1975, Chapter 251, as amended by P.L. 1979, Chapter 459 is applicable to this project.

I. It is the intent of the current standards for Soil Erosion and Sediment Control to ensure that proper measures for erosion control are employed and provide for the early establishment of vegetation that will help avoid erosion problems during and after construction. It is expected that the Contractor will anticipate possible problems and provide timely and adequate control to prevent or minimize adverse effect.

J. The Contractor shall apply and pay for all permits that may be required for any of the work involved with this project. Municipalities or Authorities having an interest or jurisdiction on this project are: **South Jersey Port Corp, City of Camden, and Camden County.**

L. All notes on plans shall be made a part of the specifications.

M. Contractor shall notify Engineer at least forty-eight (48) hours in advance of any work on Saturdays. There will be no work permitted on Sundays or holidays. This project will receive inspections and the normal working hours for the Inspector are from 8:00 AM to 4:30 PM, Monday through Friday. Any overtime inspection costs which are avoidable will be reimbursed by the Contractor.

O. Contractor shall take extreme care in the placement of the asphaltic tack coat so as to not make it visible on the concrete curb. It shall be the Contractor's responsibility to keep the concrete curb clean of this oil.

1.2 PUBLIC UTILITIES

A. The bidder is advised to ascertain all the facts concerning the location of existing utilities.

B. The Contractor shall cooperate with the utility owners in the adjustment of their facilities and shall notify the utility owners not less then ten (10) days in advance of the time Contractor proposes to perform any work that will endanger or affect their facilities.

C. The Contractor shall permit the owners of utilities, or their agent's access to the work site at all times in order to relocate, construct or protect their lines, and Contractor shall cooperate with them in performing this work.

D. Separate payments will not be made for the coordination and cooperation of the Contractor with the utility companies, nor for the protection or replacement of utilities as specified hereinbefore and the bidder shall include all such costs in the prices bid for the various scheduled items in the Bid Form.

1.3 PRE-CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall, at no extra cost, take DVD or digital photographs of the site prior to the commencement of construction. The DVD or photograph record shall accurately depict the existing preconstruction condition of all curbs, sidewalks, driveways, fences, lawns, landscaped areas, mailboxes, street furniture and all other appurtenances within, or outside a 25 foot radius of the limits of the construction of the project. One (1) copy of the CD photograph record or DVD shall be provided to the Engineer. The date of all disks, as well as identification as to the location which the records depict, must be provided.

1.4 REFERENCE TO THE STANDARD SPECIFICATIONS

A. Portions of the work performed under this contract shall comply with the requirements of the State of New Jersey Department of Transportation Standard Specifications for Road and Bridge Construction 2019, and all requirements modified, as amended or supplemented and whose specifications are made part of these specifications. The New Jersey Department of Transportation Standard Construction Details shall govern except insofar as same are modified, amended or changed in detail drawings prepared specifically for this project.

B. The Standard Specifications are made part of these specifications by this reference as if they were set forth in full. It is the responsibility of the prospective bidder to be familiar with these Standard Specifications.

1.5 DUST CONTROL

The Contractor will be required to maintain all excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, borrow areas, and all other work areas within or outside the project boundaries free from dust which would cause a hazard or nuisance to others. Approved temporary methods of stabilization consisting of sprinkling, chemical treatment, light bituminous treatment or similar methods will be permitted to control dust. Sprinkling, to be approved, must always be repeated at such intervals as to keep all parts of the disturbed area at least damp, and the Contractor must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs. If any dust control is not done within twenty-four (24) hours after written notice is given by the Engineer, the work may be done by the Owner and charged to the Contractor. Costs for dust control shall be included in the prices bid for the various items in the bid form.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for General Requirements. Include all such costs in the unit price bid for which it is a part.

END OF SECTION 010000

SECTION 012900

PAYMENT PROCEDURES

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 necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Engineer at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Owner's name.
c. Owner's Project number.
d. Name of Engineer.
e. Engineer's Project number.
f. Contractor's name and address.
g. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

    a. Related Specification Section or division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
11. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

12. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Engineer and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit Application for Payment to Engineer by the first of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Engineer.

D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.

b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire Owner's insurance.

J. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Payment Procedures. Include all such costs in the unit price bid for which it is a part.

END OF SECTION 012900

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 Summary: This section specifies requirements for handling submittals.

1.02 General Procedures: Coordinate submittal preparation with performance of construction activities, and with purchasing or fabrication, delivery, other submittals and related activities. Transmit in advance of performance of related activities to avoid delays.

1.03 Coordinate transmittal of different submittals for related elements so processing will not be delayed for coordination with other submittals. The Engineer reserves the right to withhold action on a submittal requiring coordination until related submittals are received.

1.04 Processing: Allow two weeks for review. Allow more time if processing must be delayed for coordination with other submittals. The Engineer will advise the Contractor when a submittal must be delayed for coordination. Allow two weeks for reprocessing each submittal.

1.05 No extension of time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to Permit processing.

1.1 SECTION INCLUDES

A. Definitions.

B. Submittal procedures.

C. Construction progress schedules.

D. Proposed product list.

E. Product data.

F. Shop Drawings.

G. Samples.

H. Other submittals.

I. Design data.

J. Test reports.

K. Certificates.

L. Manufacturer's instructions.

M. Manufacturer's field reports.

N. Erection Drawings.

O. Construction photographs.

P. Contractor review.

Q. Architect/Engineer review.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Architect/Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

A. Submittal Preparation: Place a label or title block on each submittal for identification. Provide a 4" x 5" space on the label or beside the title block on shop drawings to record Contractor's review and approval markings and action taken. Include the following information on the label for processing and recording action taken:
1. Project Name
2. Date
3. Name and address of Engineer
4. Name and address of Subcontractor
5. Name and address of Supplier
6. Name of Manufacturer
7. Bid Item Number

B. Transmit each submittal with Engineer-accepted form.

C. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

D. Identify: Project, Contractor, Subcontractor and supplier, pertinent Drawing and detail number, and Specification Section number appropriate to submittal.

E. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.

F. Schedule submittals to expedite Project, and deliver to Engineer at business address:
Remington & Vernick Engineers
Attn: Project Engineer

2059 Springdale Road
Cherry Hill, NJ 08034

G. Submit electronic submittals via email as PDF electronic files. Coordinate submission of related items.

H. For each submittal for review, allow 7 days excluding delivery time to and from Contractor.

I. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

J. Allow space on submittals for Contractor and Architect/Engineer review stamps.

K. When revised for resubmission, identify changes made since previous submission.

L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

M. Submittals not requested will not be recognized nor processed.

N. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Architect/Engineer.

1.4 PROPOSED PRODUCT LIST

A. Within 10 days after the date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

A. Product Data: Action Submittal: Submit to Architect/Engineer for review for assessing conformance with information given and design concept expressed in Contract Documents.

B. Submit number of copies Contractor requires, plus two (2) copies Architect/Engineer will retain.

C. Submit electronic submittals via email as PDF electronic files.

D. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

E. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.6 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer responsible for designing components shown on Shop Drawings.

1. Include signed and sealed calculations to support design.
2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit electronic submittals via email as PDF electronic files.

1.7 SAMPLES

A. Samples: Action Submittal: Submit to Architect/Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:

1. Submit to Engineer for aesthetic, color, and finish selection.
2. Submit Samples of finishes, textures, and patterns for Engineer selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; Engineer will retain one Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

1.8 OTHER SUBMITTALS

A. Informational Submittal: Submit data for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

1.9 TEST REPORTS

A. Informational Submittal: Submit reports for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

A. Informational Submittal: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Architect/Engineer.

1.11 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit manufacturer's installation instructions for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Engineer in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit report within 5 days of observation to Engineer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

1.13 ERECTION DRAWINGS

A. Informational Submittal: Submit Drawings for Architect/Engineer's knowledge as Contract administrator or for Owner.

B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Architect/Engineer or Owner.

1.14 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of Site and construction throughout progress of Work produced by photographer acceptable to Architect/Engineer.

B. Each month submit photographs with Application for Payment.

C. Photographs: One print; color, glossy; 8 x 10-inch size; mounted on 8-1/2 x 11-inch soft card stock, with left edge binding margin for three-hole punch.

D. Identify each print on the back. Identify name of Project, Contract number phase orientation of view, date and time of view, name and address of photographer, and photographer's numbered identification of exposure.

E. Digital Images: Deliver complete set of digital image electronic files on CD-ROM to Owner with Project record documents. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as sensor, uncropped.

1. Digital Images: Uncompressed TIFF format, produced by digital camera with minimum sensor size of 4.0 megapixels, and image resolution of not less than 1024 by 768 pixels.
2. Date and Time: Include date and time in filename for each image.

1.15 CONTRACTOR REVIEW

A. Review for compliance with Contract Documents and approve submittals before transmitting to Architect/Engineer.

B. Contractor: Responsible for:

1. Determination and verification of materials including manufacturer's catalog numbers.
2. Determination and verification of field measurements and field construction criteria.
3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
4. Determination of accuracy and completeness of dimensions and quantities.
5. Confirmation and coordination of dimensions and field conditions at Site.
6. Construction means, techniques, sequences, and procedures.
7. Safety precautions.
8. Coordination and performance of Work of all trades.

C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.

D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from Architect/Engineer.

1.16 ENGINEER REVIEW

A. Do not make "mass submittals" to Engineer. "Mass submittals" are defined as six or more submittals or items in one day or 15 or more submittals or items in one week. If "mass submittals" are received, Engineer's review time stated above will be extended as necessary to perform proper review. Architect/Engineer will review "mass submittals" based on priority determined by Engineer after consultation with Owner and Contractor.

B. Informational submittals and other similar data are for Engineer's information, do not require Architect/Engineer's responsive action, and will not be reviewed or returned with comment.

C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

D. Submittal approval does not authorize changes to Contract requirements unless accompanied by Change Order.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Submittal Procedures. Include all such costs in the unit price bid for which it is a part.

END OF SECTION 013300

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement
7. Aggregates.
8. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

b. Include limitations of use. Admixtures that do not comply with reference ASTM International requirements must be submitted with test data for approval.

9. Color pigments.
10. Fiber reinforcement.
11. Vapor retarders.
12. Floor and slab treatments.
13. Liquid floor treatments.

14. Curing materials.

    a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.

15. Joint fillers.
16. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.
11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
13. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
14. Intended placement method.
15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the Engineer.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates.
8. Admixtures:

a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

F. Preconstruction Test Reports: For each mix design.

G. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete, incorporating permeability-reducing admixtures.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality-Control Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.
f. Permeability.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I Type II,.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
7. Set-Accelerating 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 and complying with ASTM C494/C494M, Type C.

8. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 6 mils thick.

2.4 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

2.5 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.6 CURING MATERIALS

A. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ChemMasters, Inc.
    b. Concrete Sealers USA.
    c. Kaufman Products, Inc.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

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

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
4. Use permeability-reducing admixture in concrete mixtures where indicated.

D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum w/cm: .48
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content:

a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

B. Class B: Normal-weight concrete used for foundation walls.
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum w/cm: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content:

a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Class C: Normal-weight concrete used for interior slabs-on-ground.
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum w/cm: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content:

a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 TOLERANCES

A. Comply with ACI 117.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Details.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.5 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.

2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.6 INSTALLATION OF CAST-IN-PLACE CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Engineer.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    b. Remove projections larger than 1 inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/4 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class B.

e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish.

3. ACI 301 Surface Finish SF-3.0:

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
b. Remove projections larger than 1/8 inch.
c. Patch tie holes.
d. Surface Tolerance: ACI 117 Class A.
e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:

a. Perform no later than one day after form removal.
b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
d. Maintain required patterns or variances as shown on Drawings.

2. Grout-Cleaned Rubbed Finish:

a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
b. Do not clean concrete surfaces as Work progresses.
c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
d. Wet concrete surfaces.
e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
f. Maintain required patterns or variances as shown on Drawings.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.
        2) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
        3) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.
        4) Specified overall values of flatness, F_F 45; and of levelness, F_L 35; with minimum local values of flatness, F_F 30; and of levelness, F_L 24.
        5) Specified overall values of flatness, F_F 50; and of levelness, F_L 25; with minimum local values of flatness, F_F 40; and of levelness, F_L 17.

    b. Suspended Slabs:

1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
2) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
3) Specified overall values of flatness, F_F 35; and of levelness, F_L 20; with minimum local values of flatness, F_F 24; and of levelness, F_L 15.
4) Specified overall values of flatness, F_F 45; and of levelness, F_L 35; with minimum local values of flatness, F_F 30; and of levelness, F_L 24.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings and/or where ceramic or quarry tile is to be installed by either thickset or thin set method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Engineer before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Engineer before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps as indicated on Drawings

1. Apply in accordance with manufacturer's written instructions and as follows:

a. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications.
b. Tamp aggregate flush with surface, but do not force below surface.
c. After broadcasting and tamping, apply float finish.
d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces in accordance with manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating.
3. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
4. After final floating, apply a trowel finish.
5. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.11 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.

        3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.

2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

g. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.13 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
3. Rinse with water; remove excess material until surface is dry.
4. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
   1. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

   1. Repair and patch defective areas when approved by Engineer.
   2. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

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

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

      a. Limit cut depth to 3/4 inch.
      b. Make edges of cuts perpendicular to concrete surface.
      c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
      d. Fill and compact with patching mortar before bonding agent has dried.
      e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

      a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
      b. Compact mortar in place and strike off slightly higher than surrounding surface.

   3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.

c. Place patching mortar before bonding agent has dried.
d. Compact patching mortar and finish to match adjacent concrete.
e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article. The scheduling and costs for all testing shall be the responsibility of the contractor.
1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency to immediately report to Engineer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Engineer, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

b. Cast, initial cure, and field cure two sets of three standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39/C39M.

   a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
   c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.

       1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Engineer.

3.17 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.

3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

Payment will be made for the quantity as above determined measured in square yards, at the unit price bid per square yard in the proposal for " 6" CONCRETE" at the thickness indicated, which price shall include hauling, saw cutting, excavation, placement, compaction, disposal of unstable/undesirable material and all else necessary therefore and all other work in connection therewith or incidental thereto.

END OF SECTION 033000

SECTION 036000

GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Portland cement grout.
2. Rapid-curing epoxy grout.
3. Nonshrink cementitious grout.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components.

C. Grout:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes preparation of substrate and grout, placement, consolidation, troweling, and curing.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete for Buildings.
2. ACI 301M - Specifications for Structural Concrete (Metric).
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 318M - Metric Building Code Requirements for Structural Concrete.

B. ASTM International:

1. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
2. ASTM C40/C40M - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
3. ASTM C150/C150M - Standard Specification for Portland Cement.
4. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
5. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
6. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

7. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
8. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

C. U. S. Army Corps of Engineers Concrete Research Division (CRD):

1. CRD-C621 - Non-Shrink Grout.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and nonshrink grouts.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

E. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.4 QUALITY ASSURANCE

A. Perform Work according to NJDOT standards.

B. Perform Work according to Camden County Standards.

C. Perform Work according to City of Camden Standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT GROUT

A. Portland Cement: Comply with ASTM C150/C150M, Type I and II.

B. Water:

1. Potable.
2. No impurities, suspended particles, algae, or dissolved natural salts in quantities capable of causing:

    a. Corrosion of steel.
    b. Volume change increasing shrinkage cracking.
    c. Efflorescence.
    d. Excess air entraining.

C. Fine Aggregate:

1. Washed natural sand.
2. Gradation:

    a. Comply with ASTM C33/C33M.
    b. Represented by smooth granulometric curve within required limits.

3. Free from injurious amounts of organic impurities according to ASTM C40/C40M.

D. Mix:

1. Portland cement, sand, and water.
2. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 RAPID-CURING EPOXY GROUT

A. Manufacturers:

1. Laticrete International, Inc.
2. Sika Corporation.
3. W.R. Meadows, Inc.

B. Description:

1. High-strength, three-component epoxy grout formulated with thermosetting resins and inert fillers.
2. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids, and alkalis.

C. Performance and Design Criteria:

1. Compressive Strength:

a. 3,000 psi at seven days.
b. Comply with ASTM C579.

2. Minimum Tensile Strength:

a. 2,000 psi
b. Comply with ASTM C307.

3. Coefficient of Expansion:

a. 30x10-6 inch per degree F
b. Comply with ASTM C531.

4. Shrinkage:

a. None.
b. Comply with ASTM C827/C827M.

2.3 NONSHRINK CEMENTITIOUS GROUT

A. Manufacturers:

1. CGM, Incorporated.
2. Euclid Chemical Company (The); an RPM company.
3. Laticrete International, Inc.
4. QUIKRETE.
5. Sika Corporation.

B. Description:

1. Pre-mixed and ready-for-use formulation requiring only addition of water.
2. Nonshrink, non-corrosive, nonmetallic, non-gas forming, and no chlorides.

C. Performance and Design Criteria:

1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to CRD-C621 for Type D nonshrink grout:

a. Setting Time:

1) Initial: Approximately two hours.
2) Final: Approximately three hours.
3) Comply with ASTM C191.

b. Maximum Expansion: 0.10 to 0.40 percent.
c. Compressive Strength:

1) One-Day: 3,000 psi
2) Seven-Day: 3,500 psi
3) Comply with CRD-C621.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify areas to receive grout.

3.2 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by brushing, hammering, chipping, or other similar means until sound and clean concrete surface is achieved.

B. Roughen concrete lightly, but not to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level, and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water, and then remove excess water.

3.3 INSTALLATION

A. Formwork:

1. Construct leakproof forms anchored and shored to withstand grout pressures.
2. Install formwork with clearances to permit proper placement of grout.

B. Mixing:

1. Portland Cement Grout:

a. Use proportions of two parts sand and one part cement, measured by volume.
b. Prepare grout with water to obtain consistency to permit placing and packing.
c. Mix water and grout in two steps:

1) Premix using approximately 2/3 of water.
2) After partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing two to three minutes.

d. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
e. Do not add additional water after grout has been mixed.

2. Rapid-Curing Epoxy Grout:

a. Mix and prepare according to manufacturer instructions.
b. Minimum Compressive Strength: **2,400** psi in 48 hours and **7,000** psi in 28 days.

3. Nonshrink Cementitious Grout:

a. Mix and prepare according to manufacturer instructions.
b. Minimum Compressive Strength: **2,400** psi in 48 hours and **7,000** psi in 28 days.

4. Mix grout components in proximity to Work area and transport mixture quickly and in manner not permitting segregation of materials.

C. Placing of Grout:

1. Place grout material quickly and continuously.
2. Do not use pneumatic-pressure or dry-packing methods.
3. Apply grout from one side only to avoid entrapping air.
4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
5. Thoroughly compact final installation and eliminate air pockets.
6. Do not remove leveling shims for at least 48 hours after grout has been placed.

D. Curing:

1. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or by using wet burlap method.
2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
3. After grout has attained its initial set, keep damp for minimum three days.

3.4 FIELD QUALITY CONTROL

A. Inspection

1. Submit proposed mix design to Engineer of Record for review prior to commencement of Work.
2. Tests of grout components may be performed to ensure compliance with specified requirements.

Part 4 – UNIT PRICE - MEASUREMENT AND PAYMENT

No separate payment will be made for Grouting. Include all such costs in the unit price bid for which it is a part.

END OF SECTION 036000

SECTION 310513

SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil.
2. Topsoil.

B. Related Requirements:

1. Section 310516 "Aggregates for Earthwork" for coarse and fine aggregate materials.
2. Section 312316 "Excavation and Backfill" for excavating and backfilling as required for building foundations and utilities within building perimeter.
3. Section 312323 "Trenching, Backfilling and Compaction" for trenching, backfilling and compaction as required to bring excavations back to grade.
4. Section 312500 "Erosion and Sedimentation Controls" for slope protection and erosion control.

1.2 SUBMITTALS

A. Product Data:

1. Subsoil.
2. Topsoil.

B. Samples: Submit, in airtight containers, 10-lb. sample of each type of fill to testing laboratory.

C. Source Quality-Control Reports: For subsoil and topsoil materials.

1.3 SUSTAINABLE DESIGN SUBMITTALS

A. Product Certificates: For the source and origin for salvaged and reused subsoil and topsoil materials.

B. Product Certificates: For the source for regional subsoil and topsoil materials and distance from Project Site.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey Department of Transportation standards.
2. Camden County Engineering standards.

2.2 SUBSOIL

A. Type S1: Comply with New Jersey Department of Transportation standard.

B. Type S2 Ordinary Borrow:

1. Ordinary borrow consists of well-graded mineral soil substantially free of organic materials, loam, wood, trash, and other objectionable material which may be compressible or which cannot be compacted properly.
2. Ordinary borrow consist of a material satisfactory to the Authority and not specified as gravel borrow, sand borrow, special borrow material, or other particular kind of borrow.
3. This material conforms to the physical characteristics of soils designated as group A-1, A-2-4, or A-3 under AASHTO M 145.
4. Must be readily spread and compacted for the formation of foundations, embankments, and other subgrade improvements.
5. Liquid Limit: A-1 and A-3 = none or not measured, A-2-4 = 40 max.
6. Plasticity Index: A-1 = 6 max, A-3 = Non-Plastic (NP), A-2-4 = 10 max.

C. Type S2-a Special Borrow:

1. Special borrow consists of one or all of the following:

a. A native in-situ soil that is classified under AASHTO M 145 as A-3, or that portion of A-1 and A-2 with less than 12 percent passing the No. 200 sieve as determined by AASHTO T 311.
b. A crushed rock, either obtained from ledge excavation on the Project or other approved sources, that meets the following requirements:

1) Percent of Wear LA Abrasion Test: 50 percent.
2) Maximum Plasticity Index: 6 percent.

c. Percent Passing According to Sieve Size:

1)	3 Inches (75 mm):	100.
2)	2 Inches (50 mm):	90 to 100.
3)	No. 4 (4.75 mm):	100 to 60.
4)	No. 200 (75 micro m):	0 to 12.

D. Type S2-b Pipe Bedding Material and Drainage Layer:

1. Bedding and drainage material under loam and around utilities is comprised of natural mineral sand within the following gradation limits:

    a. Percent Passing According to Sieve Size:

        1) 1/2 Inch (12 mm): 100.
        2) 3/8 Inch (10 mm): 100 to 85.
        3) No. 4 (4.75 mm): 100 to 60.
        4) No. 16 (1.18 mm): 80 to 35.
        5) No. 50 (300 micro m): 55 to 10.
        6) No. 200 (75 micro m): 10 to 2.

E. Type S2-c Granular Fill:

1. Granular fill consists of sandy gravel or gravely sand, free of organic material, loam, snow, ice, frozen soil, and other objectionable materials, well-graded within the following limits:

    a. Percent Passing According to Sieve Size:

        1) 4 Inches (100 mm): 100.
        2) 1/2 Inch (12 mm): 85 to 50.
        3) No. 4 (4.75 mm): 75 to 40.
        4) No. 100 (150 micro m): 30 to 5.
        5) No. 200 (75 micro m): 20 to 0.

F. Type S2-d Structural Fill:

1. Structural fill consists of processed fill material that is hard durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Gradation requirements as determined by AASHTO T11 and T27 conforms to the following gradation requirements:

    a. Percent Passing According to Sieve Size:

        1) 3 Inches (75 mm): 100.
        2) 1/2 Inch (12 mm): 50 to 85.
        3) No. 4 (4.75 mm): 40 to 75.
        4) No. 50 (300 micro m): 8 to 28.
        5) No. 200 (75 micro m): 0 to 8.

G. Type S2-e Reclaimed Pavement Borrow Material:

1. Reclaimed pavement borrow material consists of crushed asphalt pavement or crushed cement concrete, and gravel borrow.
2. Provide material free of loam, clay, and deleterious materials such as brick, reinforcing steel, wood, paper, plaster, lathing, and building rubble.
3. Provide coarse aggregate with a percentage of wear not greater than 50 percent as measured by the Los Angeles Abrasion Test.
4. Determine gradation requirements in accordance with AASHTO T 311, except the material cannot be oven dried. Dry material by air drying, fan drying at low speed, or

other low temperature heat so as not to liquefy the asphalt or cause the asphalt to adhere to the sieves. Water used for the No. 200 sieve analysis must be cold tap water.

5. The gradation requirements for reclaimed pavement borrow are as follows:

    a. Percent Passing According to Sieve Size:

        1) 3 Inches (75 mm): 100.
        2) 1-1/2 Inches (37.5 mm): 70 to 100.
        3) 3/4 Inch (19 mm): 50 to 85.
        4) No. 4 (4.75 mm): 30 to 60.
        5) No. 50 (300 micro m): 8 to-24.
        6) No. 200 (75 micro m): 0 to 10.

6. The liquid limit for the portion of materials passing the No. 40 sieve cannot be greater than 25 and the plasticity index not greater than 6.
7. Compact the reclaimed pavement borrow to a minimum of 95 percent of AASHTO T 180 proctor density.
8. Determine liquid limits by AASHTO T 90.
9. Process reclaimed pavement borrow material by mechanical means and blended to form a homogeneous material. Provide equipment for producing crushed material of adequate size and having sufficient adjustments to produce the desired materials. Blended materials that are stockpiled for more than three months will require rework to provide a uniform material and must be retested prior to use; however, the Engineer may require additional testing any time the materials appear excessively hard, wet, or segregated.
10. Provide reclaimed pavement borrow material from Engineer and Owner approved sources and stockpiles.
11. The amount of combined crushed asphalt pavement and crushed cement concrete should not exceed 50 percent by volume as determined by visual inspection, or by laboratory tests required by the Engineer.

H. Type S2-f Lightweight Aggregate Fill (LWAF):

1. LWAF is a rotary kiln expanded shale aggregate manufactured by Solite Corporation of Saugerties, NY, or Norlite Corporation of Chores, NY, or an approved equivalent. No byproduct slags, coal derived by-product aggregates (cinders, bottom ash, fly ash), or pumice, scoria, or tuff are permitted. The aggregate shall meet the requirements of ASTM C330 and consist of tough, durable, non-corrosive particles with the following gradation:

    a. Percent Passing According to Sieve Size:

        1) 1 Inch (25 mm): 100.
        2) 3/4 Inch (19 mm): 90 to 100.
        3) 3/8 Inch (10 mm): 10 to 50.
        4) No. 4 (4.75 mm): 0 to 15.
        5) No. 8 (2.36 mm): 0 to 5.

2. The maximum soundness loss when tested in accordance with ASTM C88 with five (5) cycles of magnesium sulphate may not exceed 10 percent.
3. The maximum Los Angeles abrasion loss when tested in accordance with ASTM C131 (B-Grading) will be 50 percent.

4. The maximum chloride content when tested in accordance with the AASHTO T260 (acid solution) will be 100 ppm.
5. The maximum compacted moist density can not exceed 60 pcf when tested in accordance with ASTM D698 (one point test at typical moisture content when shipped to site).
6. The specific gravity when tested in accordance with ASTM C127 will be no less than 1.4.
7. The angle of internal friction will be no less than 40 degrees when tested in accordance with AASHTO T236.

2.3 TOPSOIL

A. Type S3: Comply with New Jersey Department of Transportation standard.

B. Type S4:

1. Excavated and reused.
2. Graded and single screened.
3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
4. Comply with ASTM D2487 Group Symbol OH.

C. Type S5 Imported Base Loam:

1. Imported base loam is comprised of a naturally occurring soil from geological soil forming processes, without admixtures of sand or organic matter sources (composts). Provide imported base loam as required for blending with sand and compost.
2. Imported base loam that has been contaminated by incorporation of subsoil is not acceptable for use.
3. Imported base loam for the Work is required to be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots, or other objectionable, extraneous matter or debris. Imported base loam composition is required to be free of quack-grass rhizomes, Agropyron repens, and the nut-like tubers of nutgrass, Cyperus esculentus, and other primary noxious weeds.
4. Do not deliver imported base loam for use or planting while in a frozen or muddy condition. Provide imported base loam for mixing which conforms to the following grain size distribution for material passing the No. 10 sieve:

    a. Percent Passing According to Sieve Size:

        1) No. 10 (2.2 mm): 100.
        2) No. 18 (1.0 mm): 85 to 100.
        3) No. 35 (500 micro m): 70 to 95.
        4) No. 60 (250 micro m): 50 to 85.
        5) No. 140 (106 micro m): 36 to 53.
        6) No. 270 (53 micro m): 32 to 42.
        7) 0.00008 inch (0.002 mm): 3 to 6.

5. The organic content must be between 4.0 and 8.0 percent by weight.
6. pH must be between 5.8 and 7.0.
7. Undertake chemical analysis for phosphorus, potassium, calcium magnesium, aluminum, iron, manganese, lead, cation exchange capacity, soluble salts, acidity (pH) and buffer pH.

2.4 SOURCE QUALITY CONTROL

A. Testing and Analysis:
   1. Subsoil Material: Comply with AASHTO T 180; ASTM D698; ASTM D1557; ASTM D6938.
   2. Topsoil Material: Comply with AASHTO T 180; ASTM D698; ASTM D1557; ASTM D6938.
   3. If tests indicate materials do not meet specified requirements, change material and retest.

B. Owner Inspection:

   1. Make topsoil available for inspection at source prior to packaging for shipment.
   2. Notify Owner at least seven (7) days before inspection is allowed.

C. Owner Witnessing:

   1. Allow witnessing of source testing at supplier's test facility.
   2. Notify Owner at least seven (7) days before tests are scheduled.

D. Certificate of Compliance:

   1. If supplier is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at source conforms to Contract Documents.
   2. Specified source tests are not required for Work performed by approved supplier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance.

3.2 INSTALLATION OF SUBSOIL AND TOPSOIL

A. Excavation:

   1. Excavate topsoil from designated areas.
   2. Strip topsoil to full depth of topsoil in designated areas.
   3. Remove excess excavated materials and topsoil not intended for reuse from Site at a minimum of every 30 days.
   4. Remove excavated materials not meeting requirements for topsoil materials from Site.

B. Stockpiling:

   1. Stockpile excavated material meeting requirements for topsoil materials.
   2. Stockpile materials on Site at locations as designated by SJPC.
   3. Stockpile in sufficient quantities to meet Project schedule and requirements.

4. Separate differing materials with dividers or stockpile apart to prevent intermixing of soil types or contamination.
5. Stockpile topsoil maximum 6 feet high.
6. Direct surface water away from stockpile to prevent erosion or deterioration of materials.
7. Stockpile unsuitable and hazardous materials on impervious material and cover to prevent erosion and leaching until they are disposed. Disposal shall be completed at a minimum of every 30 days.

3.3 CLEANING

A. Stockpile:

1. Remove stockpile and leave area in clean and neat condition.

a. Grade Site surface to prevent freestanding surface water.

2. Leave unused materials in neat, compact stockpile.

PART 4 - MEASUREMENT, QUANITITY AND PAYMENT

4.01 QUANTITY

A. Unless otherwise directed, no specific payment will be made for soils.

B. The quantity for which payment will be made (if directed) for the volume of material actually placed, only where directed by the Engineer measured in cubic yards compacted in place. Placement of Backfill without Engineer approval shall be done at the expense of the Contractor and at no cost to the Owner.

4.02 PAYMENT

Payment will be made for the quantity as above determined, measured in cubic yards compacted in place and as directed by the Engineer, for the item “SELECT BACKFILL, IF & WHERE DIRECTED” .

END OF SECTION 310513

SECTION 310516

AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate.
2. Fine aggregate.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork" for granular fill, topsoil, and grading materials.
2. Section 312316 "Excavation" for excavating as required for building foundations and utilities within building perimeter.
3. Section 312323 "Fill" for backfilling as required at building perimeter and Site structures to subgrade elevations.
4. Section 312500 "Erosion and Sedimentation Controls" for slope protection and erosion control.

1.2 SUBMITTALS

A. Product Data:

1. Fine aggregate.
2. Coarse aggregate.
3. Submit name of imported materials source.

B. Source Quality-Control Reports: For fine- and coarse-aggregate materials.

1.3 QUALITY ASSURANCE

A. Furnish each coarse and fine aggregate material from a single source throughout Work.

B. Perform Work according to the Department of Transportation standards in which the work is being performed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State Department of Transportation standards.

2.2 COARSE AGGREGATE

A. Type A1: Comply with DOT standard.

B. Type A2 Gravel Borrow:

1. Gravel borrow consists of processed inert fill material that is hard durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Graduation requirements are determined by AASHTO T11 and T27 and conform to the following gradation:

a. Percent Passing According to Sieve Size:

1) 2 Inches
2) 1/2 Inch
3) No. 4
4) No. 50
5) No. 200
6) Liquid Limit: Not greater than 25
7) Plasticity Index: According to ASTM D4318.

C. Type A3 Crushed Stone:

1. Crushed stone consists of one of the following materials:

a. Durable crushed rock consisting of angular fragments obtained by breaking and crushing solid or shattered natural rock, and free from a detrimental quantity of thin, flat, elongated, or other objectionable pieces. A detrimental quantity will be considered as any amount in excess of 15 percent of the total weight.

1) Thin stones are considered to be such stones whose average width exceeds four times their average thickness. Elongated stones are such stones whose average length exceeds four times their average width.

b. Durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone with a minimum diameter before crushing of 8 inches.

2. Provide crushed stone reasonably free from clay, loam, or deleterious material with not more than 1.0 percent of satisfactory material passing a No. 200 sieve allowed to adhere to the crushed stone. Where crushed stone is to be used for surfacing, this requirement shall be not more than 0.5 percent of satisfactory material passing a No. 200 sieve.

a. Percent Passing According to Sieve Size:

1) 1-1/2 Inches
2) 1-1/4 Inches
3) 3/4 Inch (19 mm)

4) 1/2 Inch (12 mm)

D. Type A3a Dense Graded Crushed Stone for Sub-base:

1. Graded crushed stone for sub-base material combines crusher-run coarse aggregates of crushed stone and fine aggregates uniformly premixed with a predetermined quantity of water. Coarse aggregate consists of hard, durable particles of fragments of stone. Materials that break up when alternately frozen and thawed or wetted and dried are not acceptable. Provide coarse aggregate with a percentage of wear, by the Los Angeles Abrasion Test, of not more than 45. Fine aggregate consists of natural or crushed sand. Provide the composite material free from clay, loam, or other plastic material, which conforms to the following gradation requirements:

a. Percent Passing According to Sieve Size:

1) 2 Inches
2) 1-1/2 Inches
3) 3/4 Inch
4) No. 4
5) No. 50
6) No. 200

E. Type A4 Pea Gravel:

1. Stone: Natural and washed.
2. Quality: Free of clay, shale, and organic matter.
3. Grading:

a. Comply with ASTM C136/C136M ASTM D2487; Group Symbol GM ASTM D2487; Group Symbol GC ASTM D2487; Group Symbol
b. Minimum Size: 1/4 inch
c. Maximum Size: 5/8 inch

2.3 FINE AGGREGATE

A. Type A5: Comply with DOT standard.

B. Type A6 Natural River or Bank Sand, Washed:

1. Quality: Free of silt, clay, loam, friable or soluble materials, and organic matter.
2. Grading: Comply with ASTM C136/C136M ASTM D2487; Group Symbol SW ASTM D2487; Group Symbol SP ASTM D2487; Group Symbol SM ASTM D2487; Group Symbol SC ASTM D2487; Group Symbol.
3. Percent Passing According to Sieve Size:

a. No. 4
b. No. 14
c. No. 50
d. No. 100
e. No. 200

f. Complete following paragraph to accurately specify required fill characteristics.

C. Type A7 Blended Aggregate:

1. Produce blended aggregate by intermixing two or more fine or coarse aggregates to produce an aggregate combination with improved grading or other properties.
2. Percent Passing According to Sieve Size:

a. 3/8 Inch
b. 1/4 Inch
c. No. 4
d. No. 10
e. No. 20
f. No. 40
g. No. 80
h. No. 200

2.4 SOURCE QUALITY CONTROL

A. Testing and Analysis:

1. Coarse-Aggregate Material: Comply with AASHTO T 180; ASTM C136/C136M ASTM; D698; ASTM D1557; ASTM D4318; ASTM D6938.
2. Fine-Aggregate Material: Perform according to AASHTO T 180; ASTM C136/C136M; ASTM D698; ASTM D1557; ASTM D4318; ASTM D6938.
3. If tests indicate materials do not meet specified requirements, change material and retest.

B. Certificate of Compliance:

1. If supplier is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at source conforms to Contract Documents.
2. Specified source tests are not required for Work performed by approved supplier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

3.2 INSTALLATION OF COARSE AGGREGATE AND FINE AGGREGATE

A. Excavation:

1. Excavate aggregate materials from Site locations as required or as directed by the engineer.

2. Remove excess excavated coarse-aggregate and fine-aggregate materials not intended for reuse from Site.
3. Remove excavated materials not meeting requirements for coarse aggregate and fine aggregate from Site.

B. Stockpiling:

1. Stockpile materials on Site at locations as approved by the engineer.
2. Stockpile excavated material meeting requirements for coarse-aggregate and fine-aggregate materials.
3. Stockpile in sufficient quantities to meet Project schedule and requirements.
4. Separate different aggregate materials with dividers or stockpile apart to prevent intermixing of aggregate types or contamination.
5. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
6. Stockpile unsuitable, hazardous materials as required by the authority having jurisdiction until the material is tested and accepted by the end user.
7. Remove unsuitable materials at a minimum of every 30 days.

3.3 CLEANING

A. Stockpile:

1. Remove stockpile and leave area in clean and neat condition.

    a. Grade Site surface to prevent freestanding surface water.

2. Leave unused materials in neat, compact stockpile.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

The cost for “TRENCH STABILIZATION, IF & WHERE DIRECTED” shall be paid on a lump sum basis included in the bid items “Trench Stabilization”, as outlined in the proposal. Price shall include the cost of excavation, hauling, handling and all labor and equipment and all else necessary therefore, and all other work in connection therewith and incidental thereto.

END OF SECTION 310516

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

Site Clearing consists of clearing of the site within the limits of construction to include the following:

1. Removal and disposal of trees and brush, weeds, roots, and similar materials.

2. Removal, Reset or disposal of structures and all other obstructions which are designated for removal by the Engineer during construction and for which payment is not otherwise provided in the Contract.

1.2 SUMMARY

A. Section Includes:

1. Removing surface debris.
2. Removing or pruning trees, shrubs, and other plant life.
3. Removing abandoned utilities.
4. Excavating topsoil.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with standards of the state in which the work is being performed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Herbicide: Approved by authority having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing plant life designated to remain is tagged or identified.

B. Identify waste area and or salvage area for placing removed materials.

3.2 PREPARATION

A. Call Local Utility Line Information service at not less than three (3) working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

3.3 PROTECTION

A. Locate, identify, and protect from damage utilities indicated to remain.

B. Protect benchmarks, survey control points, and existing structures from damage or displacement.

3.4 CLEARING

A. Clear areas required for access to site and execution of Work to minimum depth of six (6) inches.

B. Remove trees and shrubs within marked areas or as indicated on the drawings. Remove stumps, main root ball, surface rock.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Partially remove paving, curbs, and, as indicated on Drawings. Neatly saw cut edges at right angle to surface.

C. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.

D. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

E. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

A. Excavate topsoil from marked areas, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material, until disposal.

D. Do not remove topsoil from Site.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Site Clearing. Include all such costs in the unit price bid for which it is a part.

END OF SECTION 311000

SECTION 312316

EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall excavate existing material from the site(s) to the required lines, grades and slopes as shown on the Contract Drawings and as described herein. All excavated materials including clay, silt, organic soils, decomposed shale, rocks, sludge, and man-made fills shall be removed and disposed of off-site. All backfill shall be imported Dense Graded Aggregate (DGA) material as noted under Section 2.01A.

B. All work performed and materials furnished shall conform to the lines, grades, cross-sections, dimensions, details, gradation and physical requirements indicated on the Contract Drawings and as called for in the Specifications. The Engineer will be assisted in inspection of all work performed and materials furnished under this section by a qualified Soils Engineer, licensed in the State of New Jersey.

C. The Contractor during all phases of his work shall carefully protect all existing structure, pipelines, drains, conduits, or other improvements on the site, and shall restore same to a condition equivalent to conditions existing prior to his operations. Ample precautions shall be taken to prevent settlement of existing improvements.

D. All existing pipelines and services shall be maintained or, where required, shall be removed and replaced to accommodate the Work to be done under this Contract.

1.02 SUBMITTALS

A. The Contractor shall submit documentation from the manufacturer of the selected fill certifying that the suitable fill classification has been met.

B. The Contractor shall submit to the Engineer for approval a plan showing his proposed haul and access roads, stockpile and storage areas. This plan should concur with the access roads, stockpile and storage areas depicted on the Contract Drawings.

PART 2 - PRODUCTS

2.01 FILL MATERIALS CLASSIFICATION, PLACEMENT AND COMPACTION

A. Fill Classification:

1. DGA Backfill - Densely Graded Aggregate shall consist of broken stone, crushed gravel or blast furnace clay in accordance with NJDOT Section 901. This fill shall be imported from off-site and shall meet the following gradation requirement:

U.S. Sieve Size	**Percent Passing**
1½-inch	100
¾-inch	55 - 90
No. 4	25 - 60
No. 50	5 - 25
No. 200	3 - 12

2. Soil Aggregate - Soil Aggregate shall be a natural or prepared mixture consisting predominantly of hard durable particles or fragments of stone, slag, gravel, or sand, and containing some silt-clay or stone dust or remediated ID-27 petroleum contaminated soil aggregate (RPCSA) produced by a New Jersey Department of Environmental Protection (NJDEP) approved "Class B" recycling center operating pursuant to N.J.A.C. 7:26A. Soil aggregate shall be Mix I-2 in accordance with NJDOT 901.20.

U.S. Sieve Size	By Weight
2-inch	100
¾-inch	65 - 100
No. 4	40 - 75
No. 50	5 - 30
No. 200	0 - 7

PART 3 - EXECUTION

3.01 EXCAVATION, REMOVAL AND DISPOSAL OF MATERIALS

A. Material excavated from pipe trenches advanced through in-situ cohesive and miscellaneous fill layers shall be spoiled off-site unless approved by the Engineer for on-site filling operations. Hauling and dumping costs and the costs of disposal areas shall be borne by the Contractor and shall be paid under the appropriate lump sum or unit price bid item given in the Bid Form.

B. The use of coverings on trucks hauling materials in various municipalities may be required by local ordinances; however, the Contractor shall have no cause for additional claims due to such requirements. Truck wheels shall be cleaned prior to leaving the site so that no mud or other unsightly material is left on public roads. Hauling trucks shall be of a suitable type so as not to permit any soft liquid or watery material to drop onto private or public roadways.

C. The Contractor is advised that the disposal of excess excavated material in wetlands, vernal habitats, stream corridors, and flood plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him will be brought to the immediate attention of the responsible regulatory agencies with a request that appropriate action be taken against the offending parties. Further, the Contractor will be required to remove the fill and restore the impacted area.

D. Excess excavated material which is not considered to be solid waste pursuant to N.J.A.C. 7:26-1.6 shall be graded on-site only to the extent needed to achieve pre-construction grade, unless otherwise specifically approved by the NJDEP.

E. If the Contractor proposes to dispose of excavated materials on private property, a hold harmless release in favor of the Owner and NJDEP shall be obtained from the property owner.

F. The Contractor shall be aware that permitting agencies are concerned about the erosion by wind and water of excess excavated materials disposed of on private lands by sewer contractors. When obtaining releases from private land owners, the Contractor shall include a statement from the land owner that he has been apprised by the Contractor of this need for erosion control and accepts complete responsibility for its implementation.

G. All excavation shall be accomplished in such a manner which will not adversely affect otherwise acceptable underlying soil.

H. During the general excavation process the Contractor should take care to assure proper site drainage at all times in order that a minimum amount of upgrade disturbance occurs.

J. Only environmentally suitable stockpile sites may be used for the purposes of staging or storing materials, equipment and suitable trench backfill material. Environmentally suitable sites must be level and devoid of mature stands of natural vegetation. Drainage facilities and features, wetlands, vernal habitats, and stream corridors are not environmentally suitable sites.

K. Disposal sites selected by the Contractor shall be evaluated and approved by the Owner prior to their use. Disposal sites may also be selected by the Owner. The Owner shall conduct periodic inspection of disposal sites to ensure compliance with the requirements of this subsection during the off-site disposal operation.

L. The Contractor shall support all third-party utilities that he crosses during the course of his construction operations in accordance with the appropriate utility companies' rules and regulations.

3.02 ADDITIONAL EXCAVATION

A. If any over excavation is caused by the Contractor's error, or wherever the excavation is carried beyond or below the lines and grade given by the Engineer, the Contractor shall, at his own expense, refill all such excavated space with such material and in such manner as may be directed by the Engineer in order to insure the stability of the various structures. Beneath all structures, space excavated without authority shall be refilled at the direction of the Engineer with compacted DGA backfill by the Contractor at his own expense.

B. Whenever, in the opinion of the Engineer, and not shown on the Drawings, the undisturbed material found at the excavation grades shown is not satisfactory, the Contractor shall make additional excavations and backfills as directed by the Engineer, in writing, and payment will be made under Allowance for Spot Repair.

3.03 BACKFILL FOR STRUCTURES

A. All backfill material for the areas around and between structures and underneath paved areas, pipelines and utilities shall be DGA Fill as described in 2.01.

3.04 PLACEMENT AND COMPACTION OF FILLS

A. The subgrade shall be compacted by approved equipment and methods to develop to a depth of at least twelve (12") inches below ground surface at least 85% of maximum dry density as determined by the Engineer in conformance with ASTM Standard D1557-78. Any soft or weak spots detected during compaction operation or proof-rolling of subgrade must be removed and replaced with controlled fill as directed by the Engineer. The compaction shall be checked by the Engineer and lean concrete or fill shall not be placed until compaction of the existing subgrade is approved by the Engineer.

B. No backfill shall be placed until the excavation and subgrade has been approved by the Engineer and until backfill materials to be used are approved by the Engineer, and no backfill shall be placed on frozen or thawing ground. Fill shall be placed in uniform horizontal layers not more than twelve (12") inches in thickness and shall be compacted with a high energy self-propelled vibratory roller. Lift thickness may be adjusted in the field by the Engineer if the required soil density is not being achieved.

C. The backfill shall be compacted near optimum moisture content by means of vibratory compactors to not less than 95% of the maximum density determined in accordance with ASTM Standard D1557-78. The Engineer shall check the obtained in-place density of the compacted fill using the method of ASTM Standard D1556-82 for in-place density tests. Should the obtained density of the

compacted fill be less than specified, the Contractor shall recompact the area until the required maximum density is reached. Only hand held compaction equipment shall be used within four (4') feet of retaining type foundation walls and structures.

D. The moisture-density curve for the fill used shall be used as a guide in controlling moisture to achieve the required degree of compaction. If in the opinion of the Engineer fill material becomes too wet for the required compaction, the fill shall be dried by a method approved by the Engineer prior to commencing or continuing compaction operations. Likewise, if in the opinion of the Engineer the fill material becomes too dry for the required compaction, the fill shall be moistened by a method approved by the Engineer prior to commencing or continuing compaction operations.

E. The Contractor shall at all times maintain and operate proper and adequate surface and subsurface drainage in order to keep the construction site dry and in such condition that placement and compaction of fill may proceed unhindered by saturation of the area.

3.05 MAINTENANCE OF FILLS

A. All vehicles passing over the fill areas shall use diverse routes to insure uniform compaction of the fill.

B. Before shutdown of the work for any cause, and at the conclusion of the Work for the day, the fill shall be bladed to a grade which will insure drainage away from the unfinished surface of the fill.

C. Excess materials shall be stored as directed by the Engineer and following completion of the Work shall be removed from the Project Site(s).

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

A. Load Haul and Disposing of Existing Soil

Payment will be made for the quantity as above determined and measured in ton at the unit price per ton for "LOAD. HAUL AND DISPOSE OF CONTAMINATED SOIL OFF SITE (IF & WHERE DIRECTED)" and "LOAD, HAUL EXISTING SOIL (CLASSIFIED AS ID-27 OR ID-27A SOILS) (IF & WHERE DIRECTED)" which price shall include all other work in connection therewith or incidental thereto.

B. Soil Testing

Payment will be made for the quantity as above determined and measured per unit at the unit price per unit for "SOIL TESTING, IF & WHERE DIRECTED" which price shall include all other work in connection therewith or incidental thereto.

C. Removal and Disposal of Underground Existing Foundation

Payment will be made for the quantity as above determined and measured per cubic yard at the unit price per cubic yard for "REMOVAL AND DISPOSAL OF UNDERGROUND EXISTING CONCRETE FOUNDATIONS, IF & WHERE DIRECTED" which price shall include all excavation, materials, and other work in connection therewith or incidental thereto.

END OF SECTION

SECTION 312319

DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dewatering system.
2. Surface water control system.
3. Monitoring wells.
4. System operation and maintenance.
5. Water disposal.

B. Related Requirements:

1. Document 003100 - Available Project Information
2. Section 310516 - Aggregates for Earthwork
3. Section 312316 – Excavation and Backfill
4. Section 312500 - Erosion and Sedimentation Controls

1.2 DEFINITIONS

A. Dewatering:

1. Lowering of ground water table and intercepting horizontal water seepage to prevent ground water from entering excavations, trenches, tunnels, and shafts.
2. Reducing piezometric pressure within strata to prevent failure or heaving of excavations, trenches, tunnels, and shafts.
3. Disposing of removed water.

B. Piezometer: A tube inserted into a vessel or pipe to indicate the height (pressure) that a liquid can rise in the tube.

C. Pitometer: A measuring device that transforms a differential pressure into an electrical output current proportional to the flow rate.

D. Surface Water Control: The removal of surface water within open excavations.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

1.4 COORDINATION

A. Coordinate Work of this Section to permit following construction operations to be completed on dry and stable substrate:

1. Excavation for structures as specified in Section 312316 – Excavation and Backfill
2. Trenching for utilities as specified in Section 312323 – Trenching, Backfilling and Compaction

1.5 SEQUENCING

A. Sequence Work of this Section to obtain required permits before start of dewatering operations.

B. Sequence Work of this Section to install and test monitoring systems minimum seven days before testing and operating dewatering systems.

C. Sequence Work of this Section to install and test dewatering and surface water control systems minimum seven days before starting excavation, trenching, tunneling, and shaft drilling.

1.6 SUBMITTALS

A. Product Data:

1. Submit sizes, capacities, priming method, and motor characteristics for dewatering pumps.
2. Submit pumping equipment for control of surface water within excavation.

B. Shop Drawings:

1. Indicate dewatering system layout, well depths, well screen lengths, dewatering pump locations, pipe sizes and capacities, grades, filter sand gradations, surface water control devices, valves, and water disposal method and location.
2. Indicate primary and standby power system location and capacity.
3. Indicate layout and depth of monitoring wells, piezometers, and flow measuring devices for system performance measurement.
4. Include detailed description of dewatering and monitoring system installation procedures and maintenance of equipment.
5. Include description of emergency procedures to follow when problems arise.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Delegated Design Submittals:

1. Submit signed and sealed Shop Drawings.
2. Indicate design values, analyses, assumptions, and calculations to support design.
3. Include description and profile of geology, soil, and ground water conditions.
4. Submit signed and sealed survey of existing adjacent buildings, structures, and improvements for position and elevation of principal elements before and after completion of dewatering operations.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, and testing and monitoring reports.

F. Reports:

1. Initial Installation Report:

a. Installation and development reports for well points and pumps.
b. Installation and baseline reports for monitoring of wells and piezometers.
c. Test reports of well water analysis.
d. Initial dewatering flow rates.

2. Weekly Monitoring Reports:

a. Dewatering flow rates.
b. Piezometer readings.
c. Test reports of discharge water analysis.
d. Maintenance records for dewatering and surface water control systems.

G. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and depths of capped wells and piping abandoned in place.

1.8 QUALITY ASSURANCE

A. Comply with authorities having jurisdiction for following:

1. Drilling and abandoning of wells used for dewatering systems.
2. Water discharge and disposal from pumping operations.

B. Obtain permit from EPA under National Pollutant Discharge Elimination System (NPDES) for stormwater discharge from Site.

C. Maintain 2 copies of each standard affecting Work of this Section on Site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

C. Licensed Professionals:

1. Engineer experienced in design of specified Work and licensed.
2. Surveyor experienced in specified Work and licensed.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Furnish dewatering and surface water control systems to permit Work to be completed on dry and stable subgrade.

B. Provide monitoring equipment to obtain meaningful observations of conditions affecting excavation, adjacent structures.

C. Standby Equipment:

1. Store at Site and ready for immediate use upon failure of dewatering equipment.
2. Dewatering Centrifugal Pumps: One for every two installed pumps.
3. Dewatering Turbine Pumps: One for every five installed pumps.
4. Pump Power Units: One for every two installed pumps.
5. Dewatering Jet Eductor Pressure Pumps: One for every two installed pumps.
6. Portable Electric Generators: One for every two installed pumps.
7. Commercial Electric Power: 100 percent standby electric generating equipment.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Design:

1. Lower water table within areas of excavation to minimum 2 feet below bottom of excavation to permit Work to be completed on dry and stable subgrade.
2. Prevent damage to adjacent properties, buildings, structures, utilities, and other facilities from construction operations.
3. Prevent loss of fines, quick condition, or softening of foundation subgrade.
4. Maintain stability of sides and bottoms of excavations and trenches.
5. Surface Water Control System: Collect and remove surface water and seepage entering excavation.

2.3 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.

B. Provide dewatering plan for approval to Engineer at least 1 week prior to start of construction.

2.4 MONITORING EQUIPMENT

A. Flow Measurement Devices:

1. Pitometer installed to measure flow from entire dewatering system.

2.5 ACCESSORIES

A. Filter Sand: Fine aggregate Type **A5** as specified in Section 310516 - Aggregates for Earthwork.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Conduct additional borings and investigations to supplement subsurface investigations identified in Document 003100 - Available Project Information, as required to complete dewatering system design.

B. Utility Service Locator:

1. Call local utility service-line information at 811 not less than 5 working days before performing Work.
2. Request that underground utilities be located and marked within and immediately surrounding Site.
3. Identify required lines, levels, contours, and data.

C. Private Utility Service Locator:

1. Call local utility service-line locator not less than 10 working days before performing Work.
2. Request that private underground utilities be located and marked within and immediately surrounding Site.
3. Identify required lines, levels, contours, and data.
4. Coordinate with Owner and Engineer for Owner knowledge of buried private utilities.

3.2 PREPARATION

A. Protect existing adjacent buildings, structures, and improvements from damage that may be caused by dewatering operations.

3.3 DEWATERING SYSTEM

A. Install dewatering system according to approved Shop Drawings.

B. Locate system components to allow continuous dewatering operations without interfering with installation of permanent Work and existing public rights-of-way, sidewalks, and adjacent buildings, structures, and improvements.

C. Installation Standards: Install Work according to all regulatory standards.

3.4 SURFACE WATER CONTROL SYSTEM

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area, as specified in Section 312500 - Erosion and Sedimentation Controls

B. Divert surface water and seepage water within excavation areas into sumps and pump water into drainage channels, according to requirements of authorities having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

3.5 SYSTEM OPERATION AND MAINTENANCE

A. Operate dewatering system continuously until backfilling is complete.

B. Provide 24-hour supervision of dewatering system by personnel skilled in operation, maintenance, and replacement of system components.

C. Monitoring:

1. Conduct daily observation of dewatering system and monitoring system.
2. Make required repairs and perform scheduled maintenance.

D. Fill fuel tanks before tanks drop to 25 percent capacity.

E. Start emergency generators at least twice each week to check operating condition.

F. System Failure:

1. If dewatering system cannot control water within excavation, notify Engineer and stop excavation Work.
2. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
3. Demonstrate that dewatering system operation complies with performance requirements before resuming excavation operations.

G. Modify dewatering and surface water control systems if operation causes or threatens to cause damage to new construction, existing Site improvements, adjacent property, or adjacent water wells.

H. Correct unanticipated pressure conditions affecting dewatering system performance.

I. Do not discontinue dewatering operations without approval of Engineer.

3.6 WATER DISPOSAL

A. Discharge treated water into storm sewer system or drainage channels.

3.7 SYSTEM REMOVAL

A. Remove dewatering and surface water control systems after dewatering operations are discontinued.

B. Repair damage caused by dewatering and surface water control systems or resulting from failure of systems to protect property.

3.8 FIELD QUALITY CONTROL

A. Testing:

1. After dewatering system is installed, perform pumping test to determine at what point selected pumping rate lowers water level below pump intake.
2. Adjust pump speed, discharge volume, or both to ensure proper operation of each pump.

B. Monitoring and Recording:

1. Contaminates:

a. Monitor ground water discharge for contamination while performing pumping.
b. Sample and test water weekly for contaminates.

2. Existing Adjacent Buildings, Structures, and Improvements:

a. Survey weekly during dewatering to detect movement in comparison to original elevations.
b. Notify Engineer immediately of measured movement.

3.9 PROTECTION

A. Protect dewatering equipment from damage by construction operations.

PART 4- MEASUREMENT, QUANTITY & PAYMENT

Payment will be made for the quantity as above determined per lump sum in the proposal for "DEWATERING" which price shall include all other work in connection therewith or incidental thereto.

END OF SECTION 312319

SECTION 312323

TRENCHING, BACKFILLING AND COMPACTING

PART 1 -GENERAL

1.01 SUMMARY

A. This Section includes excavation and backfill as required for pipe installation or other construction in the trench, and removal and disposal of water, in accordance with the applicable provisions of the Section entitled "Earthwork" unless modified herein.

PART 2 - PRODUCTS

A. FILL MATERIALS – Suitable fill material free from deleterious or organic material or select fill as defined in Trenton Water Works Developers Packet or approved by Engineer. Select fill shall be used in accordance with the Contract Documents and/or when directed by the Engineer or Owner.

PART 3 - EXECUTION

3.01 EXCAVATION

A. The trench excavations shall be located as shown on the Contract Drawings or as specified. Under ordinary conditions, excavation shall be by open cut from the ground surface. Where the depth of trench and soil conditions permit, tunneling may be required beneath cross walks, curbs, gutters, pavements, trees, driveways, railroad tracks and other surface structures. No additional compensation will be allowed for such tunneling over the price bid for open cut excavation of equivalent depths below the ground surface unless such tunnel excavation is specifically provided for in the Contract Documents.

B. Trenches shall be excavated to maintain the depths as shown on the Contract Drawings or as specified for the type of pipe to be installed.

C. The alignment and depth shall be determined and maintained by the use of a string line installed on batter boards above the trench, a double string line installed along side of the trench or a laser beam system.

D. The minimum width of trench excavation shall be 6 inches on each side of the pipe hub for 21-inch diameter pipe and smaller and 12 inches on each side of the pipe hub for 24-inch diameter pipe and larger.

1. Or as depicted on the Contract Drawings.

E. Trenches shall not be opened for more than 300 feet in advance of pipe installation nor left unfilled for more than 100 feet in the rear of the installed pipe when work is in progress without the consent of the Engineer. Open trenches shall be protected and barricaded as required.

F. Bridging across open trenches shall be constructed and maintained where required.

G. All trenches shall be backfilled and base paved at the end of each work day.

3.02 SUBGRADE PREPARATION FOR PIPE

A. Where pipe is to be laid on undisturbed bottom of excavated trench, mechanical excavation shall not extend lower than the finished subgrade elevation at any point.

B. Where pipe is to be laid on special granular material the excavation below subgrade shall be to the depth specified or directed. The excavation below subgrade shall be refilled with special granular material as specified or directed, shall be deposited in layers not to exceed 6 inches and shall be thoroughly compacted prior to the preparation of pipe subgrade.

C. The subgrade shall be prepared by shaping with hand tools to the contour of the pipe barrel to allow for uniform and continuous bearing and support on solid undisturbed ground or embedment for the entire length of the pipe.

D. Pipe subgrade preparation shall be performed immediately prior to installing the pipe in the trench. Where bell holes are required they shall be made after the subgrade preparation is complete and shall be only of sufficient length to prevent any part of the bell from becoming in contact with the trench bottom and allowing space for joint assembly.

3.03 STORAGE OF MATERIALS

A. Traffic shall be maintained at all times in accordance with the applicable Highway Permits. Where no Highway Permit is required at least one-half of the street must be kept open for traffic.

B. Where conditions do not permit storage of materials adjacent to the trench, the material excavated from a length as may be required, shall be removed by the Contractor, at his cost and expense, as soon as excavated. The material subsequently excavated shall be used to refill the trench where the pipe had been built, provided it be of suitable character. The unsuitable and/or excess material shall be removed to locations selected and obtained by the Contractor.

1. The Contractor shall, at his cost and expense, bring back adequate amounts of satisfactory excavated materials as may be required to properly refill the trenches.

C. Due to the quality of the existing material as determined during the geotechnical borings, the Contractor is notified that imported select fill will be required for trench bedding, backfill and restoration.

3.04 REMOVAL OF WATER AND DRAINAGE

A. The Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the trench, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work.

B. The removal of water shall be in accordance with the Section entitled "Earthwork".

3.05 PIPE EMBEDMENT

A. All pipe shall be protected from lateral displacement and possible damage resulting from superimposed backfill loads, impact or unbalanced loading during backfilling operations by being adequately embedded in suitable pipe embedment material. To ensure adequate lateral and vertical stability of the installed pipe during pipe jointing and embedment operations, a sufficient amount of the pipe embedment material to hold the pipe in rigid alignment shall be uniformly deposited and thoroughly compacted on each side, and back of the bell, of each pipe as laid.

B. Concrete cradle and encasement of the class specified shall be installed where and as shown on the Contract Drawings or ordered by the Engineer. Before any concrete is placed, the pipe shall be securely blocked and braced to prevent movement or flotation. The concrete cradle or encasement shall extend the full width of the trench as excavated unless otherwise authorized by the Engineer. Where concrete is to be placed in a sheeted trench it shall be poured directly against sheeting to be left in place or against a bond-breaker if the sheeting is to be removed.

C. Embedment materials placed above the centerline of the pipe or above the concrete cradle to a depth of 12 inches above the top of the pipe barrel shall be deposited in such manner as to not damage the pipe. Compaction shall be as required for the type of embedment being installed.

3.06 BACKFILL ABOVE EMBEDMENT

A. The remaining portion of the pipe trench above the embedment shall be refilled with suitable materials compacted as specified.

1. Where trenches are within the ditch-to-ditch limits of any street or road or within a driveway or sidewalk, or shall be under a structure, the trench shall be refilled in horizontal layers not more than 6 inches in thickness, and compacted to obtain 95% maximum density, and determined as set forth in the Section entitled "Earthwork".

2. Hand tamping shall be required around buried utility lines or other subsurface features that could be damaged by mechanical compaction equipment.

B. Backfilling of trenches beneath, across or adjacent to drainage ditches and water courses shall be done in such a manner that water will not accumulate in unfilled or partially filled trenches and the backfill shall be protected from surface erosion by adequate means.

1. Where trenches cross waterways, the backfill surface exposed on the bottom and slopes thereof shall be protected by means of stone or concrete rip-rap or pavement.

D. All settlement of the backfill shall be refilled and compacted as it occurs.

E. Temporary pavement shall be placed as specified in the Section entitled "Restoration of Surfaces".

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Trenching, Backfilling & Compacting. Include all such costs in the unit price bid for which it is a part.

END OF SECTION

SECTION 312323.33

FLOWABLE FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flowable fill.
2. Lightweight cellular concrete fill (LCCF).
3. Mixes.

1.2 DEFINITIONS

A. Excavatable Flowable Fill: A type of lean cement concrete fill used where future excavation may be required, such as utility trenches, bridge abutments, and culverts.

B. Lightweight Cellular Concrete Fill (LCCF): A type of concrete made with hydraulic cement, water, and preformed foam to form a hardened material having an oven-dry density of 50 lb./cu. ft. or less. These mixtures may include fine aggregate and other material components, such as fly ash and chemical admixtures.

C. Non-excavatable Flowable Fill: A type of lean cement concrete fill used where future excavation is not anticipated, such as below structure foundations and filling abandoned utilities.

D. Utility: A buried pipe, duct, conduit, manhole, tank, or cable.

1.3 UNIT PRICES

A. Flowable Fill:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes furnishing flowable fill and installing where required.

B. LCCF:

1. Basis of Measurement: By cubic yard.
2. Basis of Payment: Includes furnishing LCCF and installing where required.

1.4 SUBMITTALS

A. Product Data: For flowable fill, LCCF, and mixes.

B. Shop Drawings:

1. Include placement methods, volumes, and stages; methods of verifying placement; and batching.
2. Include formwork arrangement, location of gauges to monitor pressures, and methods to determine density in the field.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Submit manufacturer's specifications, catalog cuts, and other engineering data needed to demonstrate compliance with specified requirements.

1. Submit mix designs, test reports, and complete descriptions of equipment, methods, and schedules of placement, showing compliance with specified properties. Include source, brand, and type of cement, foaming agents, and admixtures.
2. List and describe all equipment to be used for batching, mixing, and installing flowable fill.
3. Submit site plan, at scale, showing location of mixing plant and alignment of pump lines, if used to place flowable fill.
4. Submit manufacturer's literature and specifications for compression testing machine package to determine strength of flowable fill.
5. Submit test report for proposed flowable fill mix design, verifying that mix design conforms to specified flowable fill properties.
6. Furnish certification by foaming agent manufacturer that proposed material, equipment, application procedures, installers, and setup are acceptable before production is initiated.
7. Submit procedures to place flowable fill below standing water and during extremes in temperatures.
8. Submit as-built drawing showing spot elevations and one-foot contours of excavated subgrade and bottom of flowable fill.
9. Submit daily field reports and all test results of flowable fill.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. Product Certificates:

1. For the source and origin for salvaged and reused portland cement, foaming agent, admixtures, and aggregate materials.
2. For the source for regional fine- and coarse-aggregate materials, portland cement, foaming agent, admixtures, and distance from Project Site.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this Section with three years' experience.

B. Installers Qualifications: Company specializing in performing Work of this Section with three years' experience and approved by manufacturer.

C. Licensed Professionals Qualifications: Professional engineer experienced in design of specified Work and licensed in State of New Jersey.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey Department of Transportation standards.
2. Camden County standards.

2.2 FLOWABLE FILL

A. Provide excavatable type consisting of the following material and admixture components:

1. Portland Cement: ASTM C150/C150M Type I - Normal; Type II - Moderate.
2. Fine Aggregates: Inert natural sand conforming to the requirements of ASTM C33/C33M and AASHTO M 6.
3. Water: Potable and free from deleterious amounts of alkali, acid, and organic materials that would adversely affect setting time or strength of LCCF.
4. Admixtures:

a. Manufacturers:

1) BASF.
2) Euclid Chemical Company.
3) GCP Applied Technologies.
4) Sika Corporation.
5) W.R. Meadows.

b. Air Entrainment: ASTM C260/C260M and AASHTO M 154.
c. Chemical Admixture: ASTM C494/C494M and AASHTO M 194.
d. Fly Ash: According to ASTM C618 Class C or F and AASHTO M 295 and obtained from residue of electric generating plant using ground or powdered coal.
e. Plasticizers: Provide high-range water reducing admixtures for flowable fill utilizing polycarboxylate technology.

2.3 LIGHTWEIGHT CELLULAR CONCRETE FILL (LCCF)

A. LCCF is a mixture of portland cement and water slurry, combined with preformed foam to create air voids.

1. Foaming Agent:

a. Provide foaming agent conforming to ASTM C869/C869M when tested according to ASTM C796.
b. Manufacturers:

1) BASF.
2) Cell-Crete Corporation.
3) GeoFill Cellular Concrete.

4) Innospec.
5) MixOnSite Cellular Concrete.

2.4 MIXES

A. Mix and deliver flowable fill according to ASTM C94/C94M, Option C.

B. Flowable Fill Design Mix:

1. Cement Content:

a. Excavatable: 40 to 100 lb./cu. yd.
b. Non-excavatable: 100 to 200 lb./cu. yd.

2. Fine Aggregate:

a. Excavatable: None.
b. Non-excavatable: 2,500 to 3,500 lb./cu. yd.

3. Fly Ash Content:

a. Excavatable: 0 to 600 lb./cu. yd.
b. Non-excavatable: 250 to 600 lb./cu. yd.

4. Water Content:

a. Excavatable: As required.
b. Non-excavatable: As required.

5. Air Entrainment:

a. Excavatable: 5 to 35 percent.
b. Non-excavatable: 5 to 15 percent.

6. 28-Day Compressive Strength:

a. Excavatable: Maximum 100 psi.
b. Non-excavatable: Minimum 125 psi.

7. Unit Mass (Wet):

a. Excavatable: 36 to 70 pcf.
b. Non-excavatable: 100 to 125 pcf.

8. Temperature, Minimum, at Point of Delivery:

a. Excavatable: 50 degrees F.
b. Non-excavatable: 50 degrees F.

C. LCCF Mix Designs: Provide an LCCF mix that meets the following requirements:

1. Maximum cast density of 24 to 30 pcf, minimum compressive strength at 28 days of 40 psi, bearing capacity of 2.9 tons/sq. ft.
2. Maximum cast density of 30 to 36 pcf, minimum compressive strength at 28 days of 80 psi, bearing capacity of 5.8 tons/sq. ft.
3. Maximum cast density of 36 to 42 pcf, minimum compressive strength at 28 days of 120 psi, bearing capacity of 8.6 tons/sq. ft.
4. Maximum cast density of 42 to 50 pcf, minimum compressive strength at 28 days of 160 psi, bearing capacity of 11.5 tons/sq. ft.

D. Provide adequate water content in design mix to produce self-leveling, flowable fill material at time of placement.

2.5 SOURCE QUALITY CONTROL

A. Testing: Test and analyze properties of flowable fill design mix and certify results for the following:

1. Design mix proportions by weight of each material.
2. Aggregate: ASTM C33/C33M for material properties and gradation.
3. Properties of plastic flowable fill design mix.
4. Properties of hardened flowable fill design mix.

B. Prepare delivery tickets containing the following information:

1. Project designation.
2. Date.
3. Time.
4. Class and quantity of flowable fill.
5. Actual batch proportions.
6. Free moisture content of aggregate.
7. Quantity of water withheld.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

B. Verify excavation specified in Section 312316 "Excavation and Backfill" is complete.

C. Verify utility installation as specified in Section is complete and tested before placing flowable fill.

D. Verify excavation is dry and dewatering system is operating.

3.2 PREPARATION

A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION OF FILL, BEDDING, AND BACKFILL

A. Remove all debris and foreign matter from the excavation before depositing flowable fill.

B. Place flowable fill by chute, pumping or other methods approved by Architect/Engineer.

1. When required, place flowable fill under water using tremie procedure.
2. Do not place flowable fill through flowing water.

C. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

D. Place flowable fill to elevations indicated without vibration or other means of compaction.

3.4 INSTALLATION OF FILL FOR ABANDONED UTILITIES

A. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.

B. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.

C. Place flowable fill using the following methods to ensure there are no voids:

1. Fill pipes and conduits from high end.
2. Fill manholes, tanks, and other structures from grade level access points.

D. After filling pipes and conduits, seal both ends.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform inspection and testing according to ASTM C94/C94M.

1. Take samples for tests for every 150 cu. yd. of flowable fill, or fraction thereof, installed each day.
2. Perform in-place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill according to ASTM C403/C403M.

C. Perform in-place density tests using nuclear test device according to ASTM C1040/C1040M.

1. Perform tests at locations as directed by Architect/Engineer.

D. Defective Flowable Fill or LCCF: Either fill type failing to meet the following test requirements or fill delivered without the following documentation:

1. Test Requirements:

a. Minimum temperature at point of delivery.
b. Compressive strength requirements for each type of fill.

2. Documentation: Duplicate delivery tickets.

3.6 CLEANING

A. Remove spilled and excess flowable fill from Project Site.

B. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

A. Flowable Fill

Payment will be made for the quantity as above determined measured in cubic yard, at the unit price bid per CY in the proposal for "FLOWABLE FILL, IF & WHERE DIRECTED" at the footage installed, which price shall include delivery, placement and all else necessary therefore and all other work in connection therewith or incidental thereto.

END OF SECTION 312323.33

SECTION 312500

EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

DESCRIPTION

A. This work shall consist of temporary control measures ordered by the Engineer during the life of the contract and as shown on plans, to control erosion and sediment through use of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses and other erosion control devices or methods.

B. The primary objective of this specification is to control soil erosion to the maximum extent practicable commensurate with reasonable and economical construction practices.

C. The temporary control provisions contained herein shall be coordinated with the permanent erosion control features (grass, pavement, and other restorations) specified elsewhere in the contract to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post-construction period.

D. The erosion control measures described herein shall be continued until the construction is complete and final restorations installed.

E. Wherever construction exposes work, which is subject to erosion, the extent of such exposure in advance of the subsequent construction shall be subject to the approval of the Engineer. Erosion control features or other work to be completed within such areas shall follow as soon after exposure as practicable.

F. All materials and methods of construction shall be in accordance with the State Standards for Soil Erosion and Sediment Control in which the project is located within.

1.1 SUMMARY

A. Section Includes:

1. Diversion channels.
2. Rock energy dissipator.
3. Paved energy dissipator.
4. Rock basin.
5. Rock barriers.
6. Sediment ponds.
7. Sediment traps.

B. Related Sections:

1. Section 310513 - Soils for Earthwork.
2. Section 310516 - Aggregates for Earthwork.

3. Section 311000 - Site Clearing.
4. Section 312316 - Excavation.
5. Section 312323 - Fill.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

B. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.

C. ASTM International:

1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. Precast/Prestressed Concrete Institute:

1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Product Data: Submit data on joint filler, joint sealer, admixtures, and curing compounds geotextile.

C. Submit proposed mix design of each class of concrete for review prior to commencement of Work.

D. Test Reports: Indicate certified tests results for precast concrete at manufacturing facility, cast-in-place concrete in field, and granular backfill.

1.4 PREINSTALLATION MEETINGS

A. Preconstruction Conference

Prior to the start of the applicable construction, the Contractor shall submit for acceptance his schedules for accomplishment of temporary and permanent erosion control work, as are applicable for excavation work, and any other elements of the project which may contribute to ground erosion of siltation. No work shall be started until the erosion control schedules and methods of operations have been accepted by the Engineer.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not place grout when air temperature is below freezing.

B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 ROCK AND GEOTEXTILE MATERIALS

A. Furnish materials according to standards of the Department of Transportation in which the project site is located within.

B. Rock: type; broken stone (irregular shaped rock); solid and nonfriable; six (6) or nine (9) in size.

2.2 SOURCE QUALITY CONTROL (AND TESTS)

A. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.

B. Test samples in accordance with ACI 301.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade and/or granular base and/or stabilized soil is acceptable and ready to support devices and imposed loads.

B. Verify gradients and elevations of base or foundation for other Work are correct.

3.2 DIVERSION CHANNELS

A. Windrow excavated material on low side of channel.

B. Compact to 95 percent maximum density.

A. Install Work according to Furnish materials according to standards of the Department of Transportation in which the project site is located within.

3.3 SEDIMENTATION POND

A. Clear and grub storage area and embankment foundation area site as specified in Section 311000 – Site Clearing.

B. Excavate key trench for full length of dam. Excavate emergency spillway in natural ground.

C. Install pipe spillway, with anti-seep collar attached, at location indicated.

D. Place forms, and reinforcing for concrete footing at bottom of riser pipe with trash rack and anti-vortex device, as specified in Section 031000. Construction of embankment and trench prior to placing pipe is not required.

E. Do not use coarse aggregate as backfill material around pipe. Backfill pipe with suitable embankment material to prevent dam leakage along pipe.

F. Construct rock basin at outlet end of pipe, as specified in this Section. Place embankment material, as specified in Section 312323. When required, obtain borrow excavation for formation of embankment, as specified in Section 312323.

G. Furnish materials according to standards of the Department of Transportation in which the project site is located within.

3.4 SEDIMENT TRAPS

A. Clear site, as specified in Section 311000.

B. Construct trap by excavating and forming embankments as specified in Section 312316, and Section 312323.

C. Place coarse aggregate or rock at outlet as indicated on Drawings.

D. Place geotextile fabric, as specified for rock energy dissipator.

E. When required, obtain borrow excavation for formation of embankment, as specified in Section 312316.

F. Furnish materials according to standards of the Department of Transportation in which the project site is located within.

3.5 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.

D. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.6 FIELD QUALITY CONTROL

A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

B. Compaction Testing: As specified in Section 312323.

C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.7 CLEANING

A. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.

B. Do not damage structure or device during cleaning operations.

C. Do not permit sediment to erode into construction or site areas or natural waterways.

D. Clean channels when depth of sediment reaches approximately one-half channel depth.

3.8 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Protect paving from elements, flowing water, or other disturbance until curing is completed.

3.9 RESPONSIBILITIES:

The Contractor will be responsible for maintaining all soil erosion and sediment control measures in an acceptable manner. All temporary measures shall be removed by the Contractor as directed by the Engineer.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

4.01 QUANTITY AND PAYMENT

Payment will be made for the quantity as determined above will be measured as lump sum, at the unit price bid per lump sum (LS) in the proposal for "SOIL EROSION AND SEDIMENT CONTROL".

END OF SECTION 312500

SECTION 315000

EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes temporary excavation support and protection systems.

1.02 PERFORMANCE REQUIREMENTS

A. Where required by soil conditions and/or by depth and/or slope of proposed excavation, design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated. All designs should be performed, signed and sealed by a professional engineer licensed to practice in the State of New Jersey.

1.03 SUBMITTALS

A. Shop Drawings: For excavation support and protection system.

B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at project site.

1.05 PROJECT CONDITIONS

A. 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.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A36/A36M, ASTM A690/A690M, or ASTM A992/A992M.

C. Steel Sheet Piling: ASTM A328/A328M, ASTM A572/A572M, or ASTM A690/A690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

F. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Soldier Piles: Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

1. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

2. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

B. Sheet Piling: Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

C. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.

2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.02 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.

PART 4 MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for excavation and support. Include all such costs in the unit price bid for which it is a part.

END OF SECTION

SECTION 321123

AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aggregate materials.

B. Related Requirements:
   1. Section 312316 "Excavation and Backfill" for excavating and backfilling as required for building foundations and utilities within building perimeter.
   2. Section 312323 "Trenching, Backfilling and Compaction" for trenching, backfilling and compaction as required to bring excavations back to grade.
   3. Section 321216 "Asphalt Paving" for finish asphalt courses.

1.2 SUBMITTALS

A. Product Data:

   1. Aggregate materials.
   2. Submit data for geotextile fabric and herbicide.

B. Samples: Submit, in airtight containers, 10-lb. sample of each type of aggregate fill to testing laboratory.

C. Materials Source: Submit name of aggregate materials suppliers.

1.3 SUSTAINABLE DESIGN SUBMITTALS

A. Product Certificates:

   1. For the source and origin for salvaged and reused products.
   2. For recycled material content for recycled content products.
   3. For the source for regional materials and distance from Project Site.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of New Jersey Department of Transportation standards.
2. Camden County Engineering standards.

2.2 AGGREGATE MATERIALS

A. Subbase Aggregate: ASTM D2940; graded type.

1. Percent Passing per Sieve Size:

a.	2 Inches (50 mm):	100.
b.	No. 4 (4.75 mm):	30 to 60.
c.	No. 200 (0.075 mm):	Zero to 12.

B. Base Aggregate: ASTM D2940; graded type.

1. Percent Passing per Sieve Size:

a.	2 Inches (50 mm):	100.
b.	1-1/2 Inches (37.5 mm):	95 to 100.
c.	3/4 Inch (19 mm):	70 to 92.
d.	3/8 Inch (9.5 mm):	50 to 70.
e.	No. 4 (4.75 mm):	35 to 55.
f.	No. 30 (0.600 mm):	12 to 25.
g.	No. 200 (0.075 mm):	Zero to 8.

2.3 ACCESSORIES

A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct.

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

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 INSTALLATION OF AGGREGATE MATERIALS

A. Install geotextile fabric over subgrade according to manufacturer's instructions.

1. Lap ends and edges minimum 6 inches (150 mm).
2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

B. Spread aggregate over prepared substrate to total compacted thickness as indicated on drawings

C. Place aggregate equal thickness layers to total compacted thickness as indicated on drawings

D. Place aggregate

1. Maximum Layer Compacted Thickness: 6 inches
2. Minimum Layer Compacted Thickness: 4 inches

E. Roller compact aggregate to density scheduled in this Section.

F. Level and contour surfaces to elevations, profiles, and gradients indicated.

G. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.

H. Maintain optimum moisture content of fill materials to attain specified compaction density.

I. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch measured with 10 foot straight edge.

B. Maximum Variation from Thickness: 1/4 inch.

C. Maximum Variation from Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Compaction testing will be performed according to ASTM D1556.

B. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

C. Frequency of Tests: One test for every 1,000 sq. yd. compacted aggregate.

3.6 COMPACTION

A. Compact materials to 98 percent of maximum density as determined from test strip, according to ASTM D2940.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

A. Dense Graded Aggregate

Payment will be made for the quantity as above determined measured in cubic yard, at the unit price bid per SY in the proposal for "DENSE GRADED AGGREGATE BASE COURSE, 6' THICK" at the footage installed, which price shall include delivery, placement and all else necessary therefore and all other work in connection therewith or incidental thereto.

END OF SECTION 321123

SECTION 321216

ASPHALT 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.

B. Bituminous stabilized base course and surface course shall be constructed to the full depth and width and to the lines and grades shown on the drawings.

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt overlay.
3. Hot-mix asphalt patching.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference prior to contractor mobilizing to the project location. Engineer to coordinate with owner, contractor, other utilities, and funding agency (if applicable).

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 SUBMITTALS

A. Hot-Mix Asphalt Designs:

1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.
2. For each hot-mix asphalt design proposed for the Work.
   a. HMA Base Course
   b. HMA Surface Course

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For paving-mix manufacturer and testing agency.

B. Material Certificates:

1. Aggregates.
2. Asphalt binder.
3. Asphalt cement.
4. Tack coat.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the Department of Transportation of which Project is located.

B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Department of Transportation of which Project is located for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
1. Tack Coat: Minimum surface temperature of 32 deg F.
2. Slurry Coat: Comply with weather limitations in ASTM D3910.
3. Asphalt Base Course and Binder Course: Minimum surface temperature of 32 deg F and rising at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: ASTM D6373 or AASHTO M 320 binder designation 19M64 Base Course.

B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material and ASTM D946/D946M for penetration-graded material.

C. Emulsified Asphalt Prime Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Sand: ASTM D1073 or AASHTO M 29, Grade No. 2 or No. 3.

C. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D6690, Type I, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

A. Surface Course Limit: Recycled content no more than 15 percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by the Department of Transportation in which the project is constructed in and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: 19M64
3. Binder Course: (If & Where Directed)
4. Surface Course: 12.5M64

C. Emulsified-Asphalt Slurry: ASTM D3910, Type 2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

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

3.2 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 SURFACE PREPARATION

A. Ensure that prepared subgrade is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Spread mix at a minimum temperature of 250 deg F.
3. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide or as indicated on the plans unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.6 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread hot-mix asphalt at a minimum temperature of 250 deg F.

1. Hot-Mix Asphalt: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 SURFACE TREATMENTS

A. Slurry Seals: Apply slurry coat in a uniform thickness in accordance with ASTM D3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage (if required) a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

Part 4 - MEASUREMENT, QUANTITY & PAYMENT

A. Base Course

Payment will be made for the quantity as above determined measured in tons, at the unit price bid per ton in the proposal for "HOT MIX ASPHALT, 19M64, BASE COURSE, 6” THICK" and “HOT MIX ASPHALT SURFACE COURSE, 12.5M64, 2" THICK” at the thickness indicated, which price shall include hauling, saw cutting, excavation, placement, compaction, disposal of unstable/undesirable material and all else necessary therefore and all other work in connection therewith or incidental thereto.

B. Tack Coat

Payment will be made for the quantity as above determined measured in gallons, at the unit price bid per gallon in the proposal for “TACK COAT” which price shall include all other work in connection therewith or incidental thereto.

END OF SECTION 321216

SECTION 330505

PIPELINE INSTALLATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes all metallic and non-metallic pipelines as shown on the Contract Drawings, complete with fittings and specials.

B. Certain features of pipes shall be as scheduled.

1.02 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:

1. American Society of Testing and Materials (ASTM)

2. American Water Works Association (AWWA)

1.03 SUBMITTALS

A. In addition to those submittals identified in the General and Supplementary Conditions, the following items shall be submitted:

1. Manufacturer’s certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this specification.

2. Layout drawings are required for pipelines to be installed within structures, showing the location including the support system, sleeves and appurtenances.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Pipe

1. Materials for the piping, joints and fittings shall be as specified in the Section for the type of pipe to be installed, shown in the pipe schedule or on the Contract Drawings.

a. Pipe and appurtenances shall comply with the applicable standards for its type of material.

b. New construction water main extensions, or the modification or repair of existing facilities, shall utilize pipe materials which comply with ANSI/NSF Standard 61, Drinking Water System Components.

B. Joints

1. Type of joints shall be as scheduled in the pipe schedule or as shown or noted on the Contract Drawings.

C. Inspection

1. Pipe and appurtenances shall be inspected by the Contractor in the presence of the Engineer on delivery and prior to installation for conformance with the standards and specifications.

a. Materials not conforming to the standards and specifications shall not be stored on site but removed at once and replaced with material conforming to the specifications.

2.02 ACCESSORIES

A. Flexible Couplings

1. Flexible couplings shall be provided where shown or scheduled and shall be in accordance with the Section entitled "Flexible Pipe Couplings".

B. Wall Castings and Sleeves

1. All pipelines passing through walls, floors or slabs of structures shall be installed in a wall casting or sleeve. The wall castings and sleeves shall be in accordance with applicable sections.

PART 3 EXECUTION

3.01 INSTALLATION - UNDERGROUND

A. General

1. Install pipelines, fittings, specials, and accessories in accordance with the configuration shown on the Contract Drawings.

2. Excavation and backfilling shall be in accordance with the applicable provisions of the Section 312323 "Trenching, Backfilling and Compacting".

3. Blocking will not be permitted under pipe, except where the pipe is to be laid with concrete cradle or encasement.

4. No pipe shall be laid upon a foundation in which frost exists; nor at any time when there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.

5. Temporary bulkheads shall be placed in all open ends of pipe whenever pipe laying is not actively in process. The bulkheads shall be designed to prevent the entrance of dirt, debris or water.

6. Precautions shall be taken to prevent the flotation of the pipe in the event of water entering the trench.

B. Location and Grade

1. Pipelines and appurtenances shall be located as shown on the Contract Drawings.

2. The alignment and grades shall be determined and maintained by a method acceptable to the Engineer.

C. Subgrade

The subgrade for pipelines shall be earth or special embedment as specified or directed and shall be prepared in accordance with the Section entitled "Trenching, Backfilling and Compacting", or as shown on the Contract Drawings.

D. Joints

1. Joints shall be assembled using gaskets, lubricants and solvents as furnished by the pipe manufacturer and in accordance with the manufacturer's recommendations.

E. Embedment

1. Embedment shall be deposited and compacted in accordance with the Section entitled "Trenching, Backfilling and Compacting", and the Section for the type of pipe being installed and shall be one of the embedments shown below unless otherwise specified or directed.

2. Type "A" Embedment

Pipe of: Ductile Iron

a. The embedment shall be suitable native material or ASTM Size No. 57 Select Fill placed from a depth 6-inches below the pipe to the crown of the pipe.

b. Embedment material shall be deposited and tamped in 6-inch layers to the centerline of the pipe.

c. Native material placed above the centerline of the pipe to a depth of 12 inches above the pipe shall be deposited in such manner as to not damage the pipe.

d. When the native material under c above is not acceptable, to the Engineer, Select Fill materials shall be used.

3. Type "B" Embedment (Not In Contract)

Pressure Pipe of: Fiberglass
Polyvinyl Chloride
Steel
Thermal Plastic

a. The embedment shall consist of No. 68 granular material, as defined in NJDOT Specifications Table 901-1, placed from a depth of 4 inches below the pipe to the centerline of the pipe.

1) Embedment material shall be deposited and hand-compacted in 6-inch maximum layers.

b. From the centerline to the top of the pipe the embedment shall be native material excavated from the trench, which is acceptable to the Engineer, containing no stones larger than 1-1/□ inches in size and shall be lightly compacted.

c. From the top of the pipe to one foot above the pipe, acceptable native material shall be deposited in such manner as to not damage the pipe.

d. When the native material under b or c above is not acceptable, to the Engineer, Select Fill materials shall be used.

F. Thrust Restraints

1. For pressure piping, all valves and fittings shall be mechanical joint and shall be restrained with the use of thrust blocks according to the details on the Contract Plans or with the use of Ebba Iron Series 1100 Mega-Lugs retainer glands (or approved equal), in combination with restrained joint push-on pipe such as Field Lok (or approved equal) for the maximum length of pipe before and after the fitting as indicated in the restraining length schedule provided on the Contract Plans.

a. Thrust restraints shall be installed at all changes in direction, changes in size, dead ends or other locations where shown.

b. Thrust restraints shall be in place, and when of concrete (Class B) shall have developed the required strength, prior to testing of the pipeline.

c. Tie rods and nuts for thrust restraints shall be of high tensile steel and shall have a minimum yield strength of 70,000 psi.

1) Tie rods and nuts installed underground shall be coated with two coats of coal tar pitch preservative coating after installation.

d. Restrained joints shall be installed as shown on the drawings or as specified.

G. Service Connections

1. Connections to in-service pressure pipelines shall be in accordance with the applicable provisions of the Section 330509 "Tapped Connections".

2. Service connections shall not be backfilled until a record has been made of the “as-built” location of each.

3.02 INSTALLATION - EXPOSED

A. Exposed pipelines shall be carefully erected and neatly arranged.

1. Pipelines shall run parallel to the nearest wall of structures.

B. Supports and anchors shall be adequate to support the pipe filled with water with a minimum safety factor of 5 and for the test pressure specified.

C. Special supports shall be as specified in the Section for the type of pipe being installed.

3.03 FIELD TESTING

A. Perform leakage tests in accordance with the applicable provisions of the Section 330506 “Leakage Tests”, at the test pressure specified or scheduled.

3.04 CUTTING AND SPECIAL HANDLING

A. Field cuts of pipes shall be in accordance with the manufacturer's instructions.

B. Where a pipe requires special handling or installation it shall be in accordance with the Section for that type of pipe.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Pipeline Installation. Include all such costs in the unit price bid for which it is a part.

END OF SECTION

SECTION 330506

LEAKAGE TESTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes leakage tests of all hydraulic structures, pressure and nonpressure piping for leakage as specified.

1. The Contractor shall furnish all labor, equipment, test connections, vents, water and materials necessary for carrying out the pressure and leakage tests.

B. All testing shall be witnessed by the Engineer.

1.02 SUBMITTALS

A. In addition to those submittals identified in the General and Supplementary Conditions, the following items shall be submitted:

1. Reports of test results.

PART 2 - PRODUCTS

NOT USED

PART 3 -EXECUTION

3.02 TESTS ON PRESSURE PIPING FOR TRANSPORT OF WATER

A. General

1. Pipelines designed to transport water under pressure shall be tested hydrostatically and for leakage prior to being placed in service.

2. The length of piping and sections included in the tests shall meet the approval of the Engineer.

3. Equipment in or attached to the pipes being tested shall be protected. Any damage to such equipment during the test shall be repaired by the Contractor at his expense.

4. When piping is to be insulated or concealed in a structure, tests shall be made before the pipe is covered.

5. All fittings, hydrants and appurtenances must be properly braced and harnessed before the pressure is applied. Thrust restraining devices which will become a part of the system must also be tested at the test pressure.

6. If the line fails the test, the Contractor shall explore for the cause of the excessive leakage and after repairs have been made the line shall be retested. This procedure shall be repeated until the pipe complies.

B. Pressure and Leakage Test

1. A preliminary hydrostatic test pressure of 150 psi shall be maintained in the water main for a period of thirty minutes and a final hydrostatic test pressure of 150 psi shall be maintained in the water main once water services are installed for a minimum period of two (2) hours.

2. A At the end of the test period, if the test pressure has remained constant, the pipeline shall have passed the test.

3. If the pressure has dropped, it shall be brought back to the test pressure by pumping a known volume of water (by pumping from a graduated container or by metering) back into the pipeline.

4. The volume of water used, representing leakage from the pipeline, shall be recorded. If the leakage is less than the allowable leakage specified below, the pipeline shall have passed the test.

5. If the leakage exceeds the allowable as specified, the contractor shall:

   a. Locate the leaks.

   b. Permanently repair the sections of piping where the leaks are occurring to the satisfaction of the Authority.

   c. And Retest the pipeline as specified above.

6. This process shall be repeated until the pipeline has successfully passed the pressure test. All air shall be expelled from a pipeline before it is tested.

7. All caps, plugs and fittings shall be adequately braced and anchored to withstand the test pressures.

8. The test pressure specified by the Port Corp shall be obtained and measured at the lowest elevation in the pipeline under test.

9. Flanged, welded, threaded, and solvent welded pipelines shall show no leakage at the test pressure.

10. The leakage for mechanical joint and push-on joint pipe lines shall not exceed the allowable leakage per 1000 LF of pipe as shown in the following Table:

Allowable Leakage Per 1,000 LF at 150 PSI							
Pipe Diameter	4”	6”	8”	10”	12”	16”	20”
Gallons/Hr	0.35	0.53	0.71	0.89	1.06	1.42	1.77

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Leakage Tests. Include all such costs in the unit price bid for which it is a part.

END OF SECTION 330506

SECTION 330509

TAPPED CONNECTIONS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes tapping and installing of valves on existing or newly installed pipes without interruption of service complete with connections and accessories.

1.02 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American Water Works Association (AWWA)

1.03 SUBMITTALS

A. In addition to those submittals identified in the General and Supplementary Conditions, the following items shall be submitted:

1. Detail drawings for each size corporation stop, curb stop, tapping sleeve and valve, and service box.

PART 2 PRODUCTS

2.01 TAPPING SLEEVES AND VALVES

A. Tapping sleeves and valves shall be used for connections larger than 2 inches.

1. Tapping sleeves shall be designed and sized in accordance with the recommendations of the manufacturer.

2. Working pressure shall be 150 psi unless higher pressures are scheduled.

3. The seal of the tapping sleeve shall be mechanical joint or low lead 2.5% or less. Low lead as conforming to current regulations.

4. Valves for tapping sleeves shall be designed for the intended service and shall conform to the requirements of the Section entitled "Valves and Hydrants for Water Utility Service".

5. Tapping sleeves and valves shall be manufactured by:

a. Clow

b. Kennedy

c. U.S. Pipe

d. Or equal

PART 3 EXECUTION

3.01 INSTALLATION

A. Install connections and accessories under the direction of personnel who have performed at least ten similar connections in accordance with the applicable provisions of the referenced Standards.

3.02 FIELD TESTING

A. Perform hydrostatic and leakage tests in accordance with the applicable provisions of the Section entitled “Leakage Tests”, at the test pressure specified or scheduled.

PART 4 MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Tapped Connections. Include all such costs in the unit price bid for which it is a part.

END OF SECTION

SECTION 330509.33

THRUST RESTRAINT FOR UTILITY PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Tied joint restraint systems.

B. Related Requirements:
   1. Section 331416 "Site Water Utility Distribution Piping" for requirements for piping Work as required by this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with installation of fittings and joints that require restraint.

1.3 SUBMITTALS

A. Product Data: Tied joint restraint systems.

B. Shop Drawings:

   1. Indicate restrained joint details and materials being used.
   2. Submit layout drawings showing piece numbers and locations.
   3. Indicate restrained joint locations.
   4. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittals:

   1. Submit signed and sealed Shop Drawings with design calculations and assumptions for restrained lengths.
   2. Submit joint restraint details.
   3. Use joint restraint devices specifically designed for applications described in manufacturer information.

D. Qualifications Statements: Submit qualifications for manufacturer, fabricator, and licensed professional.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of joint restraints.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:
   1. The Municipality of Camden standards.
   2. South Jersey Port Corp standards.

B. Provide pressure pipeline with restrained joints at each bend, tee, and change in direction.

2.2 TIED JOINT RESTRAINT SYSTEMS

A. Manufacturers:

   1. Baker Hughes Company.
   2. Bulldog Restraint System; S&B Technical Products.

B. Tie Bolts:

   1. Mechanical Joints on 2- and 3-Inch (50- and 75-mm) Pipe:

      a. Size:5/8 inch (16 mm).
      b. Comply with ASTM A588/A588M, Grade B.
      c. Comply with ASTM A325 (A325M), Type 3, except increase tensile strength of full-body threaded section to 40,000 lb. (18 144 kPa) minimum for 5/8 inch (16 mm) and 60,000 lb. (27 216 kPa) minimum for 3/4 inch (19 mm) by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

   2. Mechanical and Flanged Joints on 4- to 12-Inch (100- to 300-mm) Pipe:

      a. Size: 3/4 inch (19 mm).
      b. Comply with ASTM A588/A588M, Grade B.
      c. Comply with ASTM A325 (A325M), Type 3, except increase tensile strength of full-body threaded section to 40,000 lb. (18 144 kPa) minimum for 5/8 inch (16 mm) and 60,000 lb. (27 216 kPa) minimum for 3/4 inch (19 mm) by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

   3. Mechanical Joints on 14- to 24-Inch (350- to 600-mm) Pipe:

      a. Size:3/4 inch (19 mm).
      b. Comply with ASTM A588/A588M, Grade B and ASTM A325 (A325M), Type 3.

   4. Mechanical and Flanged Joints on 30-Inch (750-mm) and Larger Pipe:

      a. Size: 1 inch (25 mm).
      b. Comply with ASTM A588/A588M, Grade B.
      c. Comply with ASTM A325 (A325M), Type 3, except increase tensile strength of full-body threaded section to 100,000 lb. (45 360 kPa) minimum by heat-treating (quenching and tempering) to manufacturer's reheat and hardness specifications.

C. Tie Nut:

1. Description: Hex nut for each tie bolt and tie rods.
2. Comply with ASTM A563 (A563M), Grade C3.
3. Stainless steel

D. Tiepin:

1. Bends and Hydrants: 3/4-inch (20-mm) round bar stock.
2. Size and Shape: 6-inch (150-mm) hairpin.
3. Comply with ASME B1.1 and ASTM A588/A588M.
4. Stainless steel

E. Tie Coupling:

1. Description: Extension of continuous-threaded rods.
2. Provide with center stop to aid installation.
3. Comply with ASTM A588/A588M.
4. Stainless steel

F. Tie Clamp:

1. Description: Retainer clamp for ductile iron, asbestos-cement, and PVC push-on pipe.
2. Location: In front of bell.
3. Comply with ASTM A36/A36M, ASTM A307, Grade A, and ASTM A563 (A563M), Grade A.
4. Stainless steel

G. Tie Rod:

1. Description: Continuous-threaded rod for cutting to desired lengths.
2. Comply with ASTM A588/A588M, Grade B, ASTM A325 (A325M), Type 3, and ASME B1.1.
3. Stainless steel

H. Tie Bar:

1. Description: Steel bar used to restrain push-in plugs.
2. Comply with ASTM A36/A36M.
3. Stainless steel

I. Tie Washer:

1. Description: Round flat washers.
2. ASTM A588/A588M, ASTM F436 (F436M), Type 1.
3. Stainless steel

2.3 SUSTAINABILITY CHARACTERISTICS

2.4 MATERIALS

A. Steel:

1. Stainless steel

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 thrust restraint for utility piping to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Clean surfaces of pipe and fittings that are to receive tied joint restraint systems.

3.3 INSTALLATION OF THRUST RESTRAINT FOR UTILITY PIPING

A. According to AWWA C600.

B. Install joint restraint system such that joints are mechanically locked together to prevent joint separation.

3.4 TOLERANCES

A. Torque 5/8-inch (15-mm) nuts on mating threaded fasteners from 45 to 60 ft.-lbf (60 to 80 N-m).

B. Torque 3/4-inch (20-mm) nuts on mating threaded fasteners from 75 to 90 ft.-lbf (100 to 120 N-m).

C. Torque 1-inch (25-mm) nuts from 100 to 120 ft.-lbf (135 to 160 N-m).

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Thrust Restraints for utility piping. Include all such costs in the unit price bid for which it is a part.

END OF SECTION 330509.33

SECTION 330519

DUCTILE IRON PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes centrifugally cast ductile iron pipe and ductile iron fittings as shown or scheduled on the Contract Drawings, complete with all accessories.

1.02 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American National Standards Institute (ANSI)

2. American Water Works Association (AWWA)

3. American Society for Testing and Materials (ASTM)

1.03 SUBMITTALS

A. In addition to those submittals identified in the General and Supplementary Conditions, the following items shall be submitted:

1. Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this specification.

2. Pipe and joint details.

3. Layout drawings for Ductile Iron Pipe to be installed within structures, showing the location and details of the support system, sleeves and appurtenances.

1.04 PROJECT CONDITIONS

A. Interruption of Existing Fire-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Engineer and Owner a minimum of three (3) working days in advance of proposed interruption of service.

2. Do not proceed with interruption of fire-distribution service without Engineer’s written permission.

B. Existing fire mains to which connections are to be performed are identified and sized according to the best records available at the issuance of the Contract Documents. Contractor shall be prepared to accommodate changes to the fittings configuration and type, and/or size by maintaining a stockpile of fittings and valves in a range of sizes, in close proximity to the work site, such that appropriate materials will be available without delay to the construction schedule.

PART 2 - PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. New construction water main extensions, or the modification or repair of existing facilities, shall utilize pipe materials which comply with ANSI/NSF Standard 61, Drinking Water System Components.

B. Ductile iron pipe and ductile iron fittings shall be Class 52 (unless otherwise indicated on the Contract Drawings) and shall comply with the following standards:

	ANSI/AWWA
Ductile Iron Pipe	C151
Fittings	C110
Joints-Mechanical and Push-On	C111
Joints-Flanged	C115
Cement Lining	C104
Polyethylene Encasement	C105
Compact Fittings	C153

C. All shipments of material shall be tested in accordance with the provisions for testing in the applicable standards.

D. All flange material shall be Ductile Iron.

E. All flange nuts and bolts shall be stainless steel.

2.02 ACCESSORIES

A. Joints

1. The type of joints for ductile iron pipe and fittings shall be as shown on the Contract Drawings.

a. Mechanical joints shall be assembled in accordance with the Notes on Method of Installation, AWWA C111, Appendix A. All bolts shall be stainless steel and shall be tightened by means of torque wrenches such that the follower shall be brought up evenly. If effective sealing is not obtained at the specified torques, the joint shall be disassembled, cleaned and reassembled.

b. For pressure piping, all valves and fittings shall be mechanical joint and shall be restrained with the use of thrust blocks according to the details on the Contract Plans or with the use of Ebba Iron Series 1100 Mega-Lugs retainer glands (or approved equal), in combination with restrained joint push-on pipe such as Field Lok (or approved equal) for the maximum length of pipe before and after the fitting as indicated in the restraining length schedule provided on the Contract Plans.

c. Push-on joints shall be assembled using lubricant furnished by the manufacturer. The joint shall be made by guiding the plain end into the bell until contact is made with the gasket and exerting sufficient force to drive the pipe home until penetration is made to the depth recommended by the manufacturer.

d. Flanged joints shall be assembled with through bolts of the size required for the pipe being installed. Stud bolts shall be used only where shown or required. Connecting

flanges shall be in proper alignment and no external force shall be required or used to bring them together.

(1) Flanges for flanged joints shall be drilled for 125 psi pressure unless otherwise specified.

(a) Flange bolts and nuts shall be stainless steel.

(b) Gaskets for water and sewage piping shall be 1/8 inch thick of the rubber type per AWWA C111 unless otherwise specified. Cloth inserted gaskets shall not be allowed.

(c) Gaskets for other service shall be as specified.

B. Welded-On Bosses

1. For ductile iron pipelines 24" diameter or larger, welded-on boss outlets, 8-inch and smaller in diameter may be used in lieu of tees. Minimum size of welded-on boss outlets shall be 3-inch in diameter.

2. Welded-on bosses shall require a minimum pipe class as follows:

a. Flanged pipe with welded-on bosses, minimum class 53.

b. All other pipe with welded-on bosses, minimum class 51.

3. Joint connections for welded-on bosses shall be as follows:

a. Flange per AWWA C-110 or ANSI B16.1 Class 125 for interior piping or piping inside of vaults.

4. Welded-on bosses shall be restrained or blocked in the same manner as a tee.

5. Welded-on bosses on flanged piping shall meet the following requirements:

a. The centerline of the outlet shall be a minimum of half of the boss diameter plus 14-inches from the inside edge of the flange.

b. For welded-on bosses on pipe other than flanged pipe, the centerline of the outlet must be a minimum of five feet from the bell face of the mainline pipe.

D. Solid Sleeves

1. Solid sleeves shall be used as shown on the Contract Drawings.

2. Solid sleeves shall conform to AWWA C153 for compact fittings and AWWA C110, unless otherwise specified.

3. Joints for solid sleeves shall be restrained joints.

E. Fire Hydrants

1. Fire hydrants shall be installed in locations as shown on the Contract Drawings.

2. Hydrants shall be New Fire Hydrant of same make and model of installed Fire Hydrants.

3. Description: AWWA dry-barrel fire hydrant. Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

4. Standard: AWWA C502.

5. Pressure Rating: 250 psig

2.03 COATING, PAINTING AND LINING

A. Coating, painting and lining shall be as follows unless otherwise specified in the pipe schedule:

1. Pipe installed in the ground, encased in concrete, in exposed exterior locations, in contact with water or inside structures but not scheduled for painting:

Interior: Standard thickness cement lining with sealcoat unless otherwise specified.

Exterior: Asphaltic coating.

2. Pipe installed inside structures or scheduled for painting:

Interior: Standard thickness cement lining with sealcoat unless otherwise specified.

3. All ductile piping shall have polyethylene encasement as per AWWA C105-10.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ductile iron pipe shall be installed in accordance with the configuration shown on the Contract Drawings.

B. All ductile iron pipe and ductile iron fittings shall be handled with padded slings or other appropriate equipment. The use of cables, hooks or chains will not be permitted.

3.02 FIELD TESTING

A. Perform hydrostatic and leakage tests in accordance with the applicable provisions of Section 02602, at the test pressure specified or scheduled.

PART 4 - QUANTITY AND PAYMENT

A. C.L.D.I.P. Water Main (Various Sizes)

Payment will be made for the quantity as above determined measured in linear foot, at the unit price bid

per LF in the proposal for “8” CLASS 52 DUCTILE IRON PIPE, WRAPPED IN POLYTEHENE”, "12” CLASS 52 DUCTILE IRON PIPE, WRAPPED IN POLYETHYNE”, and "16” CLASS 52 DUCTILE IRON PIPE, WRAPPED IN POLYETHYLENE” at the footage installed, which price shall include furnishing, delivering, saw cutting, excavation, placement, compaction, disinfection, disposal of unstable/undesirable material, making the final connections to the existing water main with the appropriate fitting and all else necessary therefore and all other work in connection therewith or incidental thereto.

B. C.L.D.I.P. Fittings (Various Sizes)

Payment will be made for the quantity as above determined measured in unit, at the unit price bid per UN in the proposal for “8" 45 DEGREE MJT RESTRAINED CLDIP FITTING”, 8" 22.5 DEGREE MJT RESTRAINED CLDIP FITTING” at the number of units installed, which price shall include furnishing, delivering, saw cutting, excavation, placement, compaction, disinfection, disposal of unstable/undesirable material and all else necessary therefore and all other work in connection therewith or incidental thereto.

C. C.L.D.I.P. Tees (Various Sizes)

Payment will be made for the quantity as above determined measured in unit, at the unit price bid per UN in the proposal for “8" X 8" X 8" MJT RESTRAINED CLDIP TEE, COMPLETE”, “16" X 16" X 12" MJT RESTRAINED CLDIP TEE, INCLUDING SLEEVES,COMPLETE”, “12" X 12" X 8" MJT RESTRAINED CLDIP TEE, COMPLETE”, and “12" X 12" X 12" MJT RESTRAINED CLDIP TEE, COMPLETE” at the number of units installed, which price shall include furnishing, delivering, saw cutting, excavation, placement, compaction, disinfection, disposal of unstable/undesirable material and all else necessary therefore and all other work in connection therewith or incidental thereto.

D. C.L.D.I.P. Reducer

Payment will be made for the quantity as above determined measured in unit, at the unit price bid per UN in the proposal for “12" X 8" MJT RESTRAINED CLDIP REDUCER” and “16" X 12" MJT RESTRAINED CLDIP REDUCER” at the number of units installed, which price shall include furnishing, delivering, saw cutting, excavation, placement, compaction, disinfection, disposal of unstable/undesirable material and all else necessary therefore and all other work in connection therewith or incidental thereto.

E. C.L.D.I.P. MJT End Cap (Various Sizes)

Payment will be made for the quantity as above determined measured in unit, at the unit price bid per UN in the proposal for “8" MJT RESTRAINED END CAP, COMPLETE”, “12" MJT RESTRAINED END CAP, COMPLETE” at the number of units installed, which price shall include furnishing, delivering, saw cutting, excavation, placement, compaction, disinfection, disposal of unstable/undesirable material and all else necessary therefore and all other work in connection therewith or incidental thereto.

END OF SECTION

SECTION 331416

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for Site water line, including**,** fire water line.
2. Tapping sleeves and valves.
3. Valves and boxes.
4. Fire hydrants and yard hydrants.
5. Pipe support systems.
6. Bedding and cover materials.

1.2 SUBMITTALS

A. Delegated Design Submittals: Not required

B. Source Quality-Control Submittals: Required

C. Results of Factory Tests and Inspections: Required

D. Field Quality-Control Submittals: Required

1.3 SUSTAINABLE DESIGN SUBMITTALS

A. Manufacturer's Certificate: Required

B. Product Cost Data: Required

PART 2 - PRODUCTS

2.1 PIPING

A. Ductile Iron Pipe:

1. AWWA C151
2. Fittings: Ductile iron
3. Joints: AWWA C111
4. Jackets: AWWA C105 PE jacket
5. Bituminous Outside Coating: Comply with AWWA C151.
6. Pipe Mortar Lining:

a. Comply with AWWA C104.
b. Thickness: Double.

2.2 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:

1. Manufacturers:
   a. Kennedy Valve Company; a division of McWane, Inc.
   b. Mueller Co.
   c. U.S. Pipe Valve & Hydrant Division.
   d. Approved Equal.

2. Description:
   a. Material: Ductile iron.
   b. Type: Dual compression.
   c. Outlet Flange Dimensions and Drilling: ASME B16.1 and MSS SP-60.

B. Tapping Valves:

1. Manufacturers:
   a. Mueller Co.
   b. U.S. Pipe Valve & Hydrant Division.

2. Description:
   a. AWWA C500.
   b. Inlet Flanges: ASME B16.1 and MSS SP-60.
   c. Mechanical Joint Outlets: AWWA C111.

2.3 VALVES AND HYDRANTS

A. Valves, Valve Boxes, and Fire Hydrants: As specified in Section 331419 - Valves and Hydrants for Water Utility Service

2.4 MATERIALS

A. Bedding and Cover:

1. Bedding: As specified in Section 310516 - Aggregates for Earthwork
2. Cover: As specified in Section 310516 - Aggregates for Earthwork

2.5 ACCESSORIES

A. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping

B. Rods, Bolt, Lugs, and Brackets: Stainless Steel

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 public water utility distribution piping to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Preconstruction Site Photos:

1. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 50 feet (15 m) of pipe trench.
2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.
3. Include Project description, date taken, and sequential number on back of each photograph.

B. Pipe Cutting:

1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
3. Grind edges smooth with beveled end for push-on connections.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION OF SITE WATER UTILITY DISTRIBUTION PIPING

A. Bedding:

1. Excavation:

a. As specified in Section 312316 - Excavation and Backfill
b. Hand trim for accurate placement of pipe to elevations as indicated on Drawings.

2. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.
3. If directed by engineer; place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches (6”) depth, ¾” clean stone (no. #57) stone.

B. Piping:

1. Comply with AWWA C600.
2. Handle and assemble pipe according to manufacturer instructions and as indicated on Drawings.
3. Strainless Steel Rods, Bolts, Lugs, and Brackets: Coat buried steel before backfilling.
4. Maintain a minimum of 10 feet of horizontal separation between water main and sewer piping.
5. Maintain a minimum of 4 feet bury depth.
6. Ductile-Iron Piping and Fittings: Comply with AWWA C600.
7. Grooved and Shouldered Pipe Joints: Comply with AWWA C606.
8. Field Welding Materials: Comply with AWWA C206.
9. Flanged Joints: Do not use in underground installations except within structures.
10. Route pipe in straight line and re-lay pipe that is out of alignment or grade.
11. High Points:

    a. Install pipe with no high points.

12. Bearing:

    a. Maintain bearing along entire length of pipe.
    b. Excavate bell holes to permit proper joint installation.
    c. Do not lay pipe in wet or frozen trench.

13. Prevent foreign material from entering pipe during placement.
14. Allow for expansion and contraction without stressing pipe or joints.
15. Close pipe openings with watertight plugs during Work stoppages.
16. Cover:

    a. Establish elevations of buried piping with not less than 4 feet of cover.
    b. Measure depth of cover from final surface grade to top of pipe barrel.

C. Valves and Hydrants: As specified in Section 331419 - Valves and Hydrants for Water Utility Service

D. Tapping Sleeves and Valves: As indicated on Drawings and according to manufacturer instructions.

E. Meters:

1. Install positive displacement meters with isolating valves on inlet and outlet according to AWWA M6.
2. Provide full line-size bypass with globe valve for liquid service meters.

F. PE Encasement:

1. Encase piping in PE to prevent contact with surrounding backfill material.
2. Comply with AWWA C105.
3. Terminate encasement 3 to 6 inches (75 to 150 mm) above ground where pipe is exposed.

G. Thrust Restraints: As specified in Section 330509.33 "Thrust Restraint for Utility Piping."

H. Backfilling:

1. Backfill around sides and to top of pipe with cover fill in minimum lifts of 8 inches. tamp in place, and compact to 95% of maximum density.
2. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.
3. Maintain optimum moisture content of bedding material to attain required compaction density.
4. Backfilling:

    a. Backfill around sides and to top of pipe as specified in Section 312316
    c. Backfill with import fill material as specified in Section 312323.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Pressure test piping system according to AWWA C600.
2. Pressure test piping system as indicated on pipe schedule.
3. Pressure test piping system according to AWWA C600 and following:

    a. Test Pressure: Not less than 150 psig in excess of maximum static pressure.

Nominal Pipe Diameter (Inches)	**Allowable Leakage Per 1000 Feet of Pipe (GPH)**		
	150 psi Test Pressure	200 psi Test Pressure	350 psi Test Pressure
3	0.25	0.29	0.38
4	0.33	0.38	0.51
6	0.50	0.57	0.76
8	0.66	0.76	1.01
10	0.83	0.96	1.26
12	0.99	1.15	1.52
14	1.16	1.34	1.77
16	1.32	1.53	2.02

    b. Conduct hydrostatic test for a minimum of two (2) hours.
    c. Slowly fill section to be tested with water; expel air from piping at high points.
    d. Install corporation cocks at high points.
    e. Close air vents and corporation cocks after air is expelled.
    f. Raise pressure to specified test pressure.
    g. Observe joints, fittings, and valves under test.
    h. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage, and retest.
    i. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
    j. Maintain pressure within plus or minus 5 psi of test pressure.
    k. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
    l. Compute maximum allowable leakage using following formula:

1) L = SD x sqrt(P)/C.
2) L = testing allowance, gph.
3) S = length of pipe tested, feet.
4) D = nominal diameter of pipe, inches.
5) P = average test pressure during hydrostatic test, psig.
6) C = 148,000.

m. All joints in pipe lines shall remain uncovered until the pipe has been subject to pressure tests. When all joints being subjected to the test are found to be tight at this pressure, in the presence of the Engineer, the test may be stopped and backfilling commenced, as hereinbefore specified. The cost of testing of the pipe lines shall be borne by the Contractor who must furnish all necessary equipment, labor and materials for the tests. Pressure shall remain constant on the pipe for at least 2 hours and shall not drop more than 5 pounds nor increase more than 5 pounds in 2 hours. The maximum amount of makeup water that can be added shall be as follows:

n. Acceptance shall be determined based on the amount of makeup water to be added to the pipe being tested. If any test of pipe has leakage greater than the specified amount the Contractor shall locate and make repairs as necessary until the leakage is within the specified allowance.

p. The Contractor shall test the pipeline in sections. Test pressure shall not be applied to existing water services.

q. Sections of main shall be tested before connection to existing mains. At connections to existing mains, existing static pressure shall be applied for test. No joints shall be covered until tested in presence of Engineer.

r. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

s. All visible leaks shall be repaired regardless of the amount of leakage. Defective joints, pipe and fittings shall be removed and replaced by the Contractor.

t. If the test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.

u. Correct visible leaks regardless of quantity of leakage.

B. Compaction Testing:

r. Comply with ASTM D1557, ASTM D698, AASHTO T180, ASTM D6938.
s. Frequency of Compaction Tests: 8” lifts and 95% maximum density.
t. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

C. Prepare test and inspection reports.

PART 4 - MEASUREMENT, QUANTITY & PAYMENT

No separate payment will be made for Site Water Utility Distribution Piping. Include all such costs in the unit price bid for which it is a part.

END OF SECTION 331416

SECTION 331419

VALVES AND HYDRANTS FOR WATER UTILITY SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide gate valves as specified herein and shown on the drawings.

B. Provide complete fire hydrant assemblies as specified herein and shown on the drawings.

C. Provide line stops valve only if & where directed by the engineer.

D. Provide complete dry hydrant assemblies as specified herein and shown on the drawings.

1.2 SUMMARY

A. Section Includes:

1. Valves.
2. Fire hydrants.
3. Valve boxes.
4. Dry hydrants.

B. Related Requirements:

1. Section 310516 "Aggregates for Earthwork"
2. Section 331416 “Site Water Utility Distribution Piping”

1.3 COORDINATION

A. Coordinate Work of this Section with installation of water mains.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference prior to contractor mobilizing to the project location. Engineer to coordinate with owner, contractor, other utilities, and funding agency (if applicable).

1.5 SUBMITTALS

A. Product Data:

1. Gates Valves.
2. Fire hydrants.
3. Valve boxes.
4. Dry hydrants.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: Record actual locations of valves and fire hydrants.

B. The Contractor shall provide a set of reproducible as-built drawings prior to final payment.

C. Project Record Documents (As-builts) shall be a reproducible of the original contract drawings including any additional sheets required. All deviations from the original contract drawings shall be on the as-builts. The drawings shall be legible, neat, and of a quality acceptable to the Engineer.

1. The Contractor shall be responsible for keeping the as-built up-to-date as the project progresses.
2. Valves & Fire Hydrants: Valves & Hydrants shall be indicated by means of triangulation off of the front of the building. If no building exists, then by three permanent features
3. This section is intended to provide a minimum level of acceptance. Any section with more stringent requirements shall have precedence over this section.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Tools: Furnish one tee (1) wrench of required length to Owner or Operator of the system.

1.8 QUALITY ASSURANCE

A. Materials in Contract with Potable Water: Certified according to NSF 61 and NSF 372.

B. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Seal valve and hydrant ends to prevent entry of foreign matter.
2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 VALVES

A. Performance and Design Criteria:

1. Pressure Rating:

    a. 12-inch Diameter and Smaller: 200 psig.
    b. 14-inch Diameter and Larger: 150 psig.

2. End Connections: Mechanical joint
3. Furnish valves of diameters 16 inches (400 mm) and larger with bypass valves and gear operators.
4. Coatings:

    a. Comply with AWWA C550.
    b. Application: Interior and exterior.

B. Resilient-Wedge Gate Valves:

1. Manufacturers:
    a. Mueller Co.
    b. Approved Equal

2. Comply with AWWA C509.
3. Body: Ductile iron
4. Seats: Resilient.
5. Stem:

    a. Type: Non-rising.
    b. Material: Bronze.

6. Operation:

    a. Square operating nut.
    b. Opening Direction: Counterclockwise (Left)

7. Opening:

    a. Open Left

C. Double-Disc Gate Valves:

1. Manufacturers:
    a. Kennedy Valve Company; a division of McWane, Inc.
    b. Mueller Co.
    c. Approved Equal

2. Comply with AWWA C500.
3. Materials:

    a. Body: Iron.
    b. Trim: Bronze.

4. Seat Type: Double disc; parallel.
5. Stem:

    a. Type: Non-rising.
    b. Seals: O-ring.

6. Operation:

    a. Square operating nut with counterclockwise opening direction.
    b. Handwheel with counterclockwise opening direction.

2.2 FIRE HYDRANTS

A. Manufacturers:

1. Kennedy
2. Approved Equal

B. Dry-Barrel, Breakaway Type:

1. Comply with AWWA C502.
2. Body: Cast iron.
3. Valve: Compression type.
4. Burial Depth: As indicated on Drawings.
5. Inlet Connection Size: 6 inches.
6. Valve Opening: 5-1/4 inches in diameter.
7. End Connections: Mechanical joint.
8. Bolts and Nuts: Stainless steel.
9. Interior Coating: Comply with AWWA C550.
10. Opening Direction: Counterclockwise (Left).

C. Hose Connections:

1. 4” Storz pumper nozzle
2. Obtain thread type and size from the local fire department.
3. Attach nozzle caps with separate chains.

D. Finishes:

1. Color: Comply with requirements of owner’s requirement.

2.3 DRY HYDRANTS

A. Manufacturers:

1. Kocheck
2. Approved Equal

B. Dry Hydrant and Fire Pond:
1. Comply with NFPA 1993, or most current edition
2. Piping, elbows, couplings and reducers : Schedule 40 PVC or heavier
3. Horizontal piping: Minimum inside diameter of six inches (6”)
4. Riser Piping: Inside diameter of six inches (6”)
5. End Connections shall consist of
    a. One 6” PVC 90 Degree elbow with a six inch 6” NH male outlet adapter
    b. One adapter, six inch (6”) NH with rocker lugs
    c. One cap, four point five inches (4.5”) NH with attaching cable
6. Finishes: All exposed PVC or metal surfaces and underground metal surfaces shall be primed and painted white

2.4 VALVE BOXES

A. Manufacturers:

1. Ford Meter Box Company, Inc.
2. Mueller Co.
3. Tyler Utilities; Union Foundry Company.
4. Approved Equal

B. 12-inch (300-mm) Diameter Valves and Smaller:

1. Material: Cast iron.
2. Type: Two piece; screw.

C. Valves Larger than 12-inch (300-mm) Diameter:

1. Material: Cast iron.
2. Type: Three piece; screw.
3. Base: Round.

D. Lid Inscription: FIRE .

2.5 ACCESSORIES

A. Valve Box Aligner: High-strength plastic device designed to automatically center valve box base and to prevent it from shifting off center during backfilling.

B. Fire Hydrant Drainage Gravel: As specified in Section 310516 "Aggregates for Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Determine exact location and size of valves from Drawings.

B. Identify required lines, levels, contours, and datum locations.

C. Verify that elevations prior to excavation and installation of valves and hydrants are as indicated on Drawings.

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

3.2 PREPARATION

A. Locate, identify, and protect from damage utilities to remain.

B. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1. Notify Engineer not less than three (3) days in advance of proposed utility interruption.
2. Do not proceed without written permission from Engineer.

3.3 INSTALLATION OF VALVES AND HYDRANTS

A. Install valves and hydrants in conjunction with pipe laying.

B. Provide buried valves with valve boxes installed flush with finished grade.

C. Provide support blocking and drainage gravel while installing fire hydrants; do not block drain hole.

D. Install dry hydrant in accordance with manufacturer's recommendations.

E. Orientation:

1. Set valves and hydrants plumb.
2. Set fire hydrants with pumper nozzle facing roadway.
3. Set fire hydrants with centerline of pumper nozzle 18 inches above finished grade and with safety flange not more than 6 inches nor less than 2 inches above grade.
4. Set dry hydrants at a forty-five (45) degree angle to the road and directed to face incoming vehicles.

F. After main-line pressure testing, flush fire hydrants and check for proper drainage.

PART 4 – PAYMENT, QUATITY & MEASUREMENT

Fire Hydrant

1. The quantity of fire hydrants for which payment is made will be the number constructed in accordance with the plans and specifications or as directed by the Engineer.

2. Payment for “FURNISH AND INSTALL FIRE HYDRANTS,COMPLETE” will be made for the quantity as above determine at the unit price bid in the Bid Form which price shall include the cost of excavation, furnishing and setting of 6" connecting pipe with gate valve and valve box, tie rods, furnishing and setting of hydrant, hydrant anchoring tee supporting wedging, jointing and jointing materials, shoring, testing, pumping, sterilization, replacement of all curb and sidewalk disturbed by construction, and all labor, materials, and equipment and all else necessary therefore and all other work in connection therewith or incidental thereto.

Gate Valves

1. The quantity of gate valves for which payment is made will be the number constructed in accordance with the plans and specifications or as directed by the Engineer.

2. Payment for “8” MJT RESTRAINED RESILIANT SEAT GATE VALVE, COMPLETE” and “12" MJT RESTRAINED RESILIENT SEAT GATE VALVE, COMPLETE” will be made at the price bid in the Bid Form, which prices shall include the cost of excavation, backfill, laying, assembling, jointing, tapping sleeve or cross, valve box, testing, sterilizing, furnishing and operation of plugging and or tapping machine, gate valve and valve box if required for conditions as specified herein, all materials, labor, equipment, and all else necessary therefore, and all work in connection therewith and incidental thereto.

END OF SECTION 331419